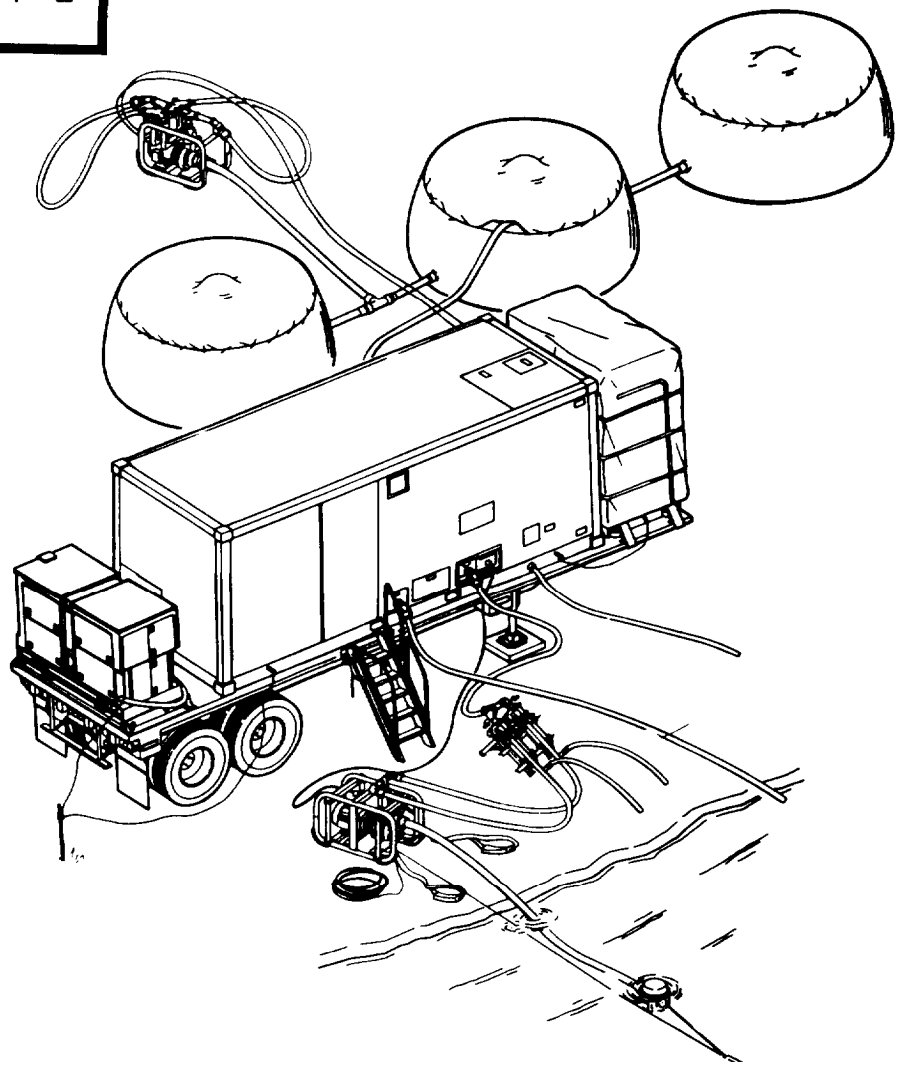
This copy is a reprint which includes current pages from Changes 1 through 3.

TECHNICAL MANUAL

OPERATOR'S AND UNIT MAINTENANCE MANUAL

WATER PURIFICATION UNIT, REVERSE OSMOSIS, 3,000 GPH TRAILER MOUNTED, FLATBED CARGO, 22-1/2 TON 8 WHEEL TANDEM MODEL NO. WTA-060 NSN 4610-01-219-8707



HEADQUARTERS, DEPARTMENT OF THE ARMY
13 May 1991

CHANGE
NO. 12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 1 APRIL 2001

Operator's and Unit Maintenance Manual

For

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3000 GPH
TRAILER MOUNTED, FLATBED CARGO
22 1/2 TON 8 WHEEL TANDUM
MODEL WTA-060
NSN 4610-01-219-8707
AND
MODEL ROWPU-1
NSN 4610-01-371-1790

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1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove Pages	**Insert Pages**
i through viii	i through viii
1-1 through 1-6	1-1 through 1-6
1-7 through 1-12.2	1-7 through 1-12.2
1-13 through 1-20.5/(1-20.6 blank)	1-13 through 1-20.5/(1-20.6 blank)
1-27/(1-28 blank)	1-27/(1-28 blank)
2-1 through 2-2.2	2-1 through 2-2.2
2-9 through 2-16	2-9 through 2-16
2-19 and 2-20	2-19/(2-20 blank)
2-21 and 2-22	--------
2-23 and 2-24	(2-23 blank)/2-24
2-25 and 2-26	2-25 and 2-26
2-35 through 2-48.2	2-35 through 2-48.2
2-48.3 and 2-48.4	--------
2-51 through 2-62	2-51 through 2-62

Remove Pages	Insert Pages
2-62.3 through 2-68	2-62.3 through 2-68
2-69 through 2-84	2-69 through 2-84
--------	2-84.1/(2-84.2 blank)
2-85 and 2-86	2-85 and 2-86
--------	2-86.1/(2-86.2 blank)
2-87 through 2-104	2-87 through 2-104
2-107 and 2-108	2-107 and 2-108
2-109 and 2-110	2-109 and 2-110
2-113 through 2-130	2-113 through 2-130
--------	2-130.1 through 2-130.4
2-131 through 2-136	(2-131 blank)/2-132 through 2-136
2-143 and 2-144	2-143 and 2-144
2-147 through 2-148.2	2-147 through 2-148.2
2-151 and 2-152	2-151 and 2-152
2-157 through 2-164	2-157 through 2-164
2-167 and 2-168	2-167 and 2-168
3-1 through 3-4	3-1 through 3-4
3-5 and 3-6	3-5 and 3-6
3-11 through 3-14	3-11 through 3-14
3-17 through 3-28	3-17 through 3-28
3-35 and 3-36	3-35 and 3-36
3-49 and 3-50	3-49 and 3-50
3-51 and 3-52	--------
3-59 and 3-60	3-59 and 3-60
3-65 and 3-66	3-65 and 3-66
4-11 through 4-12.1/(4-12.2 blank)	4-11 through 4-12.1/(4-12.2 blank)
4-23 and 4-24	(4-23 blank)/4-24
4-37 and 4-38	4-37 and 4-38
4-41 and 4-42	4-41 and 4-42
4-83 through 4-86	4-83 through 4-86
4-183 through 4-186	4-183 trough 4-186
4-205 through 4-210	--------
4-221 through 4-228	4-221 through 4-228
4-235 through 4-240	--------
4-241 through 4-246	(4-241 blank)/4-242 through 4-246
4-253 and 4-254	4-253 and 4-254
4-257 and 4-258	4-257 and 4-258
4-261 and 4-262	4-261 and 4-262

Remove Pages	Insert Pages
4-293 and 4-294	4-293 and 4-294
C-1 through C-6	C-1 through C-6
C-9 through C-22	C-9 through C-22
Index 3 through Index 6	Index 3 through Index 6
Electronic 2028	Electronic 2028
DA Form 2028's	DA Form 2028's

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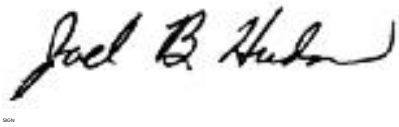

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CHANGE

NO. 11

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WASHINGTON, D.C., 1 SEPTEMBER 1999

Operator's and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO
22-1/2 TON 8 WHEEL TANDEM
MODEL WTA-060
NSN 4610-01-219-8707
AND
MODEL ROWPU-1
NSN 4610-01-371-1790

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Remove Pages	**Insert Pages**
4-287 thru 4-292	4-287 thru 4-292

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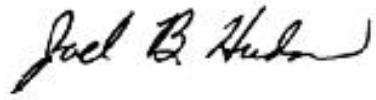

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TM 10-4610-232-12
C10

CHANGE

NO. 10

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DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 25 April 1997

Operator's and Unit Maintenance Manual

WATER PURIFICATION UNIT,
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO,
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA 060
NSN 4610-01-219-8707
AND
MODEL ROWPU-1
NSN 4610-01-371-1790

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2-55 and 2-56	2-55 and 2-56

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WASHINGTON, D.C., 23 April 1997

Operator's and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3000 GPH
TRAILER MOUNTED, FLATBED CARGO
22-1/2 TON 8 WHEEL TANDEM
MODEL WTA-060
NSN 4610-01-219-8707
AND
MODEL ROWPU-1
NSN 4610-01-371-1790

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Remove pages	Insert pages
C-1 through C-12	C-1 through C-12
C-15 through C-22	C-15 through C-22

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TM 10-4610-232-12
C9

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CHANGE

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Operator's and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3000 GPH
TRAILER MOUNTED, FLATBED CARGO
22-1/2 TON 8 WHEEL TANDEM
MODEL WTA-060
NSN 4610-01-219-8707
AND
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Remove pages	Insert pages
2-37 and 2-38	2-37 and 2-38
2-45 and 2-46	2-45 and 2-46
2-63 through 2-66	2-63 through 2-66
2-81 through 2-86	2-81 through 2-86
2-93 and 2-94	2-93 and 2-94
2-97 and 2-98	2-97 and 2-98
4-319 and 4-320	4-319 and 4-320

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TM 10-4610-232-12
C8

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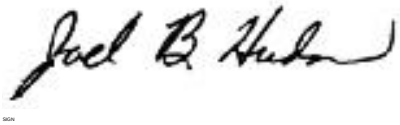

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Operator's and Unit Maintenance Manual

For

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3000 GPH
TRAILER MOUNTED, FLATBED CARGO
22-1/2 TON 8 WHEEL TANDEM
MODEL WTA-060
NSN 4610-01-219-8707
AND
MODEL ROWPU-1
NSN 4610-01-371-1790

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Remove Pages	**Insert Pages**
i through viii	i through ix/(x blank)
1-1 through 1-6	1-1 through 1-6
----	1-6.1 and 1-6.2
1-7 and 1-8	1-7 and 1-8
1-11 and 1-12	1-11 and 1-12
----	1-12.1 through 1-12.10
1-13 and 1-14	1-13 and 1-14
----	1-14.1/(1-14.2 blank)
1-15 through 1-20	1-15 through 1-20
----	1-20.1 through 1-20.5/(1-20.6 blank)
2-1 and 2-2	2-1 and 2-2
----	2-2.1 and 2-2.2
2-3 through 2-6	2-3 through 2-6

Remove Pages	Insert Pages
2-9 and 2-10	2-9 and 2-10
----	2-10.1 and 2-10.2
2-11 through 2-18	2-11 through 2-18
----	2-18.1/(2-18.2 blank)
2-19 through 2-24	2-19 through 2-24
2-31 through 2-34	2-31 through 2-34
----	2-34.1/(2-34.2 blank)
2-35 and 2-36	2-35 and 2-36
----	2-36.1 and 2-36.2
2-37 and 2-38	2-37 and 2-38
2-43 through 2-48	2-43 through 2-48
----	2-52.1 and 2-52.2
2-53 through 2-58	2-53/(2-54 blank)
	through 2-58
----	2-58.1/(2-58.2 blank)
2-59 and 2-60	2-59 and 2-60
.-.-.--	2-60.1 /(2-60.2 blank)
2-61 and 2-62	2-61 and 2-62
----	2-62.1 through 2-62.4
2-63 and 2-64	2-63 and 2-64
2-64.1/(2-64.2 blank)	----
2-65 through 2-68	2-65 through 2-68
----	2-68.1/(2-68.2 blank)
2-69 and 2-70	2-69 and 2-70
----	2-70.11/(2-70.2 blank)
2-75 and 2-76	2-75 and 2-76
----	2-76.1/(2-76.2 blank)
2-83 through 2-86	2-83 through 2-86
2-93 through 2-100	2-93 through 2-100
2-103 and 2-104	2-103 and 2-104
2-107 and 2-108	2-107 and 2-108
----	2-108.1/(2-108.2 blank)
2-129 and 2-130	2-129 and 2-130
2-130.1/(2-130.2 blank)	----
2-131 and 2-132	2-131 and 2-132
----	2-132.1/(2-132.2 blank)
2-133 through 2-136	2-133 through 2-136
2-141 through 2-144	2-141 through 2-144
----	2-144.1/(2-144.2 blank)
2-147 and 2-148	2-147 and 2-148
----	2-148.1 and 2-148.2
2-149 and 2-150	2-149 and 2-150
2-155 through 2-158	2-155 through 2-158
----	2-158.1 through 2-158.4
2-159 through 2-160	2-159/(2-160 blank)
----	3-4.1/(3-4.2 blank)
3-5 through 3-8	3-5 through 3-8
3-17 and 3-18	3-17 and 3-18
3-27 through 3-30	3-27 through 3-30

Remove Pages	Insert Pages
3-33 and 3-34	3-33 and 3-34
3-47 and 3-48	3-47 and 3-48
----	3-48.1 and 3-48.2
3-51 and 3-52	3-51 and 3-52
4-1 and 4-2	4-1 and 4-2
4-12.1/(4-12.2 blank)	4-12.1/(4-12.2 blank)
4-13 through 4-16	4-13 through 4-16
----	4-16.1/(4-16.2 blank)
4-23 through 4-26	4-23 through 4-26
----	4-26.1/(4-26.2 blank)
4-31 and 4-32	4-31 and 4-32
4-37 and 4-38	4-37 and 4-38
4-41 and 4-42	4-41 and 4-42
----	4-50.1/(4-50.2 blank)
4-51 and 4-52	4-51 and 4-52
4-93 and 4-94	4-93 and 4-94
----	4-94.1/(4-94.2 blank)
4-97 and 4-98	4-97 and 4-98
----	4-98.1 and 4-98.2
4-103 through 4-106	4-103 through 4-106
----	4-106.1 and 4-106.2
4-107 and 4-108	4-107 and 4-108
----	4-108.1 and 4-108.2
4-109 and 4-110	4-109 and 4-110
4-115 and 4-116	4-115 and 4-116
4-125 and 4-126	4-125 and 4-126
4-129 and 4-130	4-129 and 4-130
4-179 and 4-180	4-179 and 4-180
----	4-182.1 through 4-182.4
4-183 and 4-184	4-183 and 4-184
----	4-184.1/(4-184.2 blank)
4-185 through 4-188	4-185 through 4-188
----	4-190.1/(4-190.2 blank)
4-191 through 4-196	4-191 through 4-196
4-196.1 and 4-196.2	4-196.1 through 4-196.4
4-197 and 4-198	4-197 and 4-198
----	4-198.1 and 4-198.2
4-199 through 4-202	4-199 through 4-202
----	4-202.1 through 4-202.6
4-205 through 4-210	4-205 through 4-210
4-235 through 4-240	4-235 through 4-240
4-243 through 4-246	4-243 through 4-246
4-249 and 4-250	4-249 and 4-250
----	4-250.1/(4-250.2 blank)
4-251 and 4-252	4-251 and 4-252
4-261 through 4-264	4-261 through 4-264
4-264.1 and 4-264.2	4-264.1 and 4-264.2

Remove Pages	Insert Pages
----	4-266.1/(4-266.2 blank)
4-267 and 4-268	4-267 and 4-268
----	4-304.1/(4-304.2 blank)
4-305 and 4-306	4-305 and 4-306
4-309 and 4-310	4-309 and 4-310
C-3 through C-12	C-3 through C-12
C-15 and C-16	C-15 and C-16
C-21 and C-22	C-21 and C-22
Index 1 and Index 2	Index 1 and Index 2
Index 5 and Index 6	Index 5 and Index 6
FP-1/(FP-2 blank) through	FP-1/(FP-2 blank) through
FP-7/(FP-8 blank)	FP-7/(FP-8 blank)
FP-11/(FP-12 blank)	FP- 11/(FP-12 blank)
FP-1 5/(FP- 16 blank)	FP-1 5/(FP-1 6 blank)
FP-19/(FP-20 blank)	FP-19/(FP-20 blank)
FP-25/(FP-26 blank)	FP-25/(FP-26 blank)
FP-29/(FP-30 blank) and	FP-29/(FP-30 blank) and
FP-31/(FP-32 blank)	FP-31/(FP-32 blank)
FP-39/(FP-40 blank) and	**FP-39/(FP-40 blank) and**
FP-41/(FP-42 blank)	**FP-41/(FP-42 blank)**
FP-47/(FP-48 blank) through	FP-47/(FP-48 blank) through
FP-51/(FP-52 blank)	FP-51/(FP-52 blank)

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By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

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TM 10-4610-232-12
C 6

CHANGE

NO. 6

HEADQUARTERS
DEPARTMENTS OF THE ARMY
WASHINGTON, D.C., 15 July 1995

Operator's and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO,
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA-060
NSN 4610-01-219-8707

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Remove pages	Insert pages
2-37 through 2-40	2-37 through 2-40
2-59 and 2-60	2-59 and 2-60
2-63 and 2-64	2-63 and 2-64
----------	2-64.1/(2-64.2 blank)
2-129 and 2-130	2-129 and 2-130
----------	2-130.1/(2-130.2 blank)
2-143 through 2-146	2-143 though 2-146
3-1 through 3-6	3-1 through 3-6
3-39 and 3-40	3-39 and 3-40

2. Retain this sheet in front of manual for reference purposes.

TM 10-4610-232-12
C 6

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No. *5*

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DEPARTMENT OF THE ARMY,
WASHINGTON, D.C., 30 JUNE 1995

Operator's and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO,
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA-060
NSN 4610-01-219-8707

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Remove pages	Insert pages
3-41 and 3-42	3-41 and 3-42
4-113 and 4-114	4-113 and 4-114
C-1 through C-4	C-1 through C-4
C-7 through C-12	C-7 through C-12
C-15 through C-22	C-15 through C-22
	C-23/(C-24 blank)

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Operator's, and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO,
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA-060
NSN 4610-01-219-8707

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Remove pages	Insert pages
2-87 and 2-88	2-87 and 2-88
2–95 through 2–98	2-95 through 2–98
2–101 and 2–102	2–101 and 2–102
C–1 through C-22	C-1 through C-22

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CHANGE

NO. 3

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DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 January 1993

Operator's, and Unit Maintenance Manual

WATER PURIFICATION UNIT
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO,
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA-060
NSN 4610-01-219-8707

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Remove pages	Insert pages
1–11 and 1-12	1-11 and 1–12
4–77 and 4-78	4–77 and 4-78
4–313 and 4-314	4–313 and 4–314
4–318.1 and 4–318.2	—————

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NO. 2

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Operator's and Unit Maintenance Manual

**WATER PURIFICATION UNIT,
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA-060
NSN 4810-01-219-8707**

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TM 10-4610-232-12, 13 May 1991, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
c and d	c and d
i through viii	i through viii
1-1 through 1-4	1-1 through 1-4
1-23 and 1-24	1-23 and 1-24
2-11 and 2-12	2-11 and 2-12
2-21 and 2-22	2-21 and 2-22
2-25 and 2-26	2-25 and 2-26
2-49 through 2-58	2-49 through 2-58
2-61 through 2-64	2-61 through 2-64
2-67 through 2-70	2-67 through 2-70
2-75 through 2-106	2-75 through 2-106
2-109 and 2-110	2-109 and 2-110
2-113 and 2-114	2-113 and 2-114
2-119 and 2-120	2-119 and 2-120
2-123 and 2-124	2-123 and 2-124
2-129 through 2-136	2-129 through 2-136
2-151 through 2-154	2-151 through 2-154
3-17 and 3-18	3-17 and 3-18
3-39 and 3-40	3-39 and 3-40
3-45 and 3-46	3-45 and 3-46
3-49 and 3-50	3-49 and 3-50
3-61 and 3-62	3-61 and 3-62
4-3 through 4-12	4-3 through 4-12
- - - - -	4-12.1/(4-12.2 blank)
4-23 and 4-24	4-23 and 4-24

4-83 through 4-86	4-83 through 4-86
4-99 through 4-104	4-99 through 4-104
4-109 and 4-110	4-109 and 4-110
4-115 and 4-116	4-115 and 4-116
4-123 through 4-128	4-123 through 4-128
- - - - -	4-128.1/(4-128.2 blank)
- - - - -	4-132.1/(4-132.2 blank)
4-137 through 4-146	4-137 through 4-146
4-149 through 4-152	4-149 through 4-152
4-157 through 4-166	4-157 through 4-166
4-169 and 4-170	4-169 and 4-170
4-173 through 4-176	4-173 through 4-176
4-179 through 4-190	4-179 through 4-190
- - - - -	4-196.1 and 4-196.2
4-197 and 4-198	4-197 and 4-198
4-217 through 4-220	4-217 through 4-220
4-231 and 4-232	4-231 and 4-232
4-243 through 4-248	4-243 through 4-248
4-255 through 4-260	4-255 through 4-260
4-263 and 2-264	4-263 and 4-264
- - - - -	4-264.1 and 4-264.2
4-265 and 4-266	4-265 and 4-266
4-269 through 4-272	4-269 through 4-272
4-277 through 4-282	4-277 through 4-282
4-285 and 4-286	4-285 and 4-286
4-295 through 4-300	4-295 through 4-300
- - - - -	4-318.1 and 4-318.2
4-319 through 4-321/(4-322 blank)	4-319 through 4-321/(4-322 blank)
B-5 and B-6	B-5 and B-6
B-11 and B-12	B-11 and B-12
FP-1/(FP-2 blank)	FP-1/(FP-2 blank)
FP-3/(FP-4 blank)	FP-3/(FP-4 blank)
FP-7/(FP-8 blank)	FP-7/(FP-8 blank)
FP-9/(FP-10 blank)	FP-9/(FP-10 blank)
FP-13/(FP-14 blank)	FP-13/(FP-14 blank)
FP-15/(FP-16 blank)	FP-15/(FP-16 blank)
FP-17/(FP-18 blank)	FP-17/(FP-18 blank)
FP-21/(FP-22 blank)	FP-21/(FP-22 blank)
FP-23/(FP-24 blank)	FP-23/(FP-24 blank)
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FP-47/(FP-48 blank)	FP-47/(FP-48 blank)

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Chief of Staff

Official:

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CHANGE

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 12 JUNE 1992

Operator's and Unit Maintenance Manual

**WATER PURIFICATION UNIT,
REVERSE OSMOSIS, 3,000 GPH
TRAILER MOUNTED, FLATBED CARGO,
22-1/2 TON 8 WHEEL TANDEM
MODEL NO. WTA-060
NSN 4610-01-219-8707**

Approved for public release; distribution is unlimited

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Remove pages	Insert pages
1–1 and 1–2	1–1 and 1–2
2–33 through 2-48	2–33 through 2-48
———	2-48.1 through 2-48.4
2–87 through 2–90	2–87 through 2-90
4–37 through 4-84	4-37 through 4-84
A–1/(A–2 blank)	A-1/(A-2 blank)
B-15 through B-17	B-15 through B-17/(B-18 blank)
C-1 through C-6	C-1 through C-6
C-11 through C–22	C–11 through C-22

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NOTE: The portion of text affected by the changes is indicated by a vertical line in the outer Margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of issue for original and changed pages are:

Original.....0 .....13 May 91

Change .....1 .....12 Jun 92
Change .....2 .....30 Sep 92
Change .....3 .....15 Jan 93
Change .....4 .....18 Jan 94
Change .....5 .....30 Jun 95
Change .....6 .....15 Jul 95
Change .....7 .....14 Feb 96
Change .....8 .....8 Jan 97
Change .....9 .....23 Apr 97
Change .....10.....25 Apr 97
Change .....11.....1 Sep 99
Change .....12.....1 Apr 01

Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
Title	0	1-24 - 1-26	0	2-60	7
A - D	12	1-27 - 1-28	12	2-60.1 - 2-62	12
a - b	0	2-1 - 2-2.1	12	2-62.1 - 2-62.2	7
c	2	2-2.2 - 2-3	7	2-62.3 - 2-68	12
d	0	2-4	0	2-68.1 - 2-68.2	7
i - ii	12	2-5	7	2-69	12
iii	7	2-6 - 2-8	0	2-70	7
iv - v	12	2-9	7	2-70.1 - 2-71	12
vi	7	2-10	12	2-72	0
vii - viii	12	2-10.1	7	2-73 - 2-88	12
ix - x	7	2-10.2	12	2-89	2
1-1 - 1-4	12	2-11	7	2-90	12
1-5	7	2-12 - 2-13	12	2-91	0
1-6	12	2-14	0	2-92 - 2-104	12
1-6.1 - 1-6.2	7	2-15 - 2-16	12	2-105	2
1-7	7	2-17	0	2-106	0
1-8 - 1-9	12	2-18 - 2-18.2	7	2-107	7
1-10	0	2-19 - 2-26	12	2-108	12
1-11 - 1-12.1	12	2-32 - 2-34.2	7	2-108.1 - 2-108.2	7
1-12.2 - 1-12.10	7	2-35 - 2-48.2	12	2-109	2
1-13	12	2-49 - 2-50	2	2-110	12
1-14	7	2-51	0	2-111 - 2-112	0
1-14.1 - 1-20.6	12	2-52 - 2-57	12	2-113 - 2-124	12
1-21 - 1-22	0	2-58	7	2-125	0
1-23	2	2-58.1 - 2-59	12	2-126 - 2-134	12

*Zero in this column indicates an original page.

Page No.	*Change No.
2-135	2
2-136	12
2-137 - 2-141	0
2-142	7
2-143 - 2-144	12
2-144.1 - 2-144.2	7
2-145	6
2-146	0
2-147	12
2-148	7
2-148.1	12
2-148.2 - 2-149	7
2-150	0
2-151	12
2-152	2
2-153	0
2-154	2
2-155	0
2-156	7
2-157	0
2-158 - 2-163	12
2-164 - 2-166	0
2-167	12
2-168	0
3-1	6
3-2	12
3-3	6
3-4	12
3-4.1 - 3-4.2	7
3-5	12
3-6	7
3-7	0
3-8	7
3-9 - 3-11	0
3-12 - 3-13	12
3-14	0
3-15 - 3-16	0
3-17 - 3-20	12
3-21	0
3-22	12
3-23	0
3-24 - 3-26	12
3-27	7
3-28	12
3-29	0
3-30	7
3-31 - 3-32	0
3-33	7
3-34	0
3-35	12
3-36 - 3-38	0
3-39	2
3-40	6
3-41	0
3-42	5
3-43 - 3-44	0
3-45	2
3-46	0
3-47	7
3-48	0
3-48.1 - 3-48.2	7
3-49	2
3-50 - 3-52	12
3-53 - 3-59	0
3-60	12
3-61	2
3-62 - 3-64	0
3-65	12
3-66 - 3-68	0
4-1	0
4-2	7
4-3 - 4-10	2
4-11	12
4-12	2
4-12.1 - 4-12.2	12
4-13	7
4-14 - 4-15	0
4-16 - 4-16.2	7
4-17 - 4-22	0
4-23 - 4-24	12
4-25	0
4-26	7
4-27 - 4-30	0
4-31	7
4-32 - 4-36	0
4-37	1
4-38	12
4-39 - 4-41	1
4-42	12
4-43 - 4-50	1
4-50.1 - 4-51	7
4-52 - 4-67	1
4-68	0
4-69	1
4-70	0
4-71	1
4-72	0
4-73 - 4-76	1
4-77	3
4-78 - 4-83	1
4-84 - 4-85	12
4-86 - 4-93	0
4-94 - 4-94.2	7
4-95 - 4-96	0
4-97	7
4-98	0
4-98.1 - 4-98.2	7
4-99 - 4-102	2
4-103 - 4-104	7
4-105	0
4-106 - 4-110	7
4-111 - 4-113	0
4-114	5
4-115	7
4-116 - 4-123	0
4-124	2
4-125	7
4-126	2
4-127	0
4-128 - 4-128.2	2
4-129	7
4-130 - 4-132	0
4-132.1 - 4-132.2	2
4-133 - 4-137	0
4-138 - 4-140	2
4-141	0
4-142 - 4-145	2
4-146 - 4-149	0
4-150 - 4-151	2
4-152 - 4-157	0
4-158	2
4-159	0
4-160	2
4-161	0
4-162 - 4-163	2
4-164 - 4-165	0
4-166	2
4-167 - 4-169	0
4-173 - 4-174	2
4-175	0
4-176	2
4-177 - 4-179	0
4-180	7
4-181	2
4-182	0
4-182.1 - 4-183	7
4-184 - 4-186	12
4-187	2
4-188	7
4-189 - 4-190	2
4-190.1 - 4-192	7
4-193	0
4-194	7

*Zero in this column indicates an original page.

Page No.	*Change No.
4-195	0
4-196 - 4-201	7
4-202	0
4-202.1 - 4-202.6	7
4-203 - 4-204	0
4-205 - 4-210	12
4-211 - 4-217	0
4-218 - 4-220	2
4-221	0
4-222	12
4-223	0
4-224 - 4-225	12
4-226	0
4-227 - 4-228	12
4-229 - 4-230	0
4-231 - 4-232	2
4-233 - 4-234	0
4-235 - 4-245	12
4-246	0
4-247 - 4-248	2
4-249	0
4-250 - 4-251	7
4-252 - 4-253	0
4-254	12
4-255 - 4-256	2
4-257	12
4-258	0
4-259 - 4-260	2
4-261	12
4-262 - 4-264.1	7
4-264.2 - 4-266	2
4-266.1 - 4-267	7
4-268 - 4-269	0
4-270 - 4-272	2
4-273 - 4-276	0
4-277 - 4-278	2
4-279	0
4-280 - 4-282	2
4-283 - 4-284	0
4-285	2
4-286 - 4-287	0
4-288 - 4-289	11
4-290	0
4-291	11
4-292	0
4-293	12
4-294 - 4-295	0
4-296	2
4-297	0
4-298 - 4-300	2
4-301 - 4-304	0
4-304.1 - 4-306	7
4-307 - 4-308	0
4-309	7
4-310 - 4-312	0
4-313	3
4-314 - 4-318	0
4-318.1 - 4-318.2	2
4-319	0
4-320	8
4-321 - 4-322	2
A-1 - A-2	1
B-1 - B-5	0
B-6	2
B-7 - B-11	0
B-12	2
B-13 - B-14	0
B-15	1
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C-1	0
C-2 - C-6	12
C-7 - C-8	9
C-9 - C-12	12
C-13	4
C-14 - C-22	12
C-23/(C-24 blank)	5
D-1	0
E-1 - E-4	0
F-1/(F-2 blank)	0
G-1 - G-2	0
H-1 - H-8	0
Glossary 1-5	0
I-1/(I-2 blank)	0
FO-1 - FO-2	7
Index 1-2	7
Index 3-4	12
Index 5	7
Index 6	12

*Zero in this column indicates an original page.

SAFETY WARNINGS

WARNING

Avoid prolonged or repeated skin contact with the color solution. Wash with soap and water. In the event of eye contact, wash eyes for 15 minutes using the eyewash.

WARNING

Wear gloves. Chemicals contained in test kits may be hazardous. If chemical gets on skin wash with plenty of soap and water.

WARNING

Check chains on hoist for link damage or wear regularly. Damaged or worn chains must be replaced immediately to prevent accidents. Nofity unit maintenance.

WARNING

When unloading raw water and distribution pumps, crewmember on ground should stand clear of pump frame to avoid being injured in event pump falls or is released too quickly.

WARNING

Each storage tank weighs 130 lbs. (59 kg). Three people are required to carry each tank.

WARNING

Never use potable water hoses to handle raw water, or raw water hoses to handle potable water. Mixing hoses could cause contamination of water resulting in serious illness. Hoses are labeled.

WARNING

Other crewmembers must stand clear when anchor is being deployed.

WARNING

A good ground is required to protect operators and equipment, and to provide lightning protection. Failure to properly ground the generator, ISO container, and high pressure pump assembly could result in electrocution.

WARNING

Ground rod must be driven at least 8 ft (2.5 m) deep to be sure of a good ground. A poor electrical ground can lead to injury or death from electrical shock.

WARNING

Check to make certain that grounding cable is securely attached to grounding lugs to avoid a poor electrical ground which could lead to electrocution. Cable should remain attached during transport deployment but will be disconnected whenever the van or high pressure pump assembly are removed from the trailer.

WARNING

Under some unusual conditions, air may be pushed out the waste hose causing the end to whip. Stand clear of hose end by at least 20 ft (6 m) while ROWPU is operating to avoid serious injury.

WARNING

The air manual blowdown valve must be opened before removing the filter top plug. Failure to do so will result in the cap being blown off which could cause serious injury.

WARNING

Use caution when using chemicals (polyelectrolyte, sequestrant, citric acid, NTP-A, detergent, calcium hypochlorite, sodium bisulfite). Failure to do so could result in severe burns, especially to eyes. Always wear chemical protective gloves and a face shield. If a chemical comes in contact with skin or clothes, wash off immediately. If a chemical comes in contact with eyes, wash eyes immediately for 15 minutes from the eyewash station.

WARNING

Water over 1000 ppm TDS is not safe to drink.

WARNING

Keep face away from clean/flush tank port. Chemical fumes may irritate eyes.

WARNING

Do not exceed load limits of hoist. Do not operate hoist without safety latches on hooks. Failure to observe these precautions could result in serious injury and damage to equipment.

WARNING

Make sure load hook is attached at or near balance point of any load being moved. Failure to do so could result in violent swinging or dropping of load. This could result in serious injury and damage to equipment.

WARNING

To avoid unsafe work conditions do not allow the temperature inside the ROWPU to rise above 120°F (49°C). Keep doors open and water flowing to help cool the ROWPU.

WARNING

If CO level exceeds 50 ppm, evacuate the van, CO is deadly.

WARNING

Do not enter van alone during a red ALARM 2 condition. Always have another crewmember available to insure safety. CO is deadly.

WARNING

When deployed on an NBC decontamination mission, protective gear, appropriate MOPP level, as approved by the supervisor will be worn.

WARNING

When coming out of the vent, water will be contaminated. Make certain to avoid skin contact with contaminated water. Use a clearly marked container to collect this water. Failure to do so could result in death.

WARNING

Avoid skin contact with spent NBC filter media. Use protective gear and protective masks (M9 or M17). Failure to do so could result in death.

WARNING

Dirty cartridge filters may be highly contaminated in NBC missions. During NBC missions wear protective equipment. Avoid skin contact with the water which drips off them. Failure to do so will result in serious illness or death.

WARNING

Areas must be tested before removing protective gear during decon procedures. Failure to do so will result in serious illness or death.

WARNING

After an NBC decontamination mission, the ROWPU must be properly decontaminated. Failure to follow proper procedures may result in NBC agent injury or death to you and others.

WARNING

Avoid skin contact with the used carbon. Use protective gear including an apron and gloves.

WARNING

Avoid skin contact with used deionizing bed material. Use protective gear including an apron and gloves.

WARNING

Make sure electrical power is off before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

WARNING

Always disconnect electrical cables at the ROWPU first, then from the pump being serviced.

WARNING

Do not operate ROWPU without ground rod properly set and the ground cable connected. Failure to do so may result in severe injury or fatal electrical shock.

WARNING

Do not wear loose clothing or jewelry while working on equipment.

WARNING

Cleaning solvent used to clean parts can be dangerous. Wear rubber gloves to protect your hands. Solvent can be absorbed through skin. Wash with soap and water if you get solvent on your skin. Use a Lanolin based skin cream after washing. Don't use near an open flame or heat source. Don't work in a closed area. Be sure your work area gets plenty of fresh air.

WARNING

Proper hearing protection must be worn within 30 ft (9 m) of ROWPU when the ROWPU is operating. Sound pressure levels produced by ROWPU operation could cause permanent hearing damage if hearing protection is not used.

WARNING

Do not drink water from any hose or valve except the dispensing hoses. Water from all other valves and hoses can be contaminated and is NOT for drinking. Drinking contaminated water will cause severe nausea and may result in death.

WARNING

To avoid slipping or falling, keep all standing water or solutions cleaned off the floor of the ROWPU.

WARNING

Disconnect raw water pump power cable before removing cyclone separators. The pump motor could start accidentally and cause serious injury.

WARNING

Shut down electrical power to the ROWPU before attempting to replace drive belts. Failure to do so could result in serious injury.

WARNING

Relieve air compressor circuit pressure before attempting to do any work on air system. Failure to do so could result in serious injury. Close the air tank outlet valve and then open the air manifold vent valve to relieve all pressure.

WARNING

Make certain air compressor switch is turned OFF and right side drain valve has been opened to relieve pressure before changing outlet filter or working on compressor. Serious injury could result if this is not done.

WARNING

Before working on any electrical device, open the main control panel circuit breaker and stop the diesel generator. When working on the distribution pump or raw water pump motors disconnect the cable. The voltages used in the ROWPU can cause a fatal shock if these precautions are not taken.

WARNING

Side-to-side slope of ROWPU cannot be more than 2 degrees, (end to end) slope cannot be greater than 5 degrees. Greater slope could cause the unit to tip over.

WARNING

A light bulb or bulb guard that has been on can be hot. Use a glove or suitable cloth when performing maintenance to avoid getting burned.

TECHNICAL MANUAL
TM 10-4610-232-12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 13 May 1991

OPERATOR'S AND UNIT MAINTENANCE MANUAL FOR WATER PURIFICATION UNIT, REVERSE OSMOSIS, 3,000 GPH TRAILER MOUNTED, FLATBED CARGO, 22-1/2 TON 8 WHEEL TANDEM MODEL NUMBER WTA-060, NSN 4610-01-219-8707 MODEL NUMBER ROWPU-1, NSN 4610-01-371-1790

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028-2 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.armv.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or E-mail your letter, DA Form 2028, or DA Form 2028-2 direct to: Technical Publication Information Office, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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TABLE OF CONTENTS **Page**

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES - (Continued.)

LIST OF FIGURES - (Continued.)

LIST OF FIGURES - (Continued.)

LIST OF FIGURES (Continued.)

LIST OF FIGURES - (Continued.)

LIST OF FIGURES

CHAPTER 1. INTRODUCTION
SECTION I. GENERAL INFORMATION.

1-1. SCOPE.

a. *Type of Manual*. Operator and Unit Maintenance Manual.

b. *Model Number and Equipment Name*. Reverse Osmosis Water Purification Unit, referred to from now on in this manual as the ROWPU. Two models are covered by this manual; Model WTA-060 as manufactured by Aqua-Chem., Inc., and Model ROWPU-1 as manufactured by Keco Industries, Inc. When any portion of this manual refers to only one of these models, the statement “(MODEL WTA-060 ONLY)” OR "(MODEL ROWPU-1 ONLY) " will be placed immediately after the applicable sentence. If no reference is made to only one model, then that portion of the manual applies to both models.

c. *Purpose of the Equipment*. Purifies water from many different sources to make potable (drinkable) water. Can purify:

(1) Dirty fresh water.

(2) Brackish water (dirty and a little salty).

(3) Sea water (very salty).

(4) Fresh water containing nuclear, biological, or chemical (NBC) agents.

d. *Special Limitations on Equipment*

(1) Operates in temperatures between -25°F and 110°F (-32°C and 43°C).

(2) Winterization kit must be used if operating temperature is below 32°F (0°C).

(3) RO elements may be ruined if they are allowed to freeze.

(4) Temperatures of the source water cannot be greater than 110°F (43°C).

(5) The amount of water produced depends on the temperature of water being purified.

(6) Must be hauled by M818 or M932 tractors.

(7) Side-to-side slope of the ROWPU cannot be more than 2 degrees, end-to-end slope cannot be greater than 5 degrees. Greater slopes could cause unit to tip over.

1-2. MAINTENANCE FORMS AND RECORDS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs). If your ROWPU needs improvement let us know. Send us an EIR. You, the user, are the only one who can tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it directly to Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-CIP-WT, Rock Island, IL 61299-7630. We'll send a reply.

1-4. WARRANTY INFORMATION. Refer to TB 10-4610-232-24 for the warranty on Model ROWPU-1. Report all defects in material or workmanship to your supervisor.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE. Command decisions, according to tactical decision, will decide when destruction of the ROWPU will take place. A destruction plan will be prepared by the using organization, unless one has been prepared by higher authority. For general destruction procedures for this equipment, refer to TM 750-244-3, Procedures for Destruction of Equipment to Prevent Enemy Use.

1-6. PREPARATION FOR STORAGE OR SHIPMENT. Refer to Chapter 4, Section VI of this manual for preparation for storage or shipment instructions.

1-7. QUALITY ASSURANCE/QUALITY CONTROL. Refer to quality assurance/quality control specification MIL-9858A for quality assurance/quality control information.

1-8. SAFETY, CARE AND HANDLING. Always keep in mind the general CAUTIONS and WARNINGS, listed on the warning page at the front of this manual and the specific CAUTIONS and WARNINGS given with procedures throughout this manual and as data plates and decals on the ROWPU.

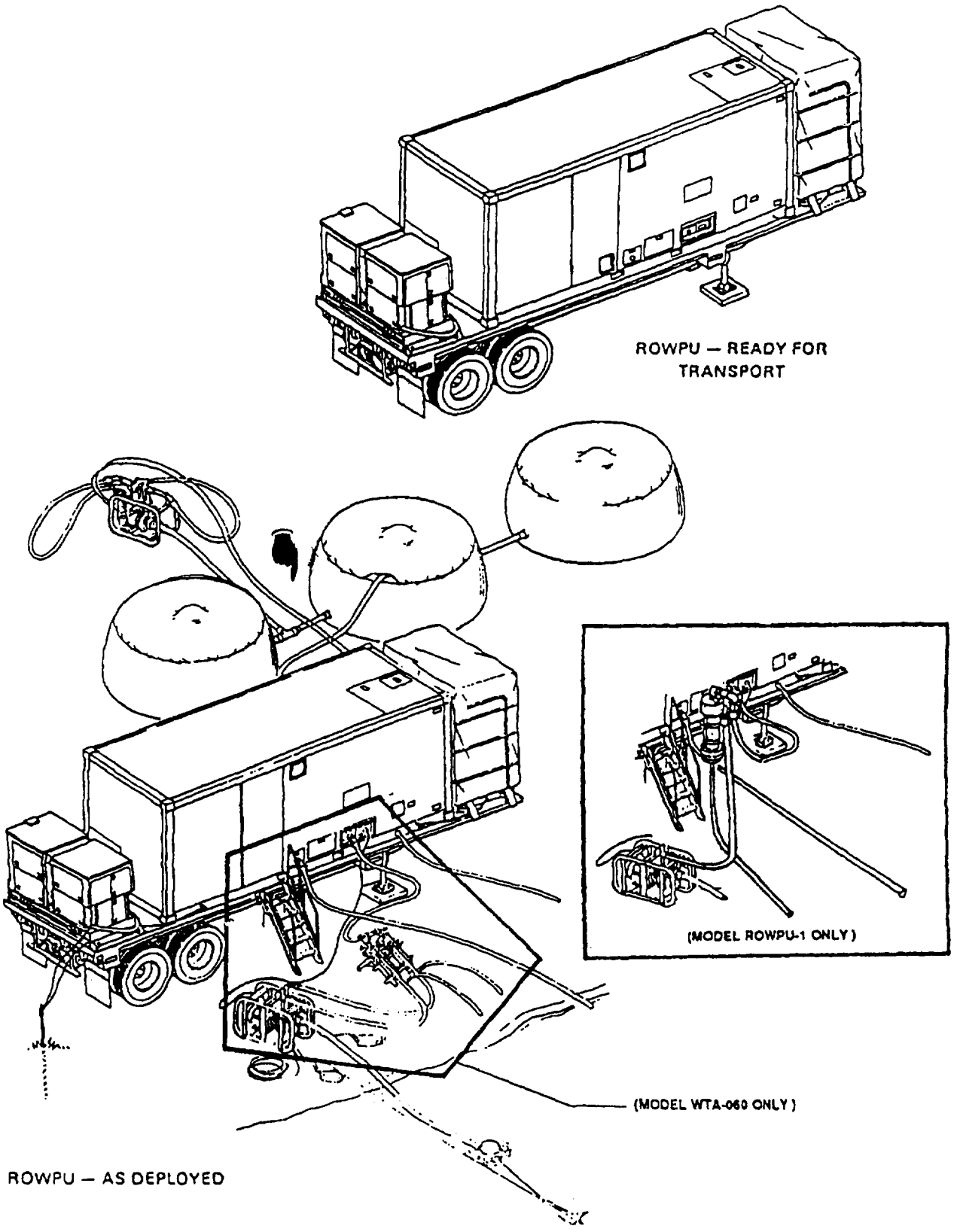


Figure 1-1. 3000 Gallons Per Hour Reverse Osmosis Water Purification Unit

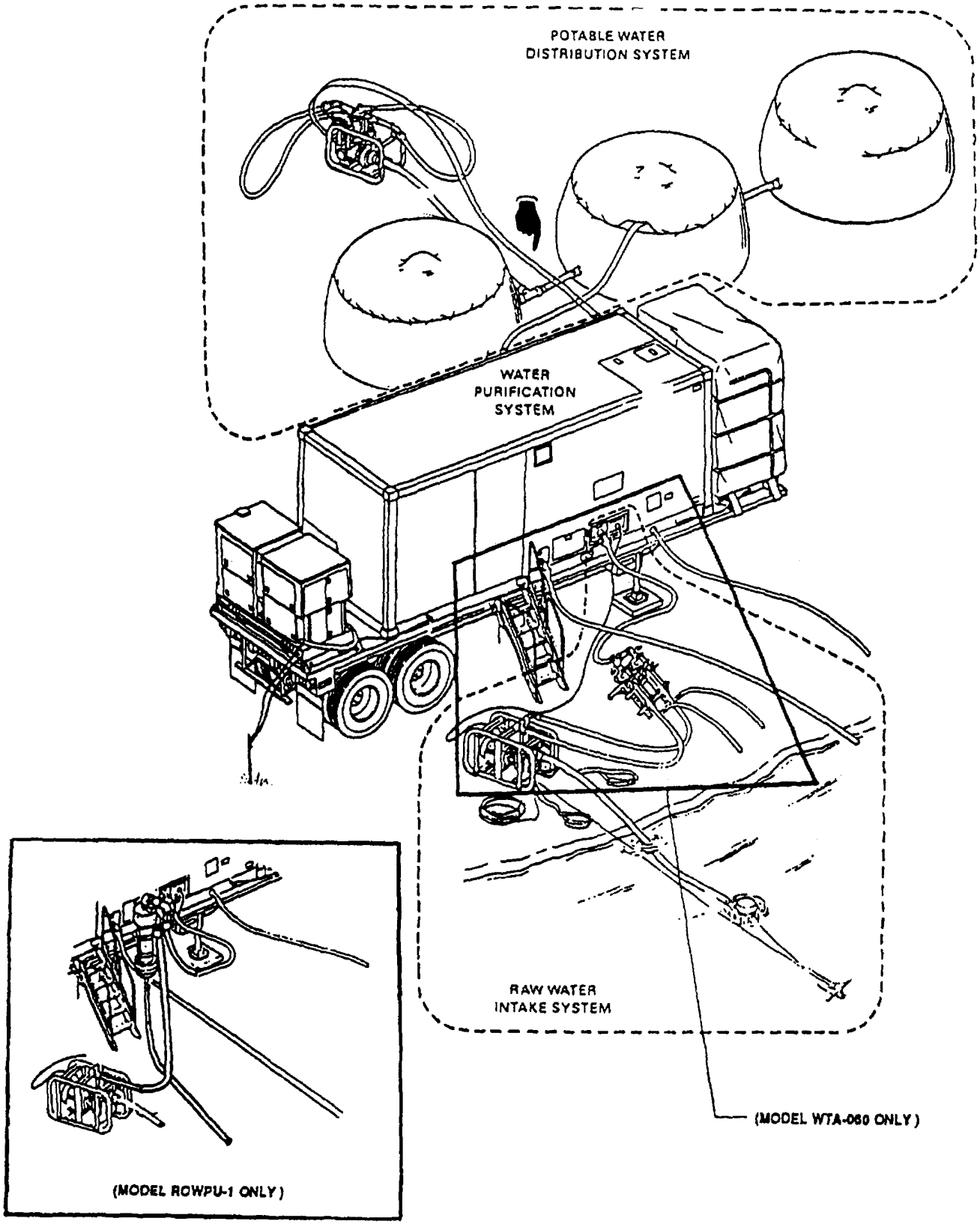


Figure 1-2. Major Systems of the ROWPU

SECTION II. EQUIPMENT DESCRIPTION.

1-9. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES.

a. *Characteristics*.

(1) Contained in a special 8 x 8 x 20 ft (2.4 x 2.4 x 6.1 m) ISO (International Standards Organization) container with skid mounted external components.

(2) The ROWPU can be shipped by military aircraft.

(3) The ROWPU is mounted on a standard 30 ft (9.5 m) M871 military trailer so it can be moved to where it is needed.

(4) The ROWPU is powered by a 60 KW utility diesel generator.

b. *Capabilities and Features*.

(1) The ROWPU can supply 60,000 gallons daily from fresh waters or brackish waters 75°F (24°C) and over. Less water is produced from colder water sources.

(2) The ROWPU can supply 40,000 gallons daily from sea water 75°F (24°C) and over.

(3) The ROWPU can supply 60,000 gallons daily from NBC contaminated fresh waters 75°F (24°C) and over.

(4) The ROWPU produces potable water to long term consumption standards of purity.

(5) It can handle raw water turbidity to 150 NTU.

(6) On an NBC decontamination mission, raw water containing up to 10 ppm CW agent, or one million microorganism colonies per 100 ml, or 100,000 pC/l (picoCuries per liter) radioactivity can all be made potable.

(7) Raw water can be taken from wells, lakes, seas, lagoons, rivers, or through an ice hole. The raw water pump can lift water about 15 feet (4.5 m) and discharge up to a height of 30 feet (9 m) at 110 gpm (416 lpm).

(8) The winter kit allows the unit to be operated at a water point where air temperatures are between -25 and 32°F (-32 and 0°C) and water temperatures are above 32°F (0°C).

(9) The ROWPU is set up and operated by a 3 person crew (one of whom is an NCO). Operation is semi-automatic.

1-10. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. The ROWPU is made up of three main systems as shown in Figure 1-2. The major components of each system are described in the following paragraphs.

NOTE

The electrical power source for operation of the ROWPU is provided by a 60 KW utility Diesel Generator. See TM 5-6115-545-12 for information about the generator. If equipped with tactical quiet generator, see TM 9-6115-645-10.

a. *Raw Water Intake System (Figure 1-3)*. The Raw Water Intake System supplies feed water to the ROWPU and consists of the following major components.

(1) *Intake Strainer*. A floating intake strainer holds the raw water intake hose off the bottom of the water source and screens out leaves, sticks, fish, and other large objects. It is connected by sections of rigid suction hose to the raw water pump. A non-floating strainer (part of winterization kit) is used for ice hole operation.

(2) *Anchor*. Used to deploy the intake strainer and hold it in place.

(3) *Raw Water Pump*. Draws water through the intake strainer and discharges the water to the cyclone separators. A hand priming pump is used to assist initial prime to the water pump.

(4) *Cyclone Separators*. Remove sand and heavy dirt by centrifugal water flow action. Raw water discharge hose sections deliver the water from separators to the water purification system at the feed water booster pump inlet.

(5) *Priming Assist Pump*. This hand operated pump is used to help draw water up to the raw water pump. It is disconnected from raw water pump after priming is completed.

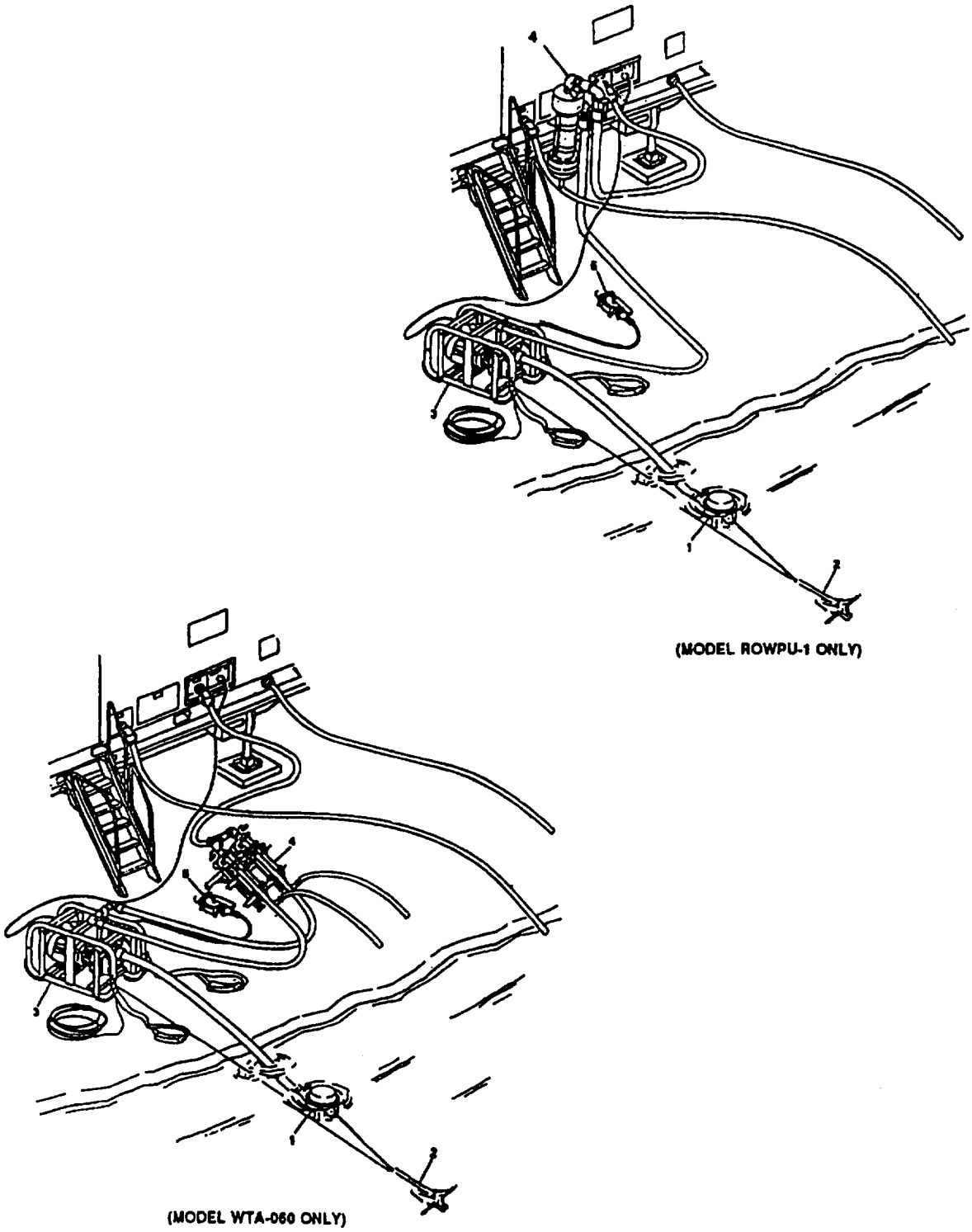


Figure 1-3. Major Components of the Raw Water Intake System

b. Water Purification System (Figure 1-4). This system purifies the raw water to make potable water suitable for drinking.

(1) The components of the Water Purification System are contained in the ISO container (van) (1) and the separate high pressure pump assembly (2).

(2) The Water Purification System consists of the following major components and appropriate piping and valves, monitoring devices, and semi-automatic controls.

(a) *Feed Water Booster Pump (3)*. Pressurizes water from the raw water system as needed for the filtration processes. It is a 115 gpm (435 lpm) pump and requires 35-40 psig (241-276 kPa) to operate.

(b) *Basket Strainer (4)*. Removes remaining large particles in the water to prevent clogging of the internal distributors of the media filter.

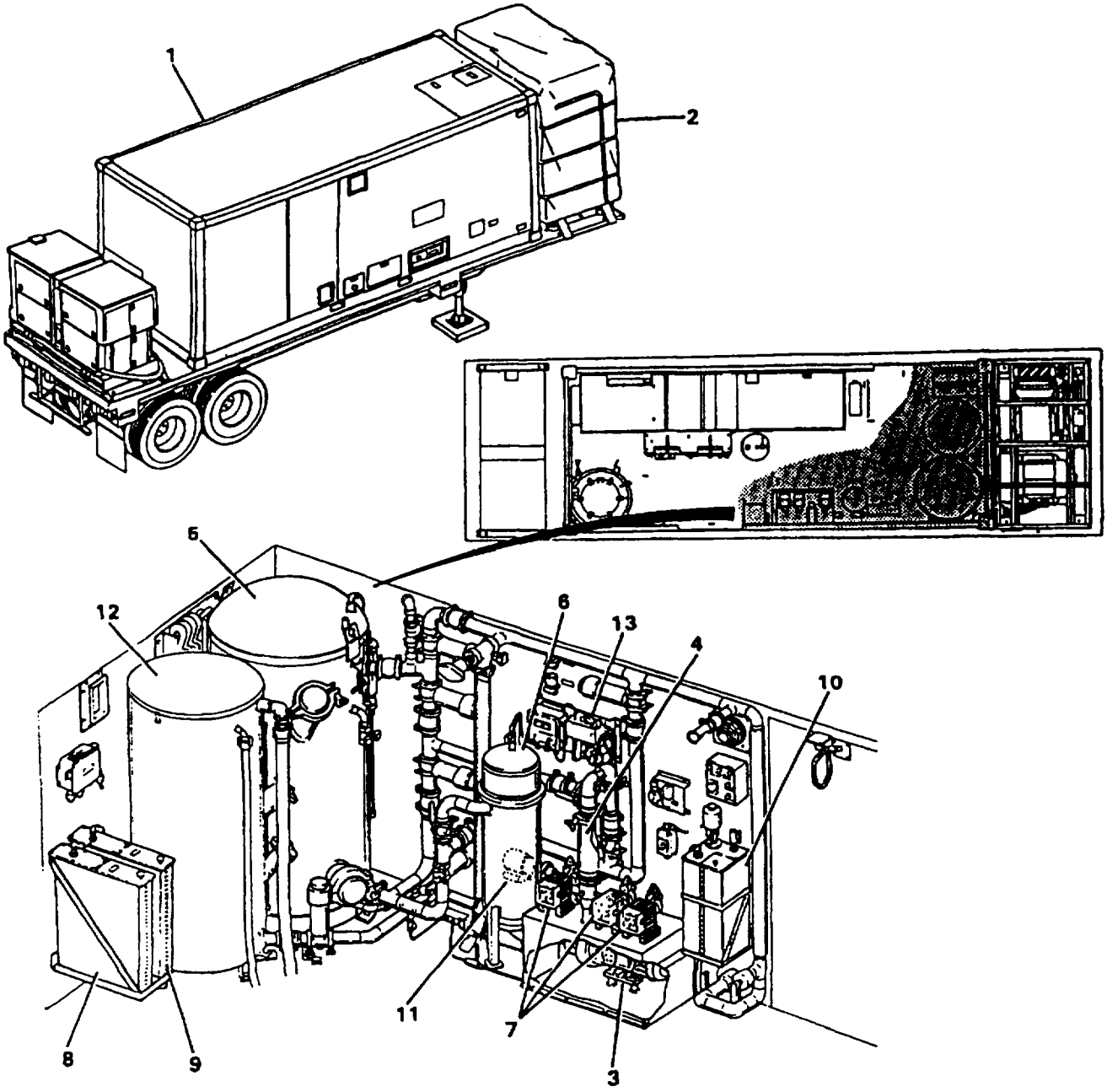


Figure 1-4. Major Components of the Water Purification System (Sheet 1 of 4)
(MODEL WTA-060 ONLY)

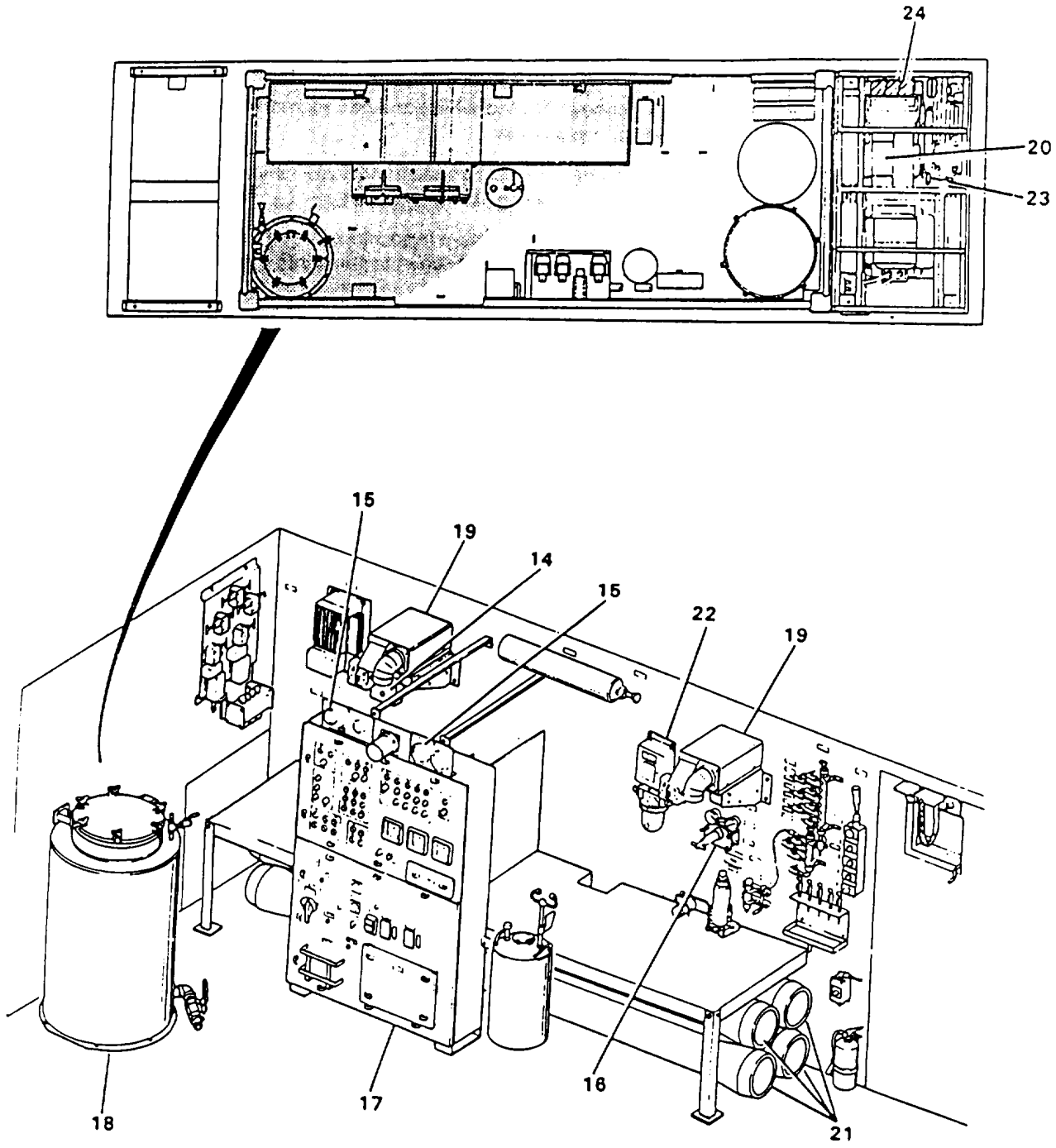


Figure 1-4. Major Components of the Water Purification System (Sheet 2 of 4)
(MODEL WTA-060 ONLY)

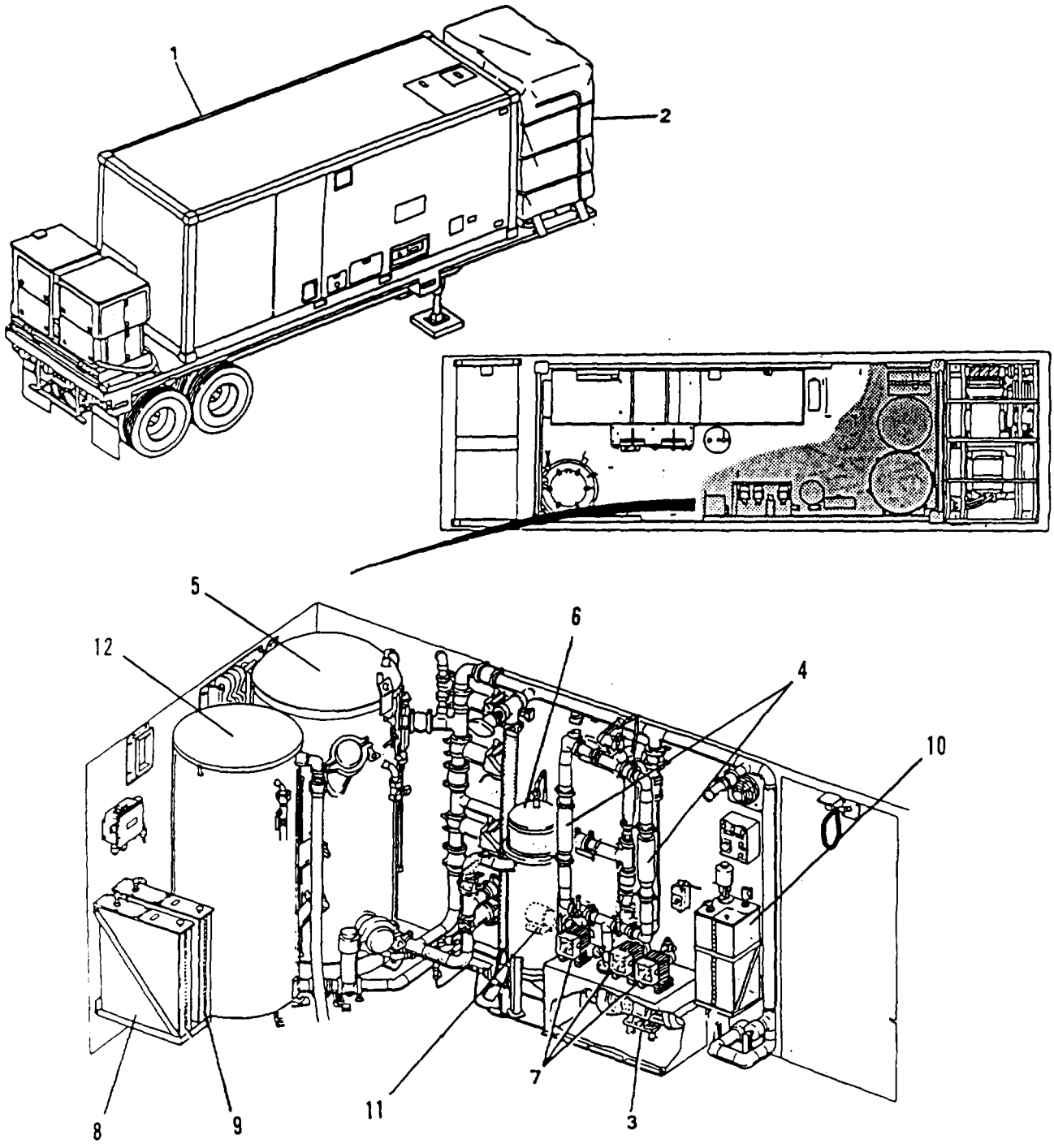


Figure 1-4. Major Components of Water Purification System (Sheet 3 of 4)
(MODEL ROWPU-1 ONLY)

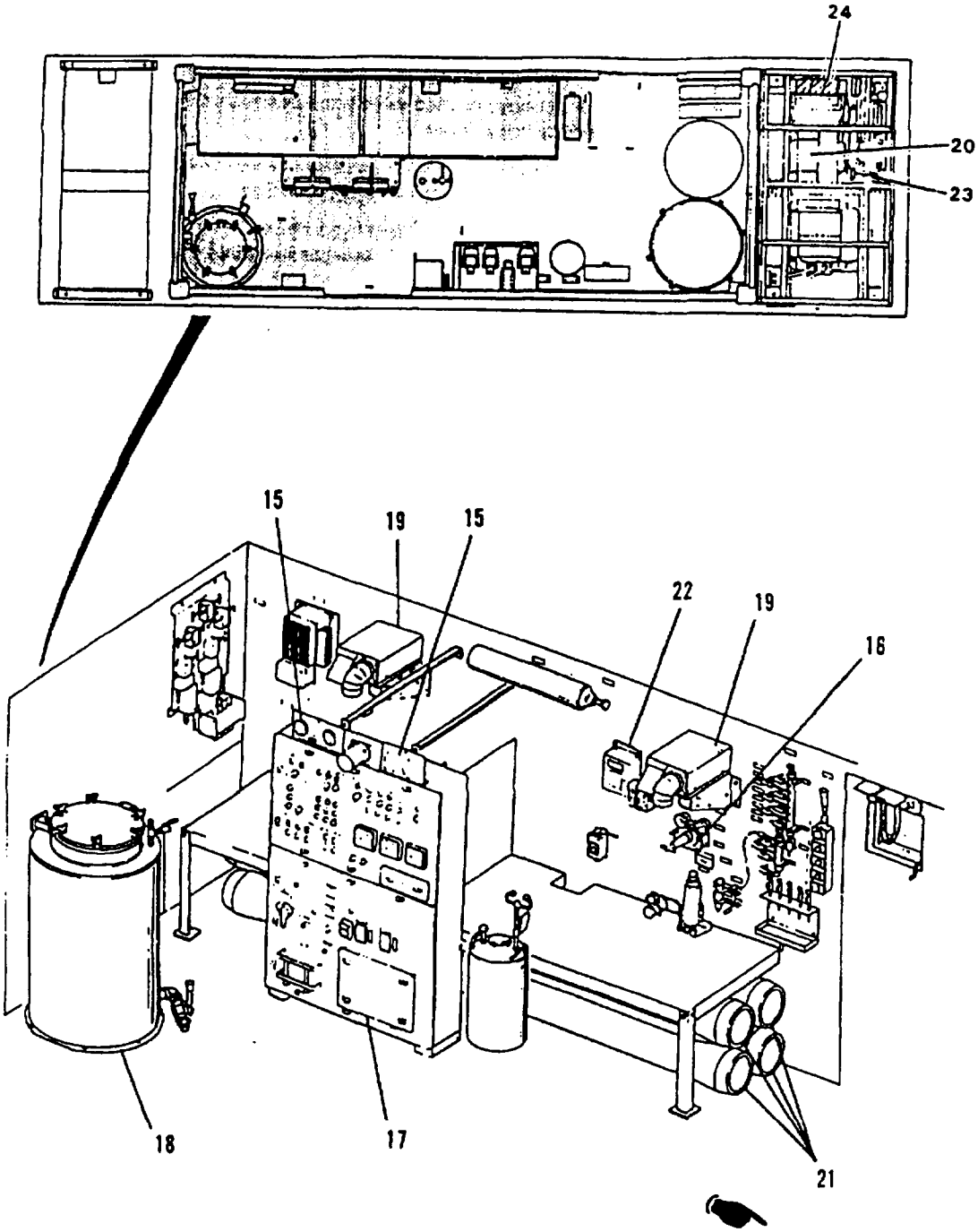


Figure 1-4. Major Components of Water Purification System (Sheet 4 of 4)
(MODEL ROWPU-1 ONLY)

(c) *Media Filter* (5). Removes most of the suspended solids from the raw water by passing the water through a filter bed of AG media (special lightweight material) and garnet sand.

(d) *Cartridge Filter* (6). Removes very fine suspended solids in the raw water by passing the water through replaceable cartridges.

(e) *Chemical Injection Pumps* (7). Inject water treatment chemicals into the feed and product water.

(f) *Polyelectrolyte Tank* (8). A reservoir for a chemical called polyelectrolyte which is mixed with water and used to help the media filter remove suspended solids by coagulation.

(g) *Sequestrant Tank* (9). A reservoir for a chemical called sequestrant (scale inhibitor) which is mixed with water and used to prevent scale from building up in the reverse osmosis elements.

(h) *Hypochlorite Tank* (10). Contains a chemical called calcium hypochlorite which is added to the backwash water to control organic growth in the media filter. Also injected by a separate pump into the product water to control bacterial contamination while in the storage tanks and after distribution.

(i) *Hypochlorite Backwash Pump* (11). Injects hypochlorite into the media filter backwash water.

(j) *Clean/Flush Tank* (12). Reservoir for holding water used to backwash the media filter and to flush and clean the system during cleaning procedures.

(k) Deleted.

(l) Deleted.

(m) *Gage Panel* (15). Gages indicate pressure and differential pressure related to the filters and the RO elements.

(n) *Air System Low Pressure Regulator* (16). Regulator valve controls air pressure to automatic valves and other air system components.

(o) *Main Control Panel* (17).

- Low Voltage Section (110 VAC). Contains the electrical controls, lights, circuit breakers, and water flow metes.
- High Voltage Section (440 VAC). Contains the circuit breakers, motor starters and transformers needed to operate the ROWPU.

(p) *NBC Filter* (18). Used during NBC decontamination operations. Removes trace nuclear, biological, or chemical contaminants from the feed water remaining after purification by the filtration and the RO process.

(q) *Heaters*. Diesel fired heaters (19) provide heat inside of van, an electric heater (20) provides heat to the high pressure pump assembly mounted outside the van.

(r) *RO Vessels* (21). Contain the RO elements which reduce the TDS content of the feed water.

(s) *Carbon Monoxide Monitor* (22). A self-contained device which indicates presence of harmful amounts of carbon monoxide by an audio alarm and visual display.

(t) *Air Compressor* (23). Provides air for aiding the backwash of the media filter, for operating automatic valves and utility service air.

(u) *High Pressure Pump* (24). Pressurizes the feed water after it is filtered for the reverse osmosis process.

c. *Potable Water Distribution System (Figure 1-5)*. This system stores and dispenses the potable water produced by the ROWPU.

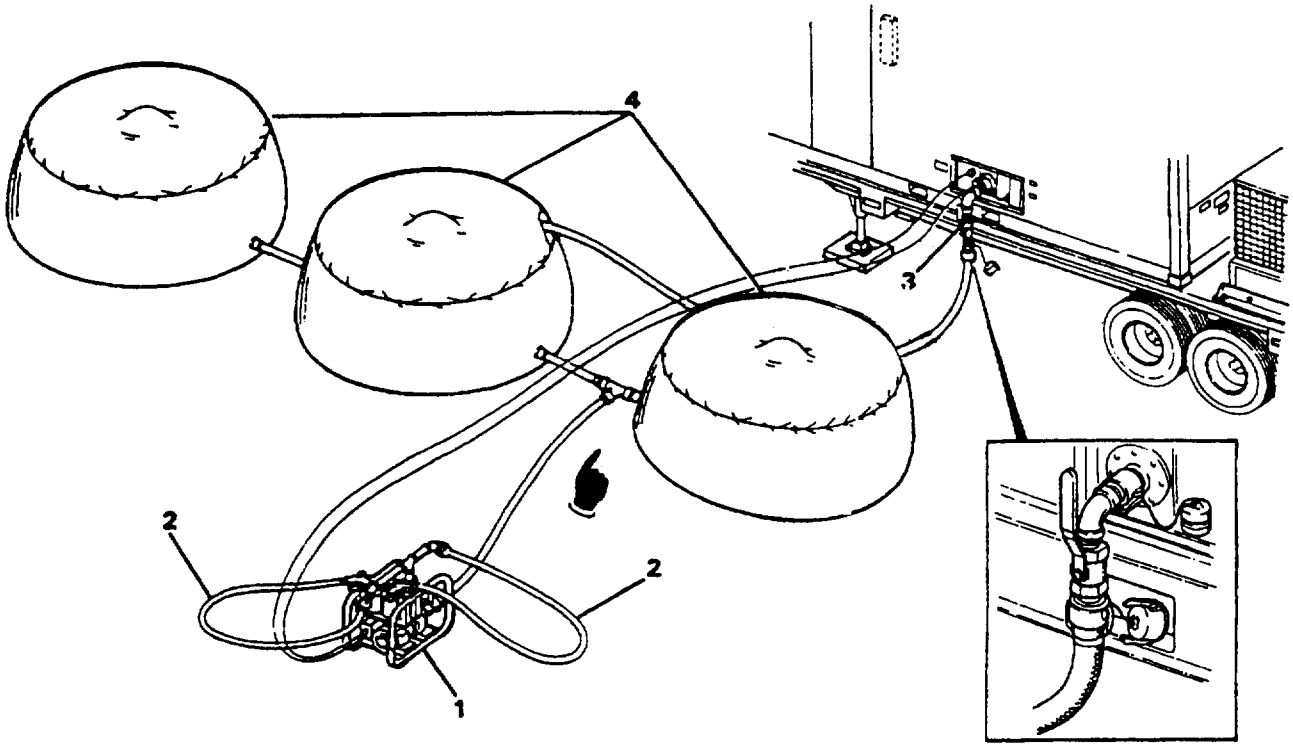


Figure 1-5. Major Components of the Potable Water Distribution System

NOTE
Three 3000 gallon (11,355 l) potable water storage tanks store the potable water produced by the ROWPU

(1) *Distribution Pump* (1). Draws potable water from storage tanks and pressurizes it.

(2) *Distribution Hoses and Dispensing Nozzles* (2). The potable water is dispensed through hoses and manually controlled nozzles.

(3) *Product Shut-Off Valve* (3). This valve is normally open and is closed when cleaning the RO elements.

(4) *Storage Tanks* (4). These are 3000 gallon (each) collapsible potable water storage tanks (see TM 5-5430-225-12).

d. *Winter Kit* (Figure 1-6). Contains items required to prevent freezing of water during cold weather operation. Items 1 thru 6 are stored in a winter kit storage box when not in use. The covers (8 and 9) and skids (10 and 11) are stored on the table to the left of the main control panel under the spare cartridge filter elements

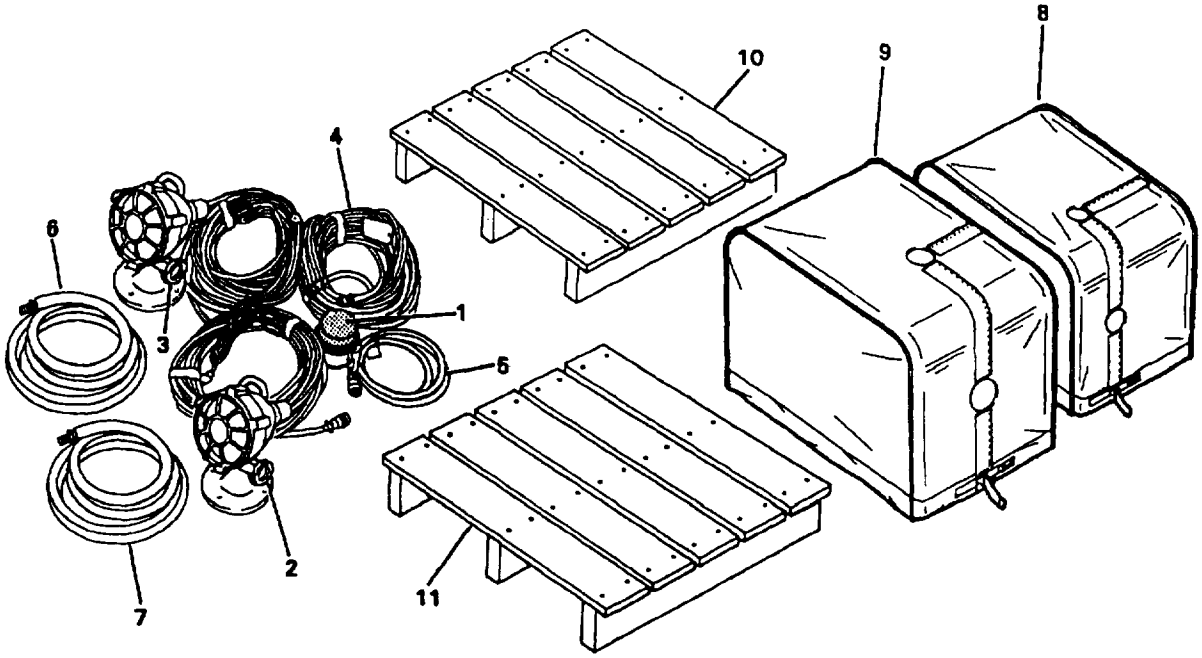


Figure 1-6. Winter Kit Components

(1) *Intake Strainer*(l). Use with ice holes.

(2) *Distribution Pump Heat Lamp* (2). With 55 ft (17 m) of permanently attached cable.

(3) *Raw Water Pump Heat Lamp* (3). With 110 ft (34 m) of permanently attached cable.

(4) *Extension Cord* (4). This 110 ft (34 m) cable is used if the cable on item 3 above does not reach the heater outlet on the van.

(5) *Electrical Harness* (5). Used to connect one of the van's diesel heaters to the generator battery to provide power for the heater during transport and when power to the ROWPU is off.

(6) *Raw Water Pump Drain Hose* (6).

(7) *Distribution Pump Drain Hose* (7).

(8) *Distribution Pump Cover* (8).

(9) *Raw Water Pump Cover* (9).

(10) *Distribution Pump Skid* (10).

(11) *Raw Water Pump Skid* (11).

e. *Government Furnished Property* (Figure 1-7). The following items, furnished by the government are required for operation of the ROWPU.

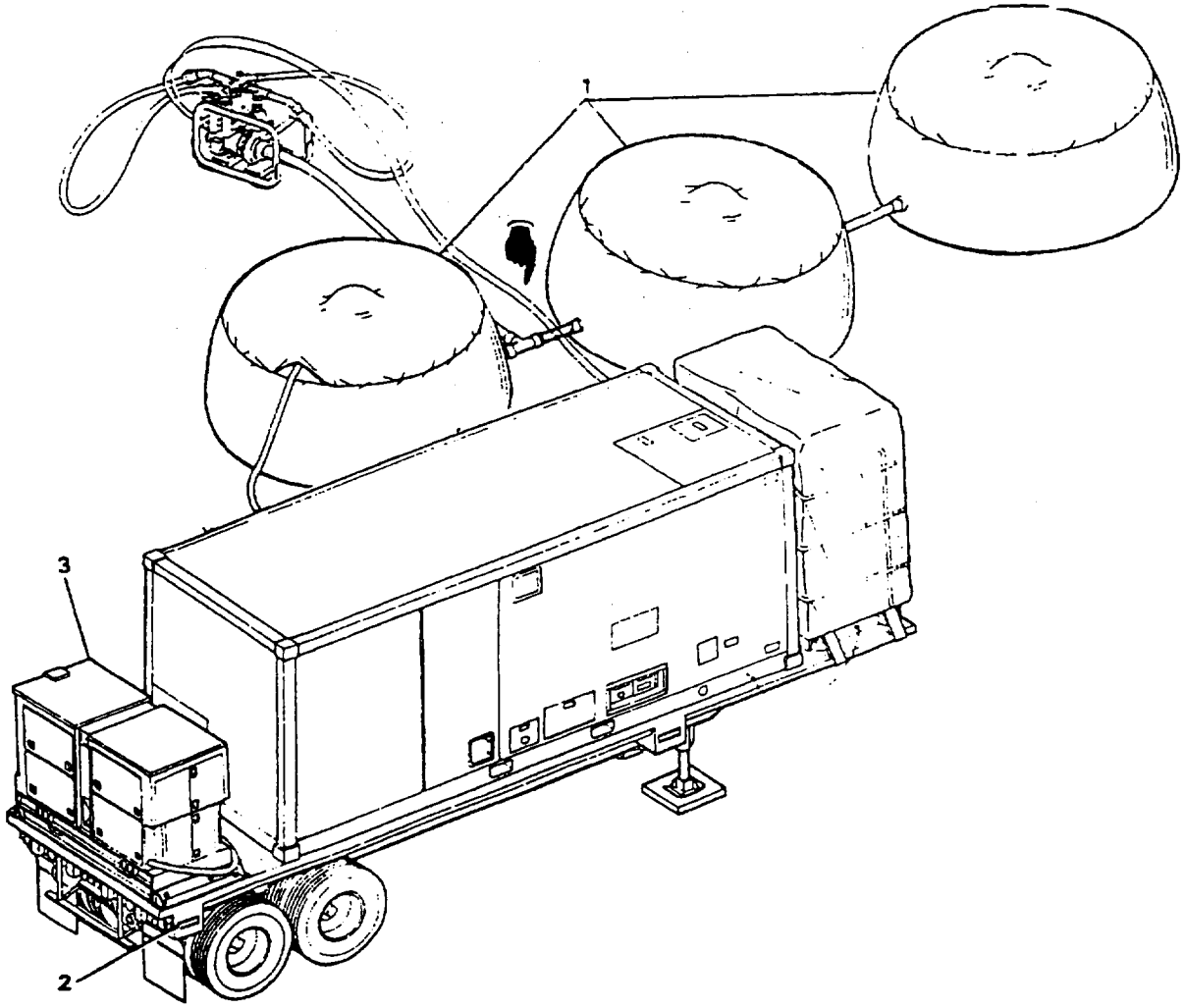


Figure 1-7. Government Furnished Property

(1) *Storage Tanks* (1). Used to store potable water. See TM 5-5430-225-12&P for more information.

(2) *Semi-Trailer* (2). ROWPU is mounted on this trailer so it can be moved to the mission site. See TM 9-2330-358-14&P or TM 9-2330-386-14&P for more information.

(3) *Generator Set* (3). Electrical power source required for operation of ROWPU is a 60 KW generator mounted on the same semi-trailer as the ROWPU. See TM 5-6115-545-12 for more information. For tactical quiet generator, see TM 9-6115-645-10.

1-11. EQUIPMENT DATA.

a. Performance.

Brackish water (based upon TDS of 1000-15,000 at 77°F (25°C) water temperature:

Flow Rate ..... 53 gpm (200 l/min)
Average Daily Production ..... 60,000 gallons (227,100 l)
Quality ..... 20 to 200 ppm TDS
Fuel Consumption ..... 2.0 to 3.4 gph (7.5 to 12.9 l/hr)

Sea water (based upon TDS of 15,000-35,000 at 77°F (25°C) water temperature:

Flow Rate ..... 34 gpm (128.7 l/min)
Average Daily Production ..... 40,000 gallons (151,400 l)
Quality ..... 470 to 825 ppm TDS
Fuel Consumption ..... 3 to 3.4 gph (11.4 to 12.9 l/hr)

Fresh water and NBC contaminated fresh water (based upon TDS of up to 1000 TDS at 77°F (25°C) water temperature:

Flow Rate ..... 53 gpm (200 min)
Average Daily Production ..... 60,000 gallons (227,100 l)
Quality ..... 0.1 to 10 ppm TDS
Fuel Consumption ..... 2.0 to 3.4 gph (7.5 to 12.9 l/hr)

NOTE

When the temperature is lower than 75°F (24°C), the flow rate and daily production of potable water may be less. This is due to viscosity effects.

b. Operating Temperatures ..... -25°F to +110°F (-32°C to +43°C)

c. Storage Temperatures.

ROWPU less sensitive items ..... -28°F to +145°F (-33°C to +63°C)
Sensitive-items ..... 35°F to +110°F (+2°C to +43°C)
RO Elements
Polyelectrolyte
Sequestrant
Color Test Kit
Available Chlorine Color Comparator Test Kit
Turbidity Standards
NTP-A Cleaner
Membrane Cleaner Detergent

d. Power Requirements ..... 60 KW maximum demand

e. Dimensions and Weight

(1) ISO container fully packed ..... 20 x 8 x 8 ft (6.1 x 2.4 x 2.4m), 15,100 lb (6849 kg)
..... (MODEL WTA-060 ONLY)
..... 20 x 8 x 8 ft (6.1 x 2.4 x 2.4 m), 14,790 lb (6723 kg)
..... (MODEL ROWPU-1 ONLY)
(2) Mobility configured ..... 8 x 13 x 30 ft (2.4 x 3.9 x 9.1 m)
(3) ROWPU with generator mounted on trailer ready for transport and deployment ..... 37,960 lb (17,215 kg)
..... (MODEL WTA-060 ONLY)
..... 37,650 lb (17,114 kg)
..... (MODEL ROWPU-1 ONLY)

1-11.1. DIFFERENCE BETWEEN MODELS. Two different models of the reverse osmosis water purification unit are covered by the information contained in this manual. This paragraph defines the differences between each of these models. These two models are as follows:

MODEL WTA-060	MANUFACTURED BY AQUA-CHEM, INC.
MODEL ROWPU-1	MANUFACTURED BY KECO INDUSTRIES

The following list defines the major differences between Model WTA-060 and Model ROWPU-1.

a. **Cyclone Separators**. (Refer to Figure 1-7.1.) The cyclone separation system used on the WTA-060 model consists of two separators (1) mounted on a separate frame (2) which is placed on the ground near the ROWPU (3). The cyclone separation system for the ROWPU-1 model consists of only one cyclone separator (4) which has been fabricated to be mounted in one of the stake pockets on the M871 trailer (5) used to transport the ROWPU system. As a result of this difference, the piping system on the raw water pump (6) and the raw water hose (7) routing have been modified as shown in the illustration.

b. **Raw Water Strainer System**. (Refer to Figure 1-7.2.) The strainer system used on the WTA-060 model uses a single strainer (1) in the piping system to strain raw water entering the ROWPU. The ROWPU-1 model, however, is equipped with a dual strainer system (2) which allows the ROWPU system to remain in operation while either of the two strainers is being cleaned. One strainer is kept in operation at all times through the use of two manual valves (3).

c. **Automatic Valves**. (Refer to Figure 1-7.3.) Throughout the ROWPU system a series of automatic valves are used to direct the water as it passes through the ROWPU piping. The type of automatic valves (1) used by the WTA-060 model looks slightly different than the automatic valves (2) used on the ROWPU-1 model. Although the appearance of the valves is different, the function of the valve is identical. The repair procedures differ slightly and are indicated in the related paragraphs for the maintenance of these valves.

d. **Control Panel Gauges Drain Valves**. (Refer to Figure 1-7.4) To prevent freezing of the gauges (1) used on the top of the control panel, the ROWPU-1 model of the ROWPU has been equipped with valves (2) which are used to drain fluids form the gauges and gauges tubing prior to shutdown or storage of the unit in cold or freezing conditions. The WTA-060 model of the ROWPU does not have these valves.

e. **Pressure Switches**. (Refer to Figure 1-7.5.) Various pressure switches are used in the piping system of the ROWPU to indicate how various parts of the piping system are functioning. The pressure switches (1) used on the ROWPU-1 model of the ROWPU have a different appearance than the pressure switches (2) used on the WTA-060 mode. Although the appearance of these switches is different, the function of each switch is identical. The repair procedures differ slightly and are indicated in the related paragraphs for the maintenance of these switches.

f. **High Pressure Pump Jog Switch**. (Refer to Figure 1-7.6.) To prevent the cracking of the high pressure pump housing during freezing, the ROWPU-1 model of the ROWPU has been equipped with a jog switch (1) used to momentarily jog the high pressure pump to remove any water that may have been left in the pump housing during the shutdown process. The WTA-060 model does not have this switch.

g. **Roof Design**. (Refer to Figure 1-7.7.) The roofing material used on the ROWPU-1 model has been redesigned to incorporate a one piece roofing skin (1). The WTA-060 model is equipped with a roof design that uses many roof sections to form the roof (2).

h. **Deleted**.

i. **Deleted**.

j. Grounding Configuration. On the WTA-060 Model the grounding wire configuration connects the ROWPU and the generator ground wires individually to the generator ground lug. On the ROW PU-1 the grounding wire configuration connects the ROWPU and the generator to a new grounding lug on the M871 Semitrailer which is then attached to the grounding rod.

k. Miscellaneous Relocations. Throughout the ROWPU there have been minor relocations of some equipment. Items such as the thermostats and fire extinguishers have been moved slightly to allow for better operation of the ROWPU. While the location of these items may have changed, the maintenance operation and maintenance procedures have not.

You will note that throughout this book there are a number of locating illustrations used to show the position of various components used in the operation: and repair of the ROWPU. When these locating illustrations involve components and related components which are different between the WTA-060 model and the ROWPU-1 model, both locating illustrations are shown. When these locating illustrations identify components or related components which are the same on both models, the locating illustrations have not been revised and simply reflect the WTA-060 version.

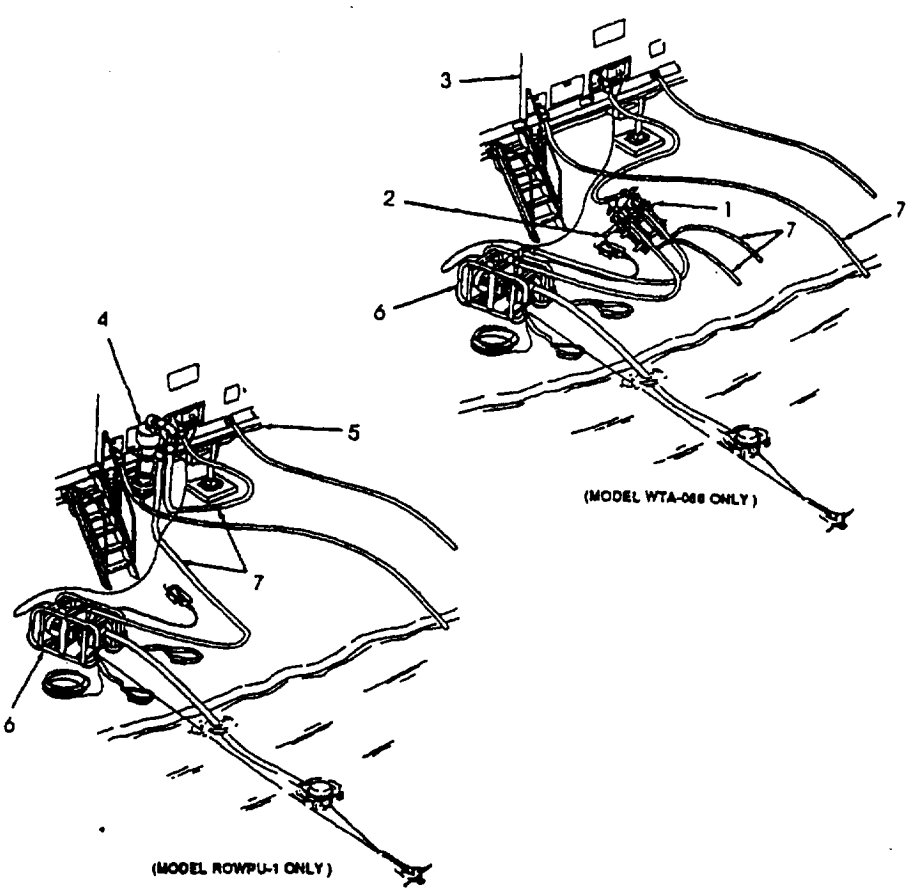
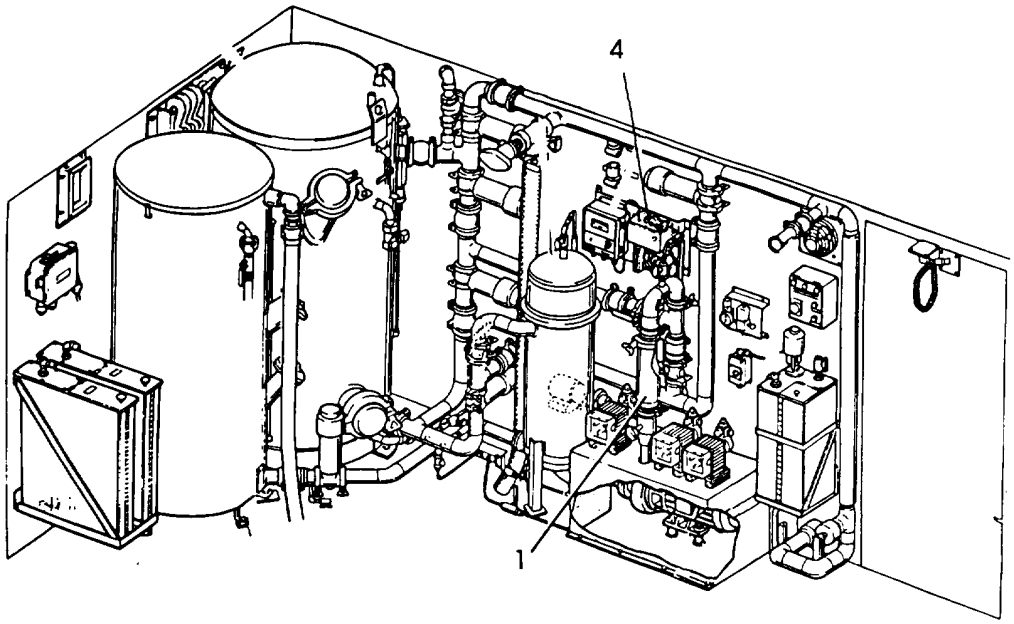


Figure 1-7.1. Cyclone Separators



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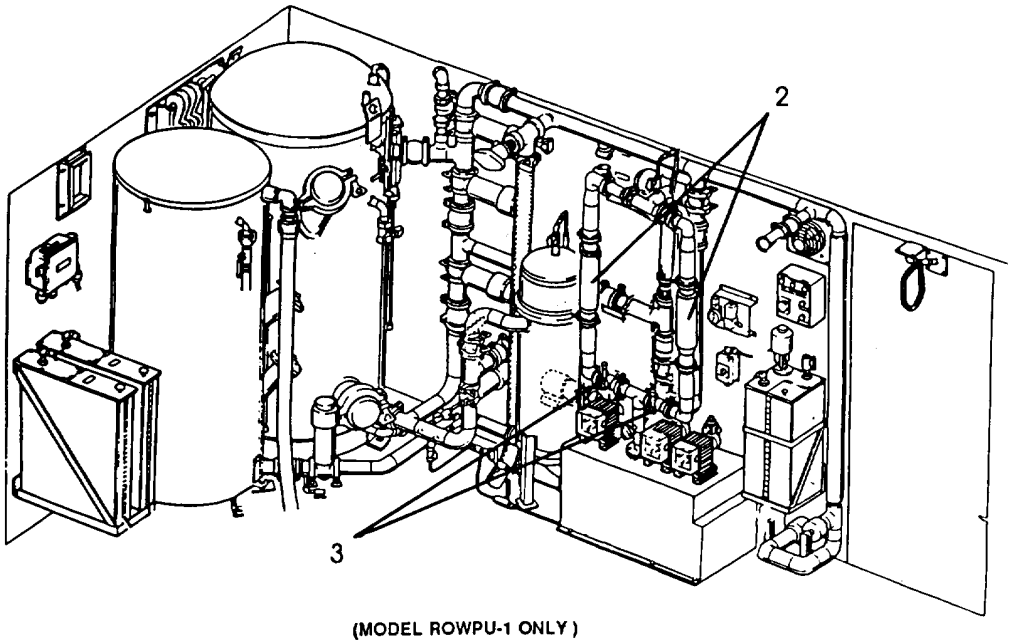
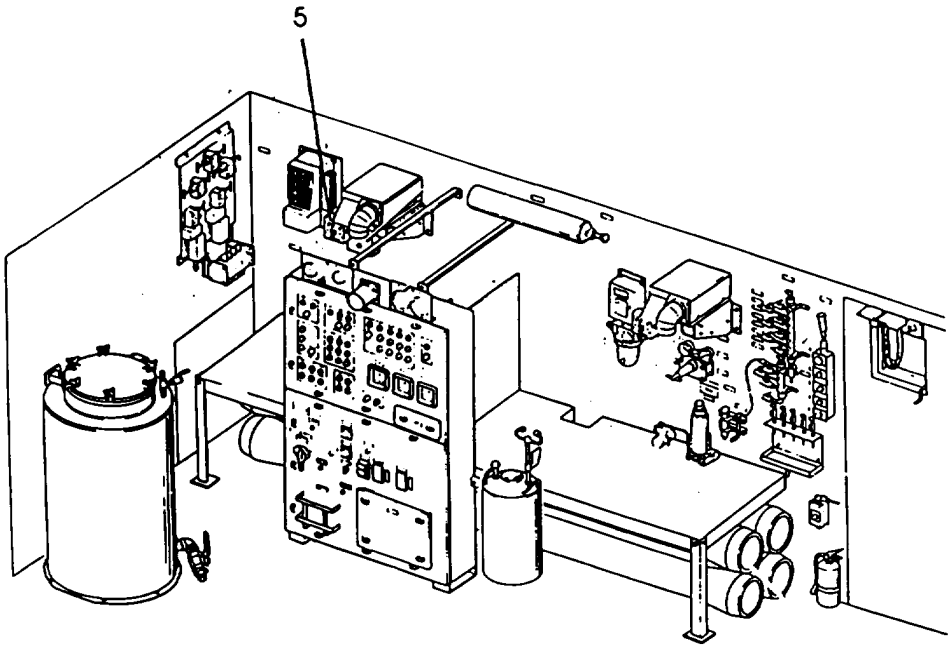
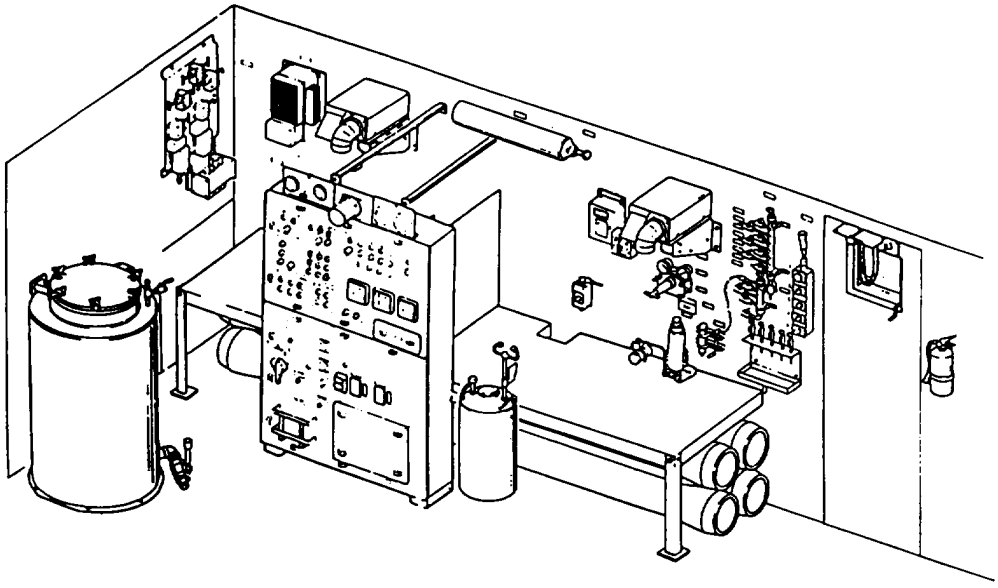


(MODEL ROWPU-1 ONLY)

Figure 1-7.2. Raw Water Strainer System (Sheet 1 of 2).

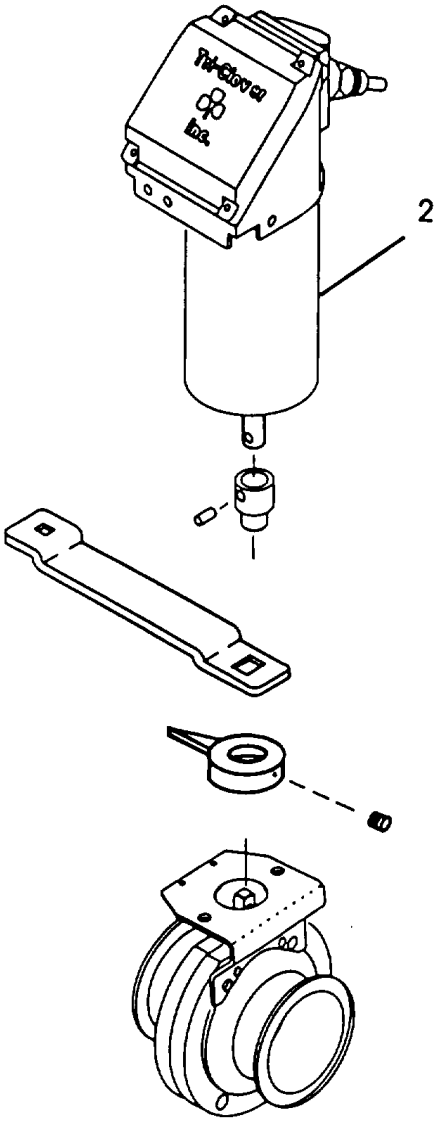


(MODEL WTA-060 ONLY)

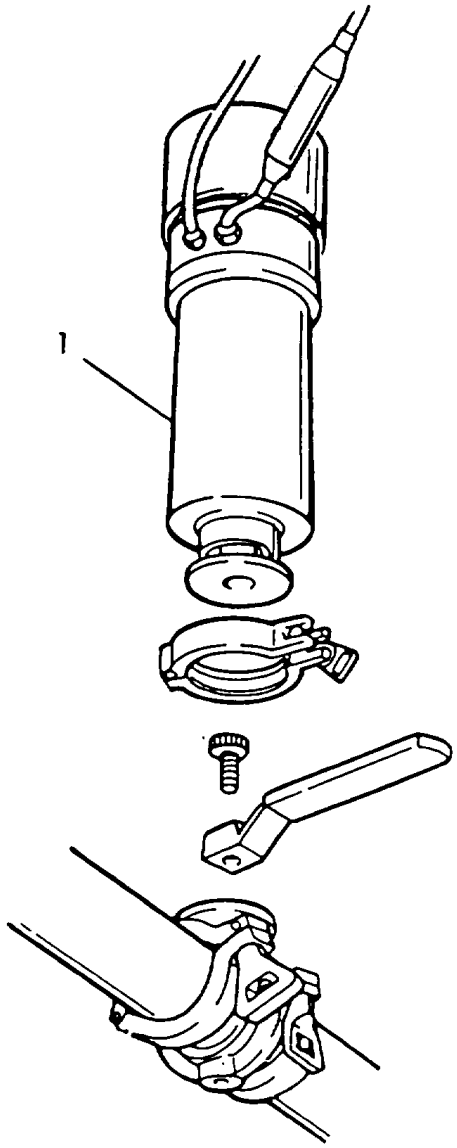


(MODEL ROWPU-1 ONLY)

Figure 1-7.2. Raw Water Strainer System (Sheet 2 of 2).



(MODEL ROWPU-1 ONLY)



(MODEL WTA-060 ONLY)

Figure 1-7.3. Automatic Valves.

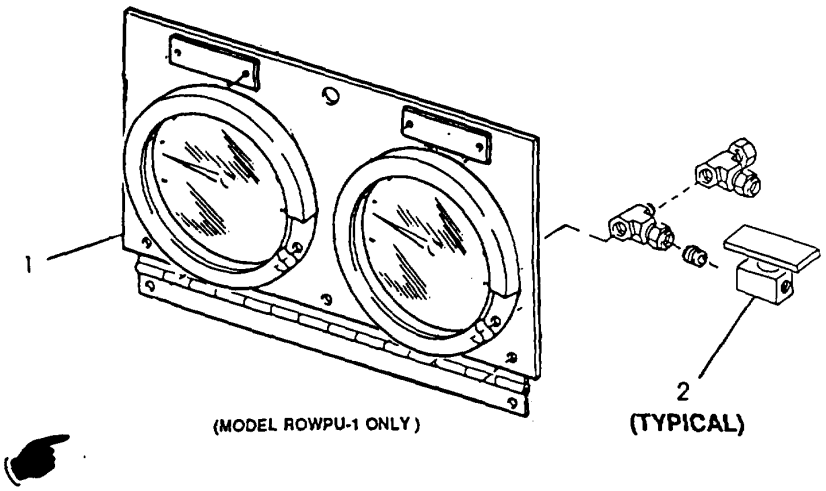


Figure 1-7.4. Control Panel Gauges.

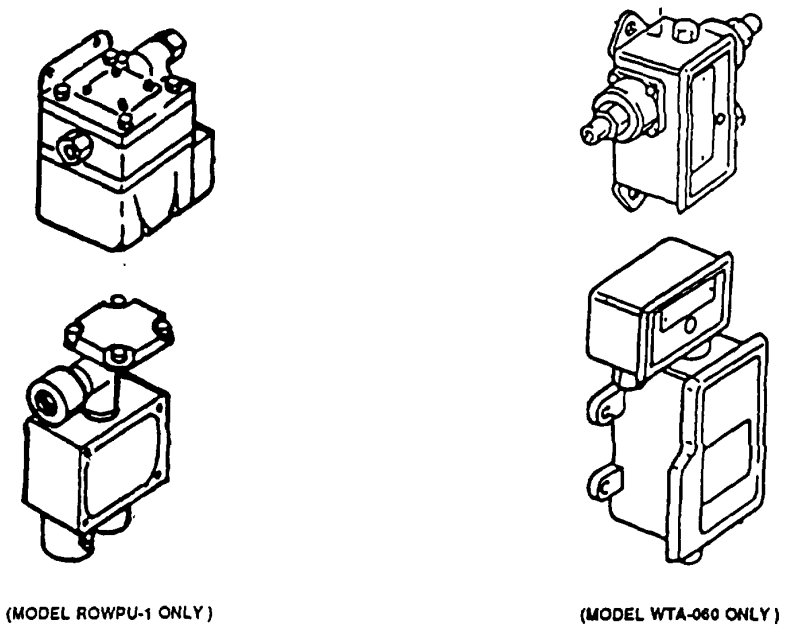
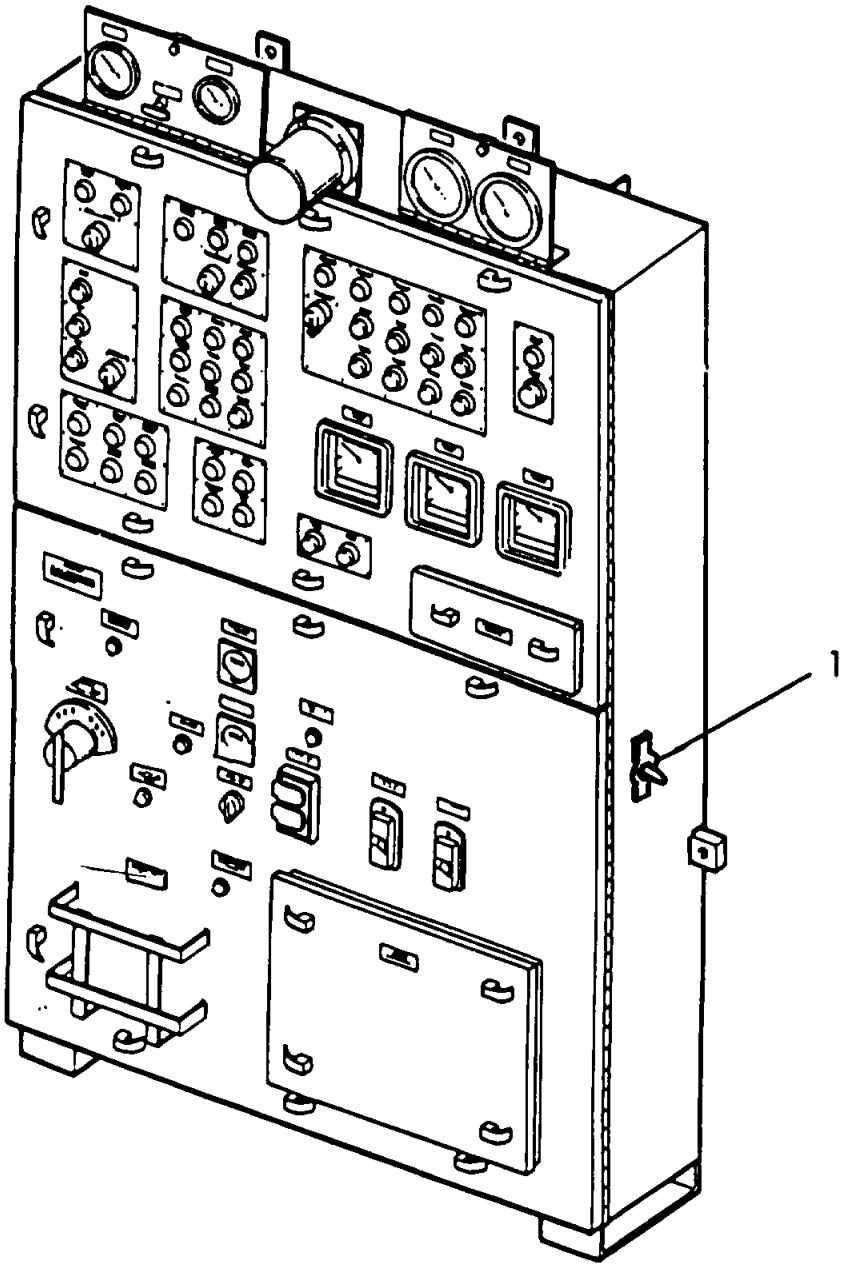


Figure 1-7.5. Pressure Switches.



(MODEL ROWPU-1 ONLY)

Figure 1-7.6. High Pressure Pump Jog Switch.

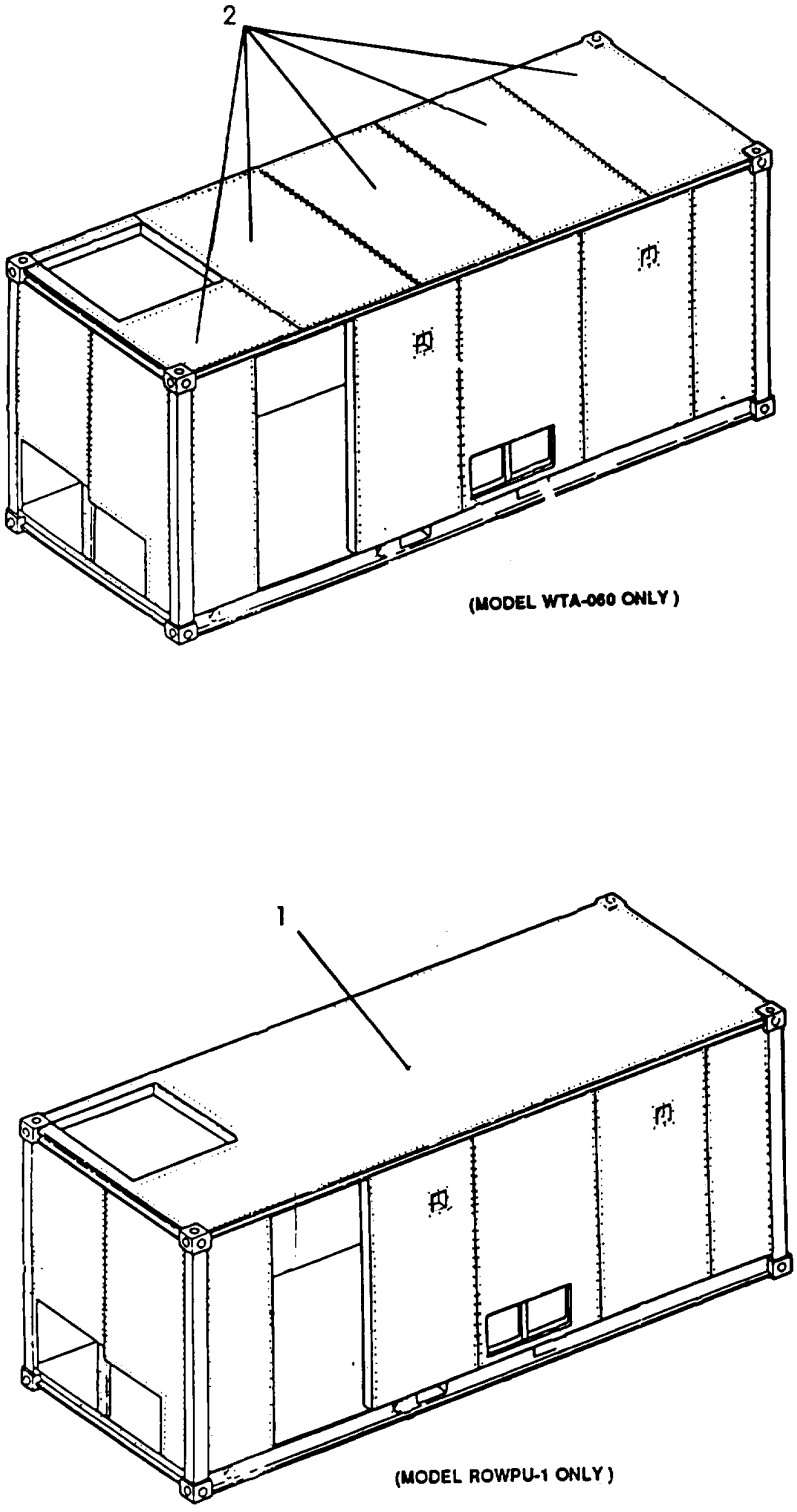


Figure 1-7.7. Roof Design.

SECTION III. TECHNICAL PRINCIPLES OF OPERATION.

1-12. INTRODUCTION. Raw water contains suspended solids which makes it look turbid (cloudy or muddy) Suspended solids include silt, dirt, small particles, micro organisms, algae, and plant and animal products. Raw water also contains dissolved solids which cause poor taste and can make water unfit to drink. The ROWPU removes all suspended solids and reduces the dissolved solids to produce water which tastes good and is safe to drink. This section describes how the ROWPU works.

1-13. RAW WATER INTAKE SYSTEM (Figure 1-8). The Raw Water Intake System pumps raw water from the water source through the cyclone separators to the Water Purification System.

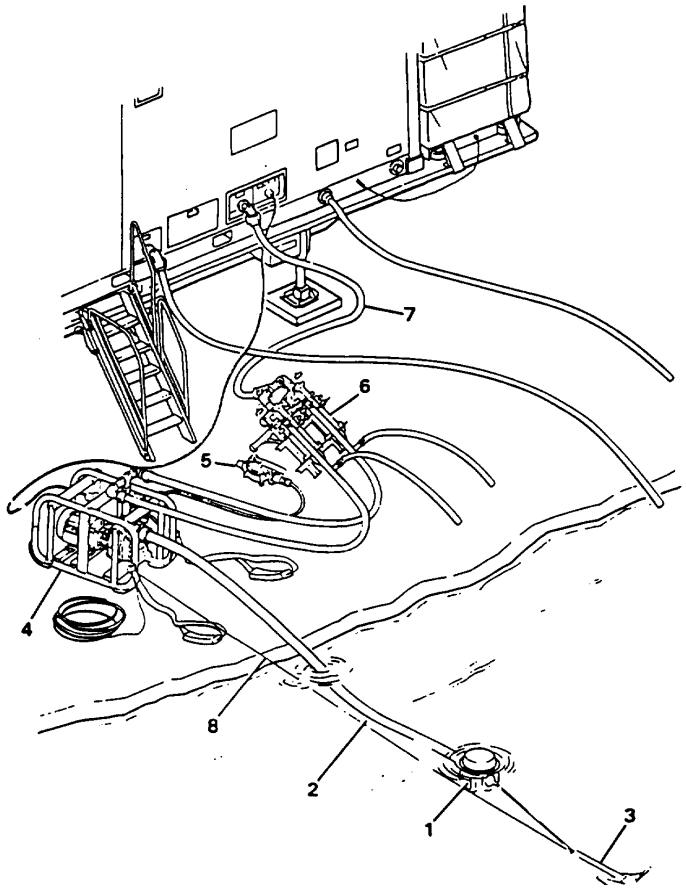


Figure 1-8. Raw Water Intake System
(Sheet 1 of 2) (Model WTA-060 ONLY)

a *Intake Strainer (1).* The intake strainer is connected to the end of the suction hose (2). The strainer will float just under the water, but still well above the bottom of the river, lake or ocean. This keeps the ROWPU from picking up bottom mud or surface debris and oil The strainer contains a perforated screen which keeps out large debris and fish An anchor (3) is used to deploy the strainer and hold it in place. A 300 ft (91 m) rope (8) secures the anchor to the strainer and Is used to deploy and retrieve the anchor and the intake strainer. A second, non-floating strainer Is used for Ice holes

b *Raw Water Suction Hose (2).* Ten 10 ft (3 m) sections of 3 in. (7.6 cm) suction hose come with the ROWPU. These hose sections are used as needed to connect the intake strainer to the raw water pump

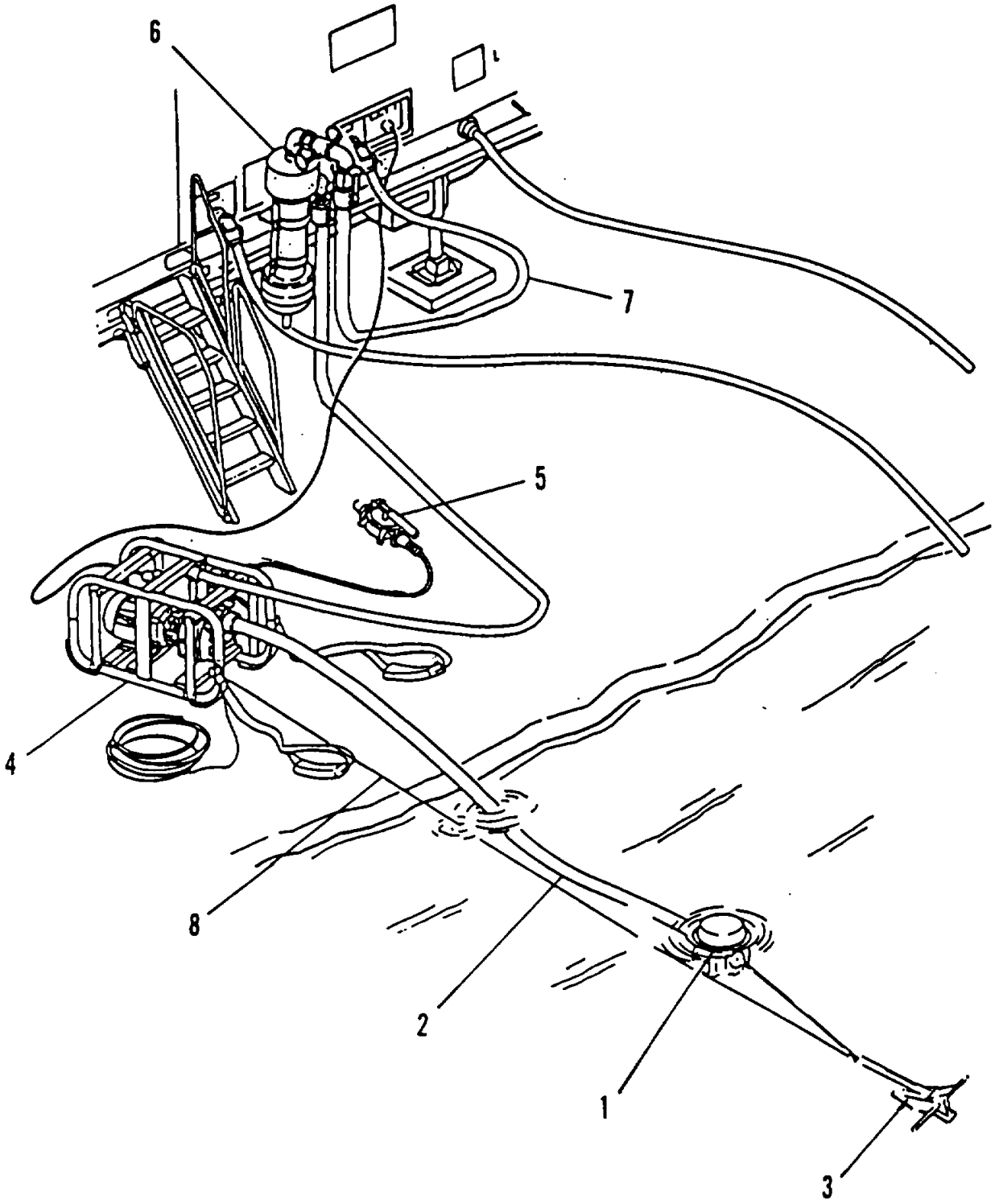


Figure 1-8. Raw Water Intake System (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

c. Raw Water Pump (4). This pump is mounted on a separate frame so it can be located near the water source. A detachable hand pump (5) is provided to help prime the pump rapidly. The pump is self priming after the initial prime and can pull the air out of the suction hose when started. The hand pump is not mandatory but helps speed the Initial priming. Raw water is drawn through the intake strainer and suction hose, pressurized, and discharged through the cyclone separators (6) to the ROWPU. The pump can lift raw water to 15 ft (4.5 m) above the surface level of the water source. The discharge water pressure is great enough to allow placement of the ROWPU up to 30 ft (9 m) above the pump.

d. Cyclone Separators (6). On Model WTA-060, two cyclone separators are mounted on a separate frame and located near the raw water pump frame (See Figure 1-8, Sheet 1). On the ROWPU-1 Model, there is one separator which is mounted onto the trailer in one of the trailer stake pockets (See Figure 1-8, Sheet 2). As water enters the cyclone separator, a high speed swirl is formed. The heavier dirt is thrown to the outside and drops to the bottom where it is carried out by a small amount of water flow. The main water flow (101 gpm, 382 lPM) leaves the separator at the center of the top and enters the discharge hose to flow to the ROWPU. The cyclone(s) will remove dirt which will settle in a glass in 20 minutes. They are very important for sand removal at ocean beach deployment areas.

e. Raw Water Discharge Hose (7). On all models, four 50 ft (15 m) lengths of 2-1/2 in. (6.4 cm) canvas hoses, which are used to carry raw water to the cyclone separator(s), a supplied with the ROWPU. Model WTA-060 is supplied with two 10 ft. (3 m) lengths of 2 in. (5.1 cm) rubber hoses, and Model ROWPU-1 is supplied with one 10 ft (3 m) length of 2 in. (5.1 cm) rubber hose. These hoses are called raw water to cyclone separator(s) hoses and are used to carry water from the cyclone separator(s) to the Water Purification System. The connectors are cam and groove type (quick disconnect). On Model WTA-060, you lose 9 gallons (34.1 l) of water through drain hoses on the cyclone separators. On Model ROWPU-1, you lose 5 gallons (19 l) of water through the drain hose on the cyclone separator.

1-14. WATER PURIFICATION SYSTEM. Water from the Raw Water Intake System is discharged to the Water Purification System. Here, the water is filtered, treated with chemicals, and pressurized for the reverse osmosis process which reduces the TDS of the water. All necessary piping, valves, controls, and indicators required to accomplish purification of the feed water and cleaning of the system components are included.

a. Filtration (Figure 1-9). The raw water is first treated by filtration. The filters reduce the turbidity of the raw water by removing suspended particles of fine clay, dirt, and organic matter. Turbidity not only makes water unfit to drink, but it may also foul (clog) the RO elements. Usually the water leaving the cartridge filter will have a turbidity of 0.5 to 1.5 NTU. This turbidity value will cause only slow fouling which can be removed by routine RO element cleaning. Fouling reduces the amount of water which can be produced by the ROWPU.

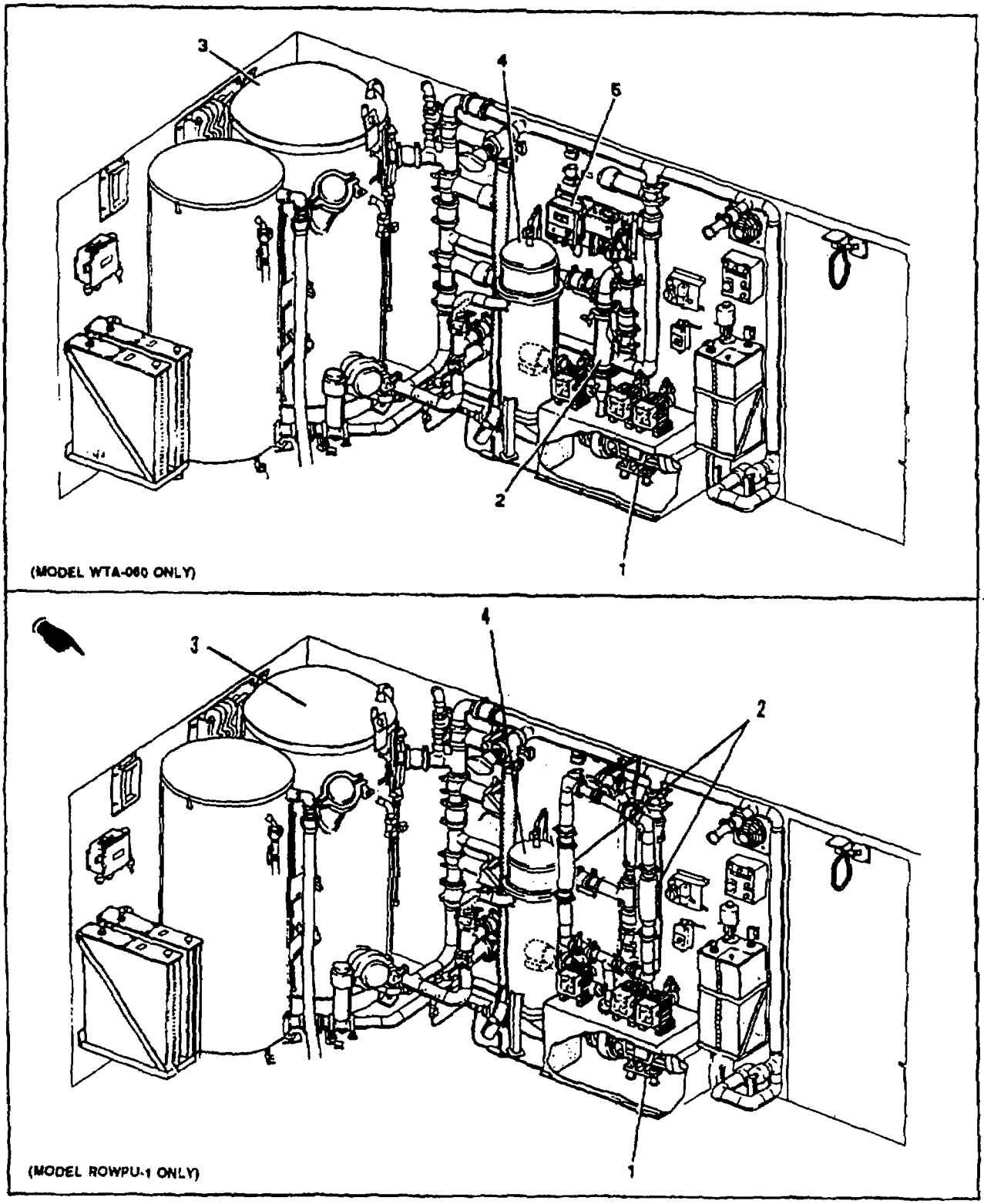


Figure 1-9. Operation of the Water Purification System

(1) *Feed Water Booster Pump (1)*. This centrifugal pump receives water from the raw water discharge hose and pressurizes it so it can go through the filtration steps which follow.

(2) *Basket Strainer (2)*. The WTA-060 Model is equipped with only one basket strainer. The ROWPU-1 Model is equipped with two basket strainers to allow the replacement of a clogged strainer without shutting down the ROWPU. The basket strainer removes any remaining large foreign particles not removed by the cyclone separator(s). This prevents clogging of the water distributors inside the media filter. A spare strainer basket is carried on-board to provide for quick change when the basket strainer becomes dirty. When the basket strainer gets dirty, the pressure at the basket strainer outlet becomes lower than the basket strainer inlet. The ROWPU controls sense that pressure drop (or differential) and set off a yellow strainer plugged warning light and pulsing horn.

(3) *Media Filter (3)*. The media filter removes most of the suspended solids. The water enters the top of the filter through the upper distribution flows downward through one layer of course AG filter media and a final layer of very fine garnet sand. These layers are all supported by three layers of support gravel. A collector picks up the filtered water for discharge. The suspended solids are too small to be removed by the straining action of the filter media and many of the particles contain layers of electrical charges which prevent them from forming larger particles. The secret to removing these particles is the addition to the feed water of a treatment chemical called polyelectrolyte. With the aid of this chemical, the filter can remove most of the suspended solids from the water resulting in a turbidity between 0.5 and 2 NTU in most cases. On Model WTA-060, the turbidity is measured by a continuous reading Turbidity Meter (5). On Model ROWPU-1, turbidity is measured by taking readings using the portable turbidity meter.

(4) *Cartridge Filter (4)*. This filter contains ten 30 in. (76 cm) filter cartridges. Water goes through these filters for final (polishing) filtration. When it has gone through this filter, the water will normally have a turbidity of 0.5 to 1.5 NTU. In time, these cartridges will become dirty. When the cartridge filter gets dirty, the pressure at the cartridge filter outlet becomes lower than the pressure at the cartridge filter inlet. The ROWPU controls sense that pressure drop (or differential) and set off a yellow cartridge filter plugged warning light and pulsing horn. The ROWPU must be shut down and the dirty cartridges replaced.

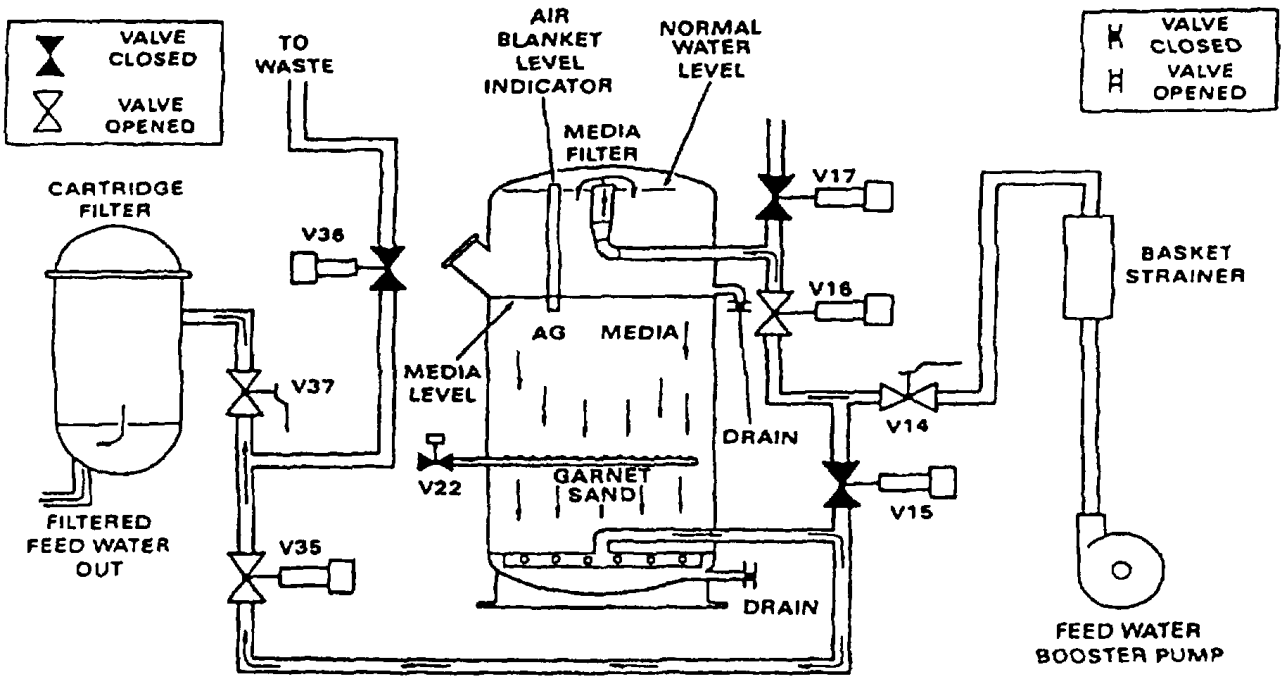


Figure 1-10. Normal Flow Thru Filters (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

b. *Backwashing*. In time, the suspended solids trapped in the media filter will cause an increase in the pressure drop between the inlet and outlet pressure. When the media filter gets dirty, the pressure at the media filter outlet becomes lower than the pressure at the media filter inlet. The ROWPU controls sense that pressure drop (or differential) and set off a yellow media filter plugged warning light and pulsing horn. The controls are then set by the operator to automatically backwash the media filter. Normal flow is shown in Figure 1-10. The backwash cycle is shown in Figure 1-11 (5 sheets). The filter is backwashed before the yellow warning light and horn indicates high pressure drop in the following situations:

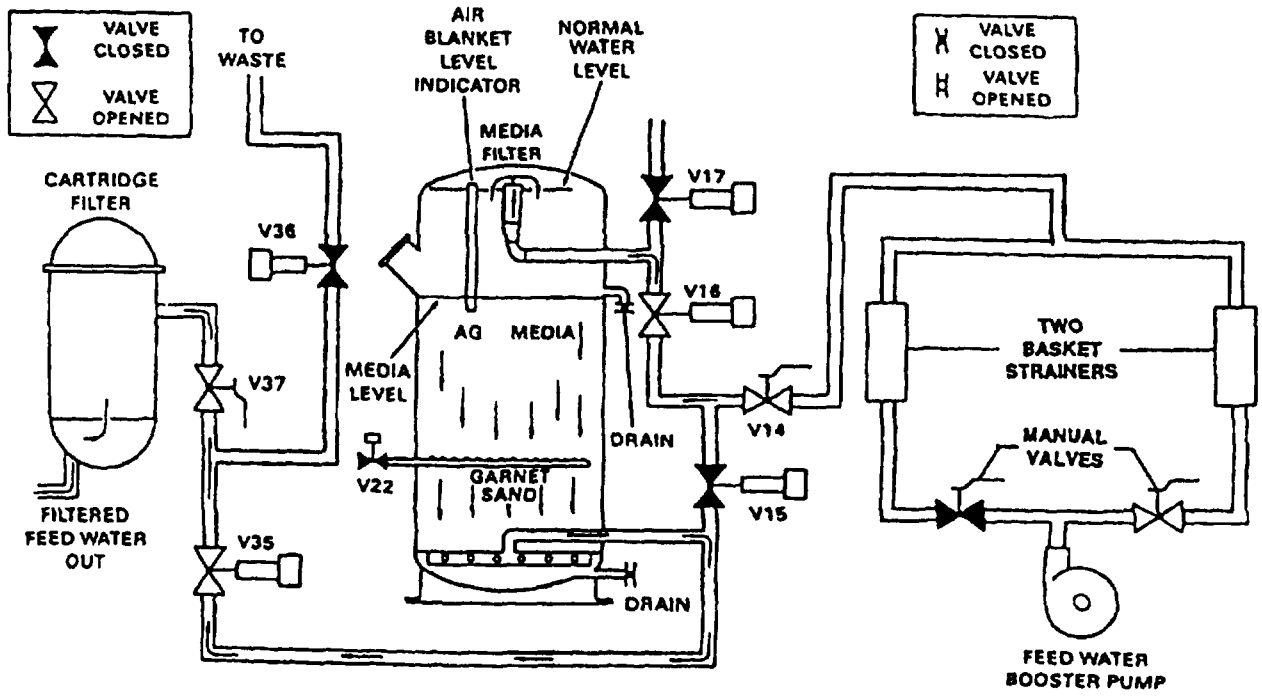
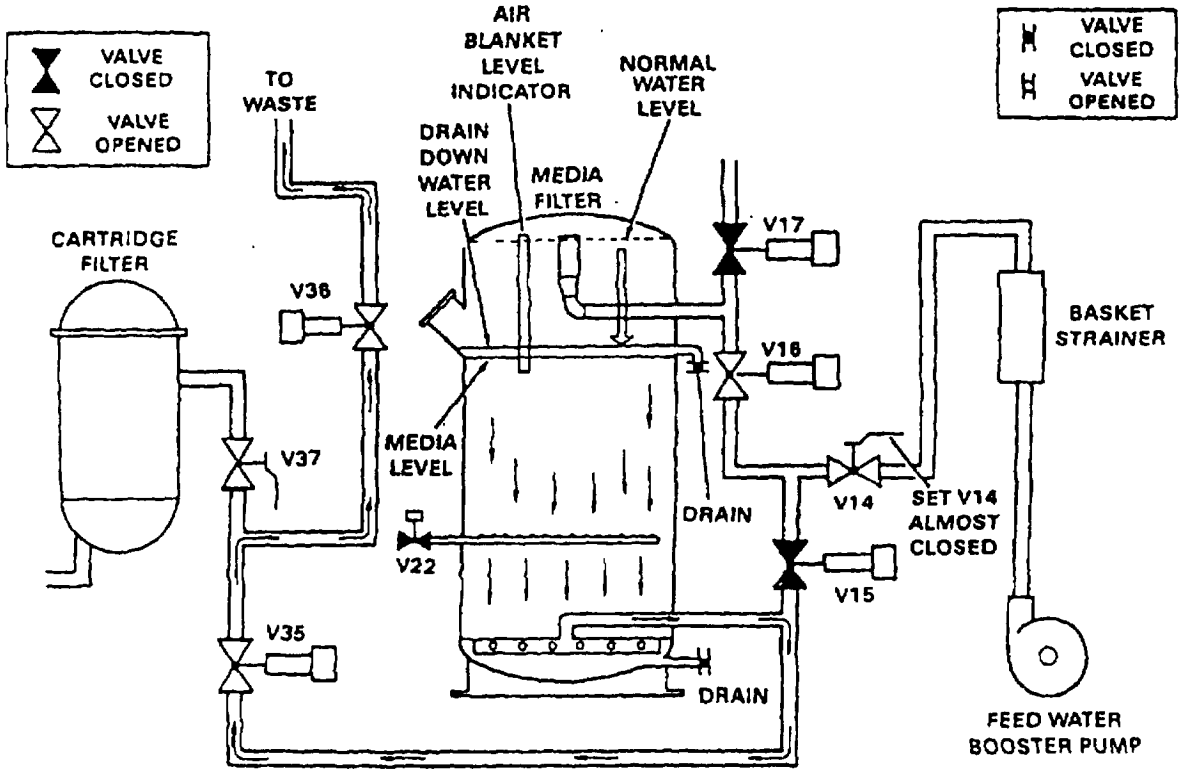


Figure 1-10. Normal Flow Thru Filters (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

(1) When operating on a river or lake with a heavy concentration of organic material present, a turbidity over 15 NTU, and a temperature over 70°F (21°C), the media filter is backwashed every 6 hours.

(2) On any water, the filter is backwashed at least once daily.

(3) On some waters, most of the places in the filter bed for the suspended solids to stick are used up without causing a high enough pressure drop to set off the alarm. When this happens, the filtered water turbidity begins to increase. If It increases by more than 0.5 NTU, the filter is backwashed.



NOTE

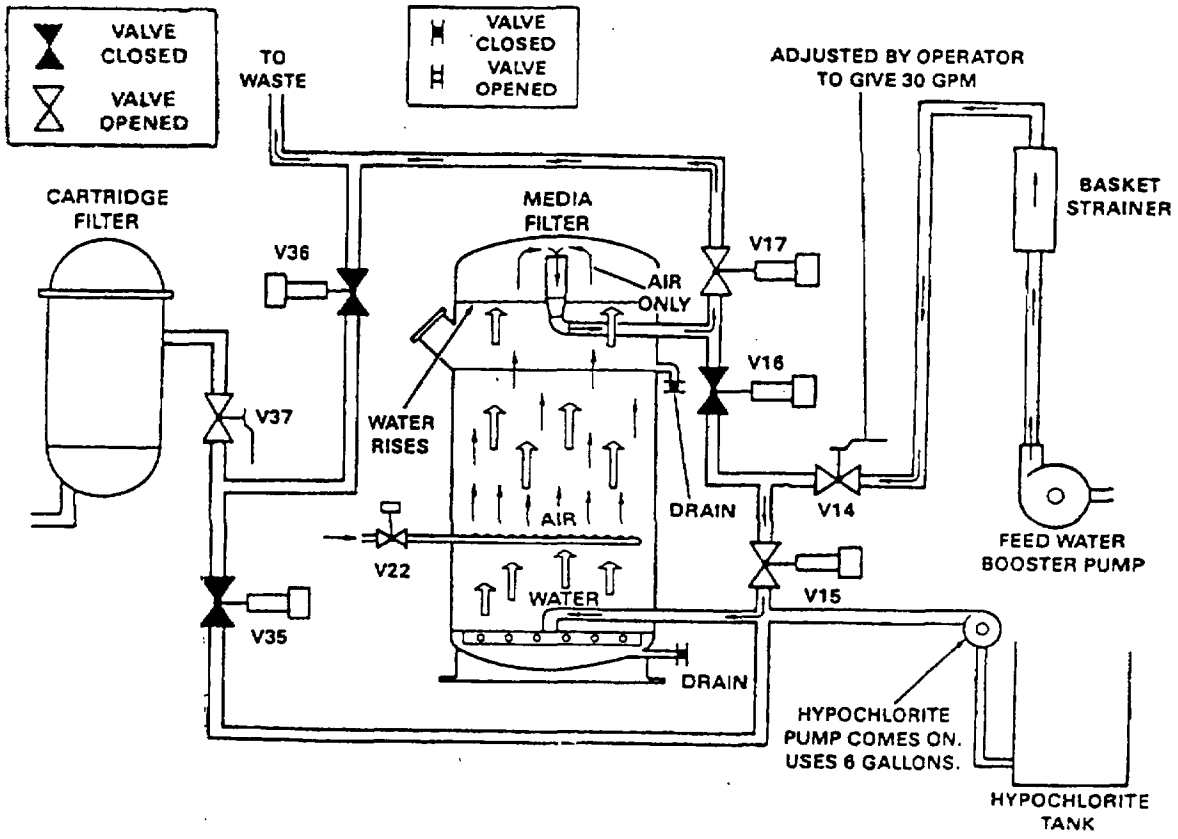
OPERATOR STOPS PUMPS, SETS SELECTOR SWITCH TO BACKWASH, AND PUSHES INITIATE BUTTON. AFTER V1 4 SET ALMOST CLOSED.

BACKWASH STEP 1: DRAIN DOWN

- ALL PUMPS STOP. AUTO VALVES CHANGE AS SHOWN.
- PRESSURE PUSHES WATER OUT OF MEDIA ALTER UNTIL PROPER LEVEL IS REACHED.
- CYCLE TAKES APPROXIMATELY 1 MINUTE.

PURPOSE: DURING THIS STAGE, WATER IS QUICKLY PURGED FROM THE MEDIA FILTER. THE INITIAL BURST OFTEN BLOWS MUCH OF THE TURBIDITY OUT OF THE FILTER.

Figure 1-11. Backwash Cycle (Sheet 1 of 10)
(MODEL WTA-060 ONLY)

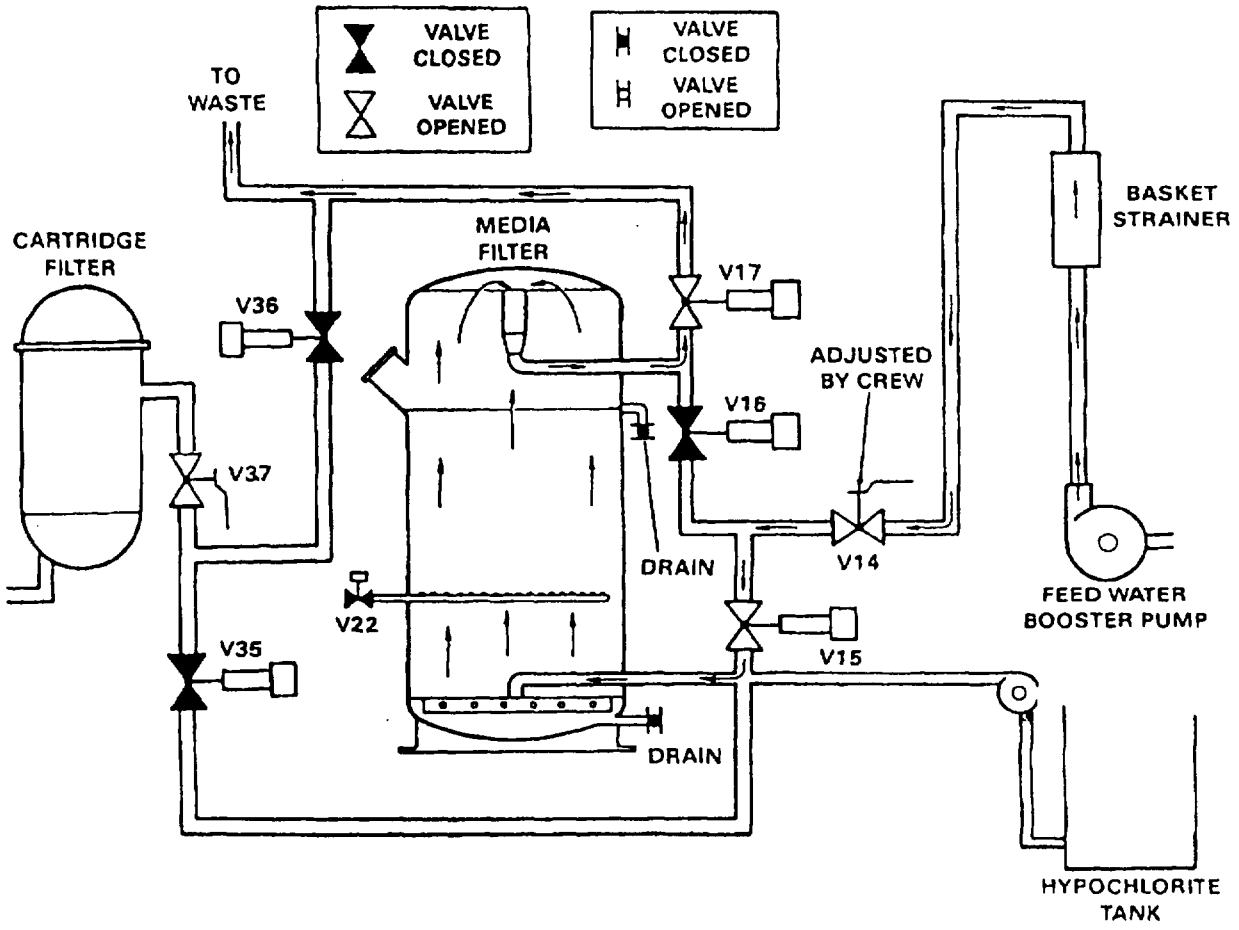


BACKWASH STEP 2: AIR/WATER BACKWASH

- RAW WATER PUMP ON.
- AUTO VALVES SWITCH AS SHOWN.
- AIR ON.
- HYPOCHLORITE PUMP ON.
- VALVE V14 ADJUSTED BY OPERATOR TO GIVE 30 GPM (114 LPM).
- CYCLE TAKES APPROXIMATELY 1-1/2 MINUTES.

PURPOSE: DURING THIS STAGE, AIR AND 30 GPM (114 LPM) OF WATER ARE BREAKING UP THE PACKED MEDIA BEDS. ALSO, CHLORINE IS BEING INJECTED TO KILL BACTERIA.

Figure 1-11. Backwash Cycle (Sheet 2 of 10)
(MODEL WTA-060 ONLY)

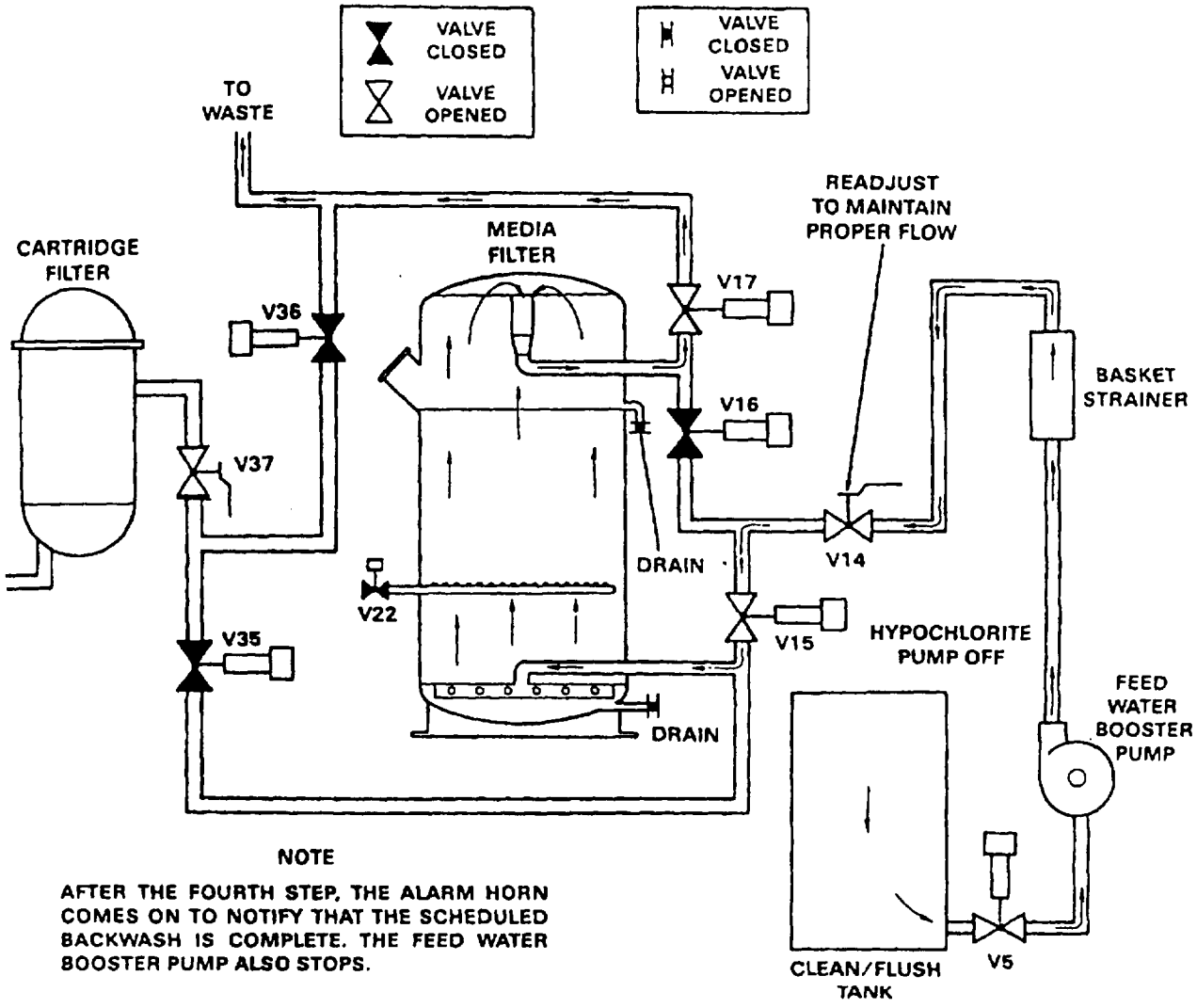


BACKWASH STEP 3: WATER BACKWASH

- BACKWASH AIR VALVE (V22 CLOSED).
- BOOSTER PUMP ON.
- RAW WATER PUMP ON.
- HYPOCHLORITE PUMP REMAINS ON.
- VALVE V14 CREW ADJUSTED FOR PROPER FLOW. (PROPER FLOW SELECTED FROM TABLE AGAINST WATER TEMPERATURE.)
- CYCLE TAKES 10 MINUTES.

PURPOSE: DURING THIS STAGE, THE MEDIA BED IS BEING SCOURED AND CLEANED USING A FASTER FLOW RATE.

Figure 1-11. Backwash Cycle (Sheet 3 of 10)
(MODEL WTA-060 ONLY)

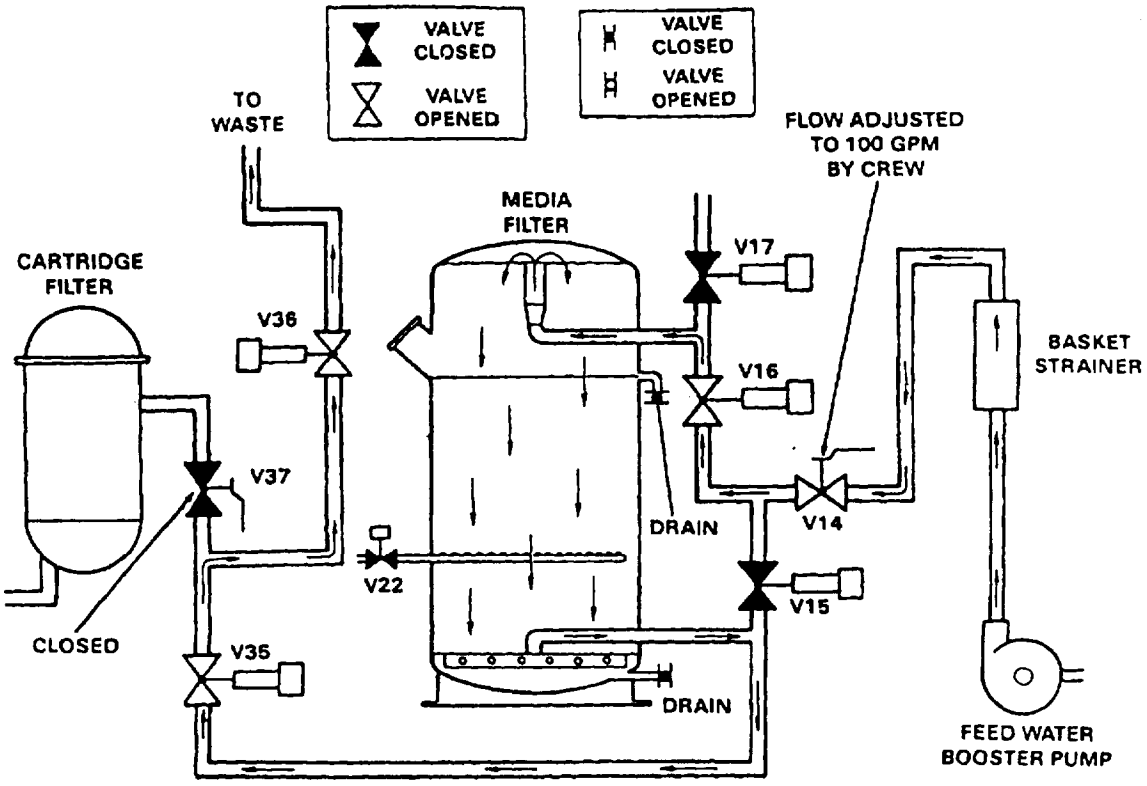


BACKWASH STEP 4: CLEAN WATER BACKWASH

- RAW WATER PUMP OFF.
- HYPOCHLORITE PUMPS STOPPED.
- CLEAN/FLUSH TANK VALVE (V5) OPENED.
- CYCLE TAKES APPROXIMATELY 2 MINUTES.

PURPOSE: DURING THIS STAGE, THE MEDIA BED IS BEING RINSED WITH SANITIZED WATER FROM THE CLEAN/FLUSH TANK.

Figure 1-11. Backwash Cycle (Sheet 4 of 10)
(MODEL WTA-060 ONLY)

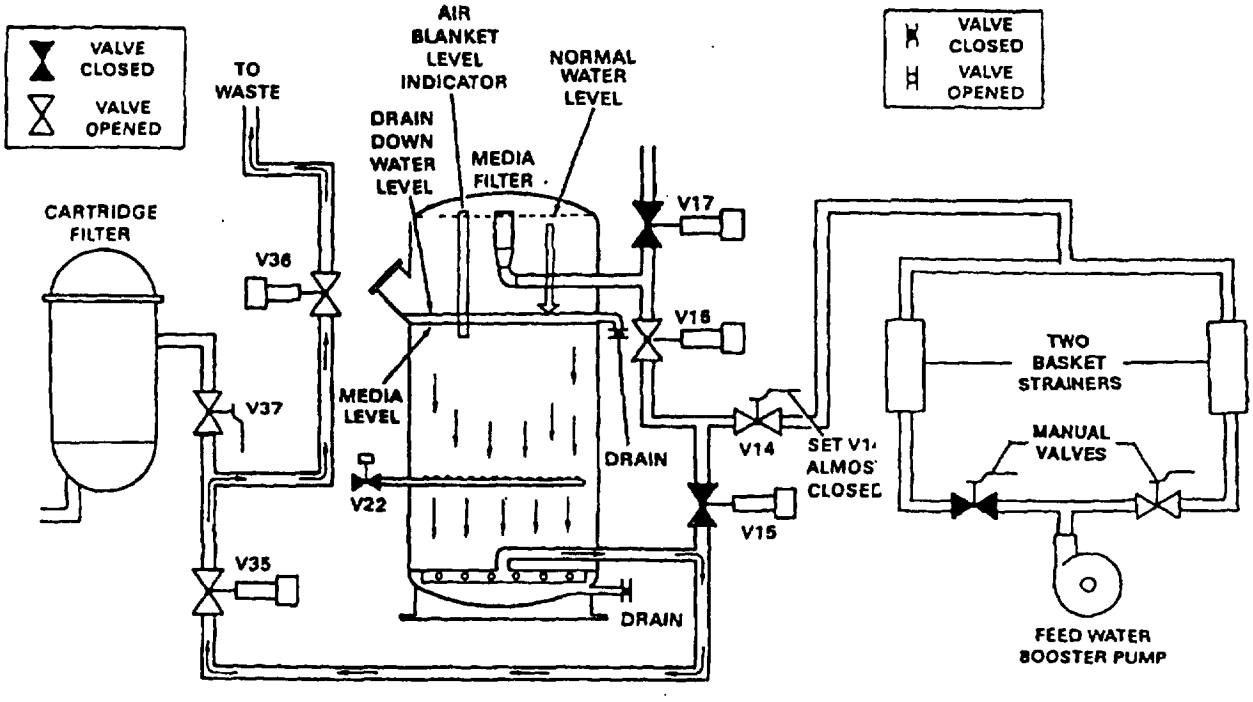


BACKWASH STEP 5: FORWARD FLUSH

- RESETS CONTROL PANEL FOR NORMAL OPERATION AND OPENS V36 BY PUSH BUTTON.
- OPERATOR CLOSES V37.
- OPERATOR STARTS RAW WATER AND BOOSTER PUMPS.
- V14 ADJUSTED FOR 100 GPM.
- CYCLE TAKES 5 MINUTES.

PURPOSE: DURING THIS STAGE, THE MEDIA BED IS BEING REPACKED AND SETTLED.

Figure 1-11. Backwash Cycle (Sheet 5 of 10)
(MODEL WTA-060 ONLY)



NOTE

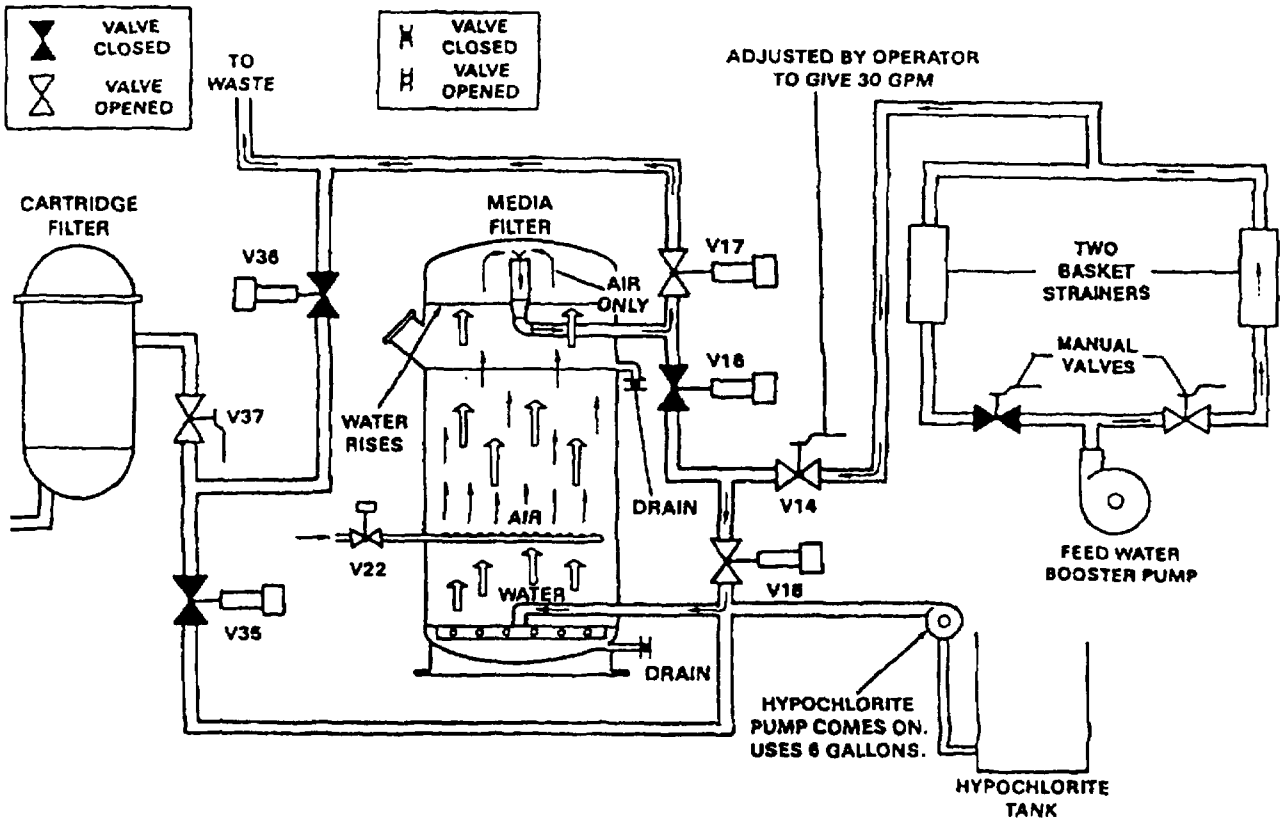
OPERATOR STOPS PUMPS. SETS SELECTOR SWITCH TO BACKWASH, AND PUSHES INITIATE BUTTON. AFTER V14 SET ALMOST CLOSED.

BACKWASH STEP 1: DRAIN DOWN

- ALL PUMPS STOPPED. AUTO VALVES CHANGE AS SHOWN.
- PRESSURE PUSHES WATER OUT OF MEDIA FILTER UNTIL PROPER LEVEL IS REACHED.
- CYCLE TAKES APPROXIMATELY 1 MINUTE.

PURPOSE: DURING THIS STAGE, WATER IS QUICKLY PURGED FROM THE MEDIA FILTER. THE INITIAL BURST OFTEN BLOWS MUCH OF THE TURBIDITY OUT OF THE FILTER.

Figure 1-11. Backwash Cycle (Sheet 6 of 10)
(MODEL ROWPU-1 ONLY)

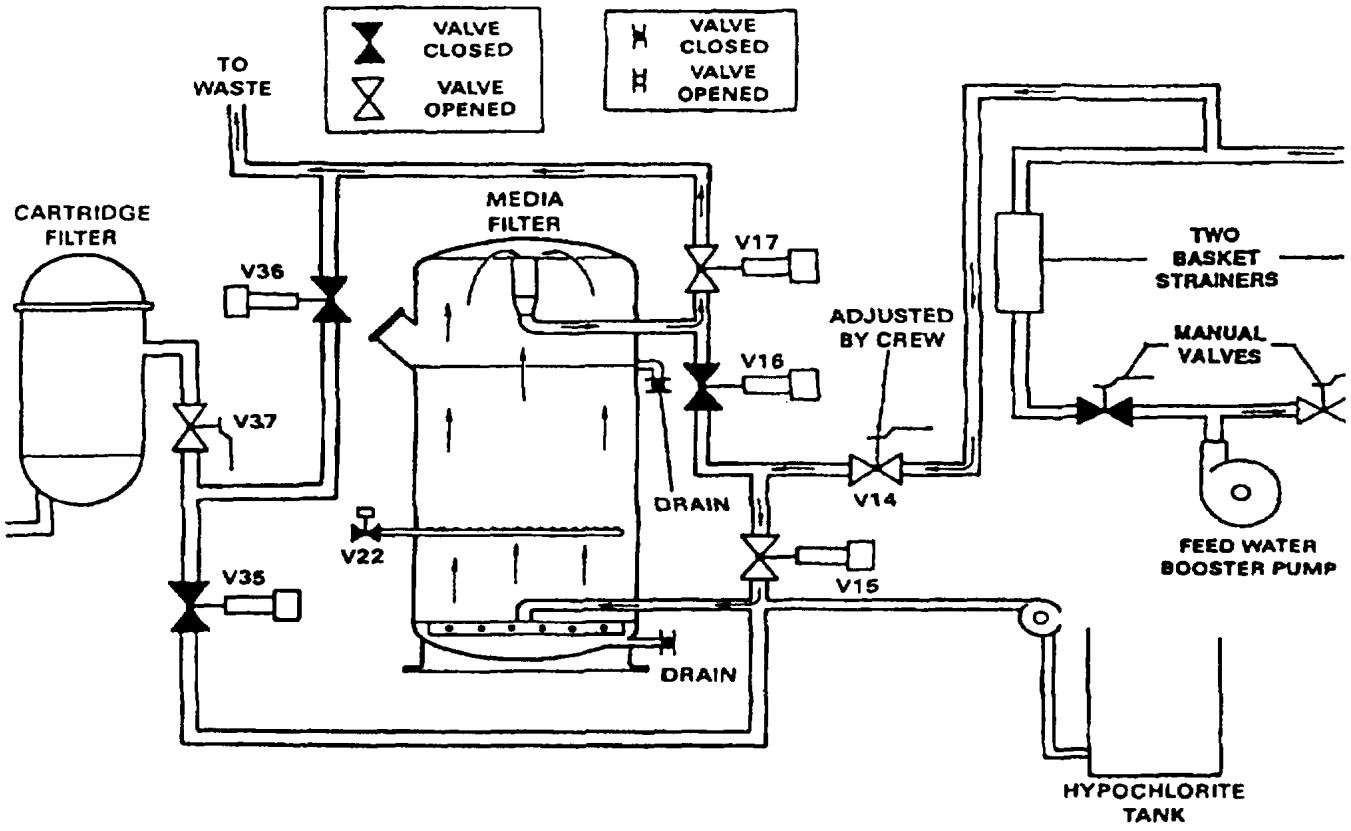


BACKWASH STEP 2: AIR/WATER BACKWASH

- RAW WATER PUMP ON.
- AUTO VALVES SWITCH AS SHOWN.
- AIR ON.
- HYPOCHLORITE PUMP ON.
- VALVE V14 ADJUSTED BY OPERATOR TO GIVE 30 GPM (114 LPM).
- CYCLE TAKES APPROXIMATELY 1-1/2 MINUTES.

PURPOSE; DURING THIS STAGE, AIR AND 30 GPM (114 LPM) OF WATER ARE BREAKING UP THE PACKED MEDIA BEDS. ALSO, CHLORINE IS BEING INJECTED TO KILL BACTERIA.

Figure 1-11. Backwash Cycle (Sheet 7 of 10)
(MODEL ROWPU-1 ONLY)

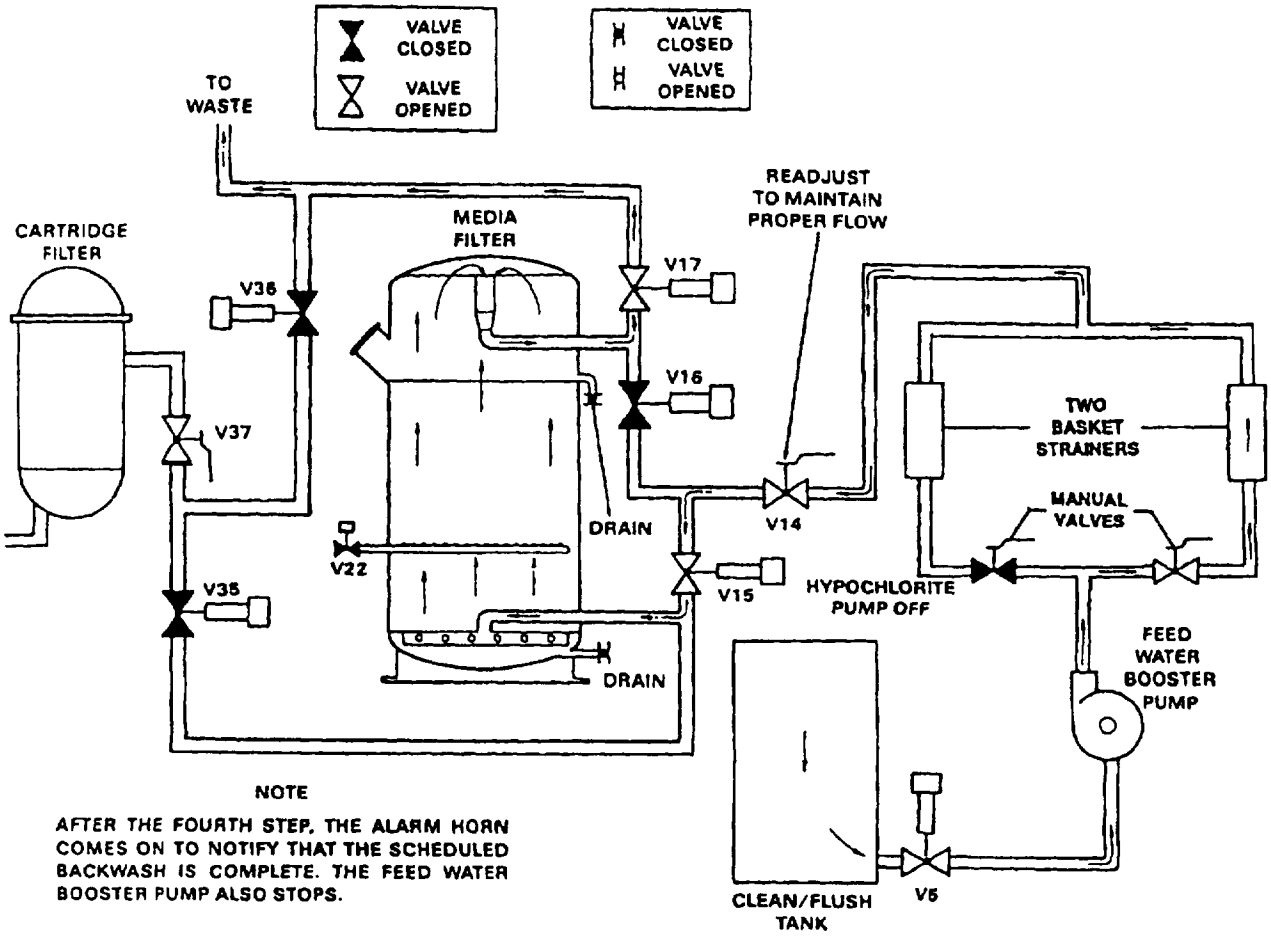


BACKWASH STEP 3: WATER BACKWASH

- BACKWASH AIR VALVE (V22 CLOSED).
- BOOSTER PUMP ON.
- RAW WATER PUMP ON.
- HYPOCHLORITE PUMP REMAINS ON.
- VALVE V14 CREW ADJUSTED FOR PROPER FLOW.
- (PROPER FLOW SELECTED FROM TABLE AGAINST WATER TEMPERATURE.)
- CYCLE TAKES 10 MINUTES.

PURPOSE: DURING THIS STAGE, THE MEDIA BED IS BEING SCOURED AND CLEANED USING A FASTER FLOW RATE.

Figure 1-11. Backwash Cycle (Sheet 8 of 10)
(MODEL ROWPU-1 ONLY)

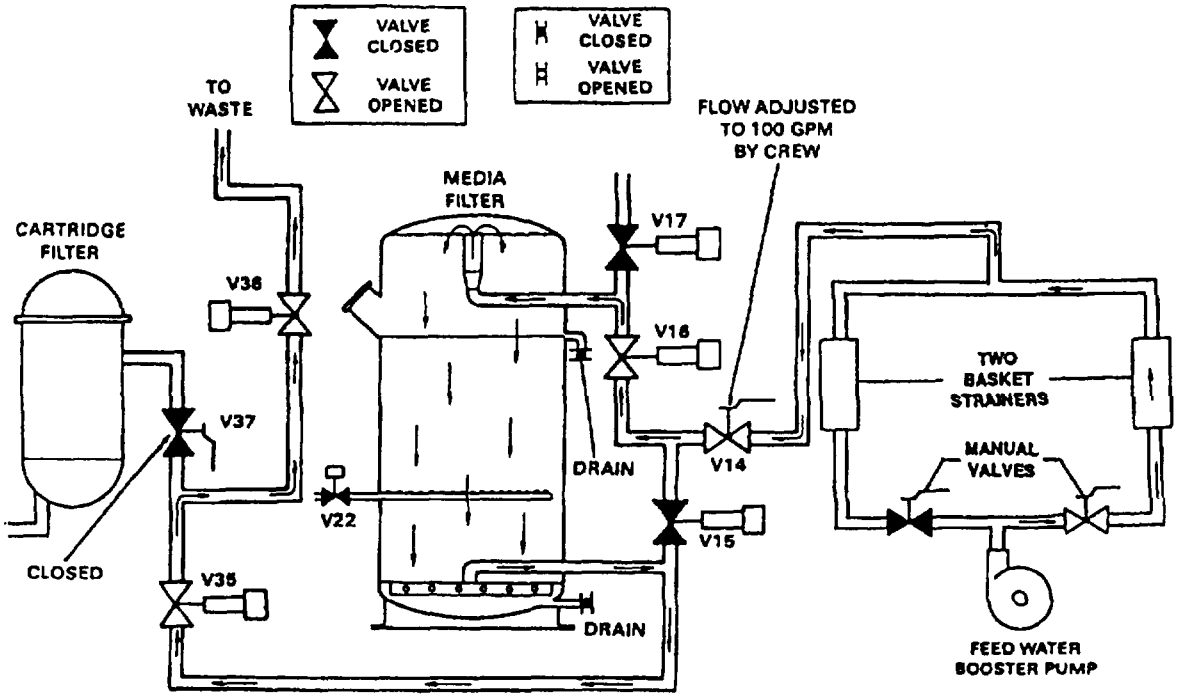


BACKWASH STEP 4: CLEAN WATER BACKWASH

- ALL WATER PUMPS OFF.
- HYPOCHLORITE PUMPS STOPPED.
- CLEAN/FLUSH TANK VALVE (V5) OPENED.
- CYCLE TAKES APPROXIMATELY 2 MINUTES.

PURPOSE: DURING THIS STAGE, THE MEDIA BED IS BEING RINSED WITH SANITIZED WATER FROM THE CLEAN/FLUSH TANK.

Figure 1-11. Backwash Cycle (Sheet 9 of 10)
(MODEL ROWPU-1 ONLY)



BACKWASH STEP 5: FORWARD FLUSH

- OPERATOR RESETS CONTROL PANEL FOR NORMAL OPERATION AND OPENS V36 BY PUSH BUTTON.
- OPERATOR CLOSES V37.
- OPERATOR STARTS RAW WATER AND BOOSTER PUMPS.
- V14 ADJUSTED FOR 100 GPM.
- CYCLE TAKES 5 MINUTES.

PURPOSE: DURING THIS STAGE, THE MEDIA BED IS BEING REPACKED AND SETTLED.

Figure 1-11. Backwash Cycle (Sheet 10 of 10)
(MODEL ROWPU-1 ONLY)

c. *Reverse Osmosis (Figure 1-12).* After filtration to remove the suspended solids, the feed water is further processed by reverse osmosis. The feed water is pressurized and delivered to RO vessels containing RO elements. In the RO elements, the feed water flows across sheets of membrane material. Some of the water passes through the membrane sheets and is collected to become product water. Most of the dissolved solids (salts) are blocked from passing through. Only 1/3 to 1/2 of the feed water passes through the membrane sheets to become product water. The rest of the water containing most of the dissolved solids (salts), continues flowing past the membranes and exits the RO vessels as waste water.

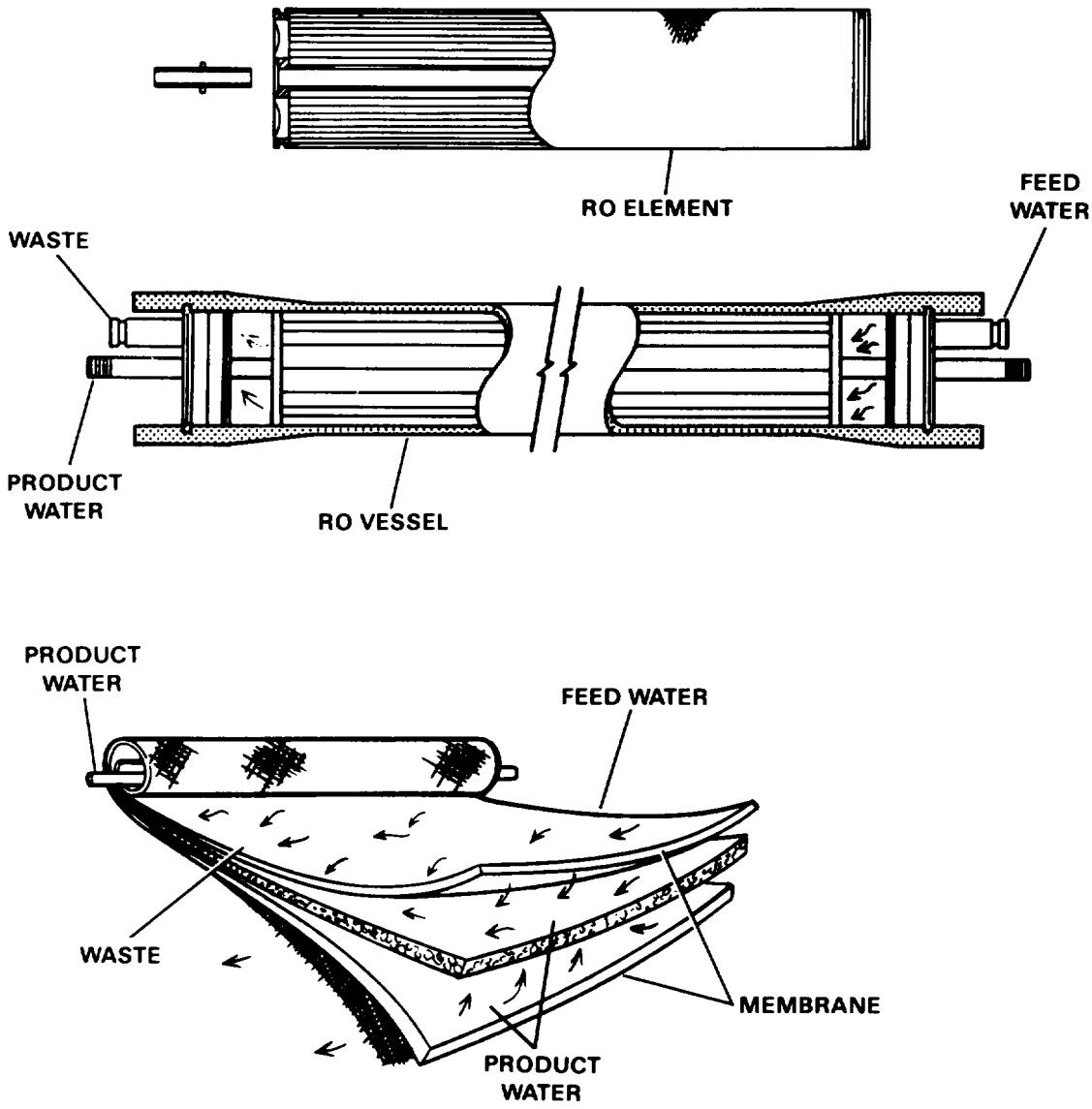


Figure 1-12. Reverse Osmosis Process

d. *Reverse Osmosis Components (Figure 1-13).*

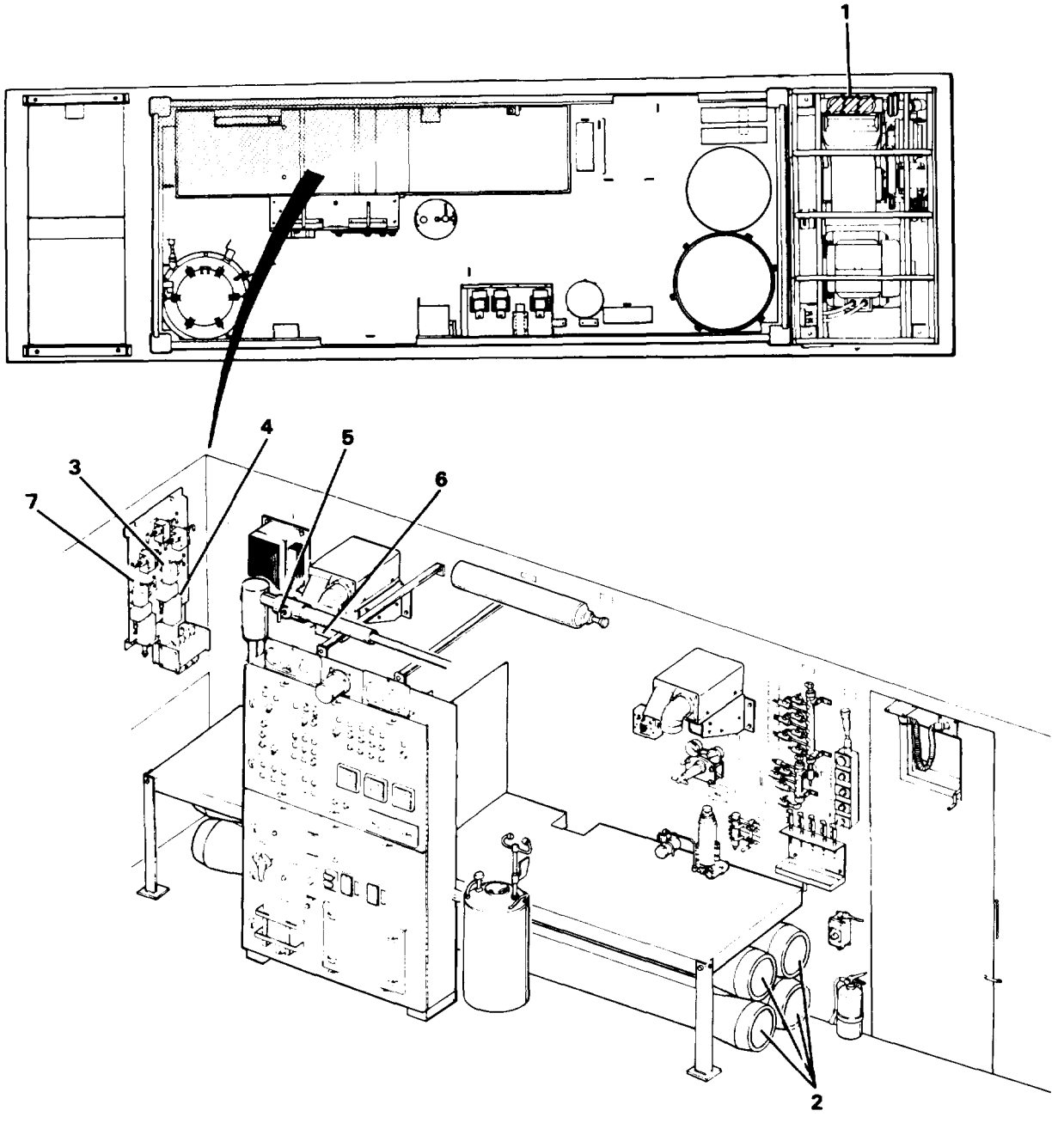


Figure 1-13. Reverse Osmosis Components

(1) High Pressure Pump (1). This is a three-plunger positive displacement pump. It pumps 101 gpm (382 lpm) pressurizing the water to the RO vessels (2). The pump is belt-driven by a 60 hp motor. Pump speed and delivery are fixed. The pump is mounted in a package separate from the ISO container. Restriction of the water supply (blocked intake flow) will cause extreme vibration of the pump, therefore a low pressure switch (3) will automatically shut down the ROWPU. Extreme discharge pressure from the pump is unsafe, therefore a high pressure switch (4) will also automatically shut down the ROWPU.

(2) RO Vessels (2). The pressurized feed water is discharged through a high pressure hose to a manifold connecting the top two RO vessels. pressurized water enters the top two vessels and, as it passes across the membrane sheets, some of the water passes through and is collected in a central product water tube. The feed water, now containing a higher concentration of dissolved solids (higher TDS), discharges through an end fitting into a high pressure pipe which directs the water back to the inlet end of the corresponding lower RO vessel. The water similarly passes across the membrane sheets within the lower vessels, producing additional product water,

(3) *System Pressure Control Valve (5).* The remaining feed water leaving the bottom RO vessels is now waste water and contains concentrated salts, From each vessel it passes through an orifice to decrease the pressure and then is combined to pass through the high pressure control valve and another orifice. This valve controls the working pressure of the system. By controlling the pressure of the system, the valve controls the amount of product water made. A high pressure switch (4) limits the pressure to 900 psig (6205 kPa).

(4) *Product Water.* The product water from each vessel is collected in a header and piped to the outlet. An in-line TOS meter (6) and portable TDS meter monitor dissolved solids content to assure that product water meets potable water standards. Just before the outlet, calcium hypochlorite is added to disinfect the product water. The chlorinated product water is called potable water. When the TDS meets potable water standards, the product water hose is manually inserted in a storage tank. When the product water does not meet potable water standards, the hose is directed to waste. A pressure switch (7) shuts down the ROWPU if hose blockage causes high pressure.

e. NBC Filter (Figure 1- 14). The ROWPU can decontaminate waters which contain nuclear, biological or chemical agents. The feed water filters and the reverse osmosis elements remove most of these agents, however, safe levels are not assured. When decontaminating NBC contaminated water the product water is additionally passed through the NBC filter for final agent removal. After filtration, the water is chlorinated and is potable. The filter is connected by jumper hoses when required, The filter contains a layer (bed) of activated carbon(1) and a layer (bed) of ion exchange resin beads (2), The NBC agents are removed by these materials. The carbon and resin beads are replaced after each 100 hours of water production to assure that there is always capability to absorb NBC materials.

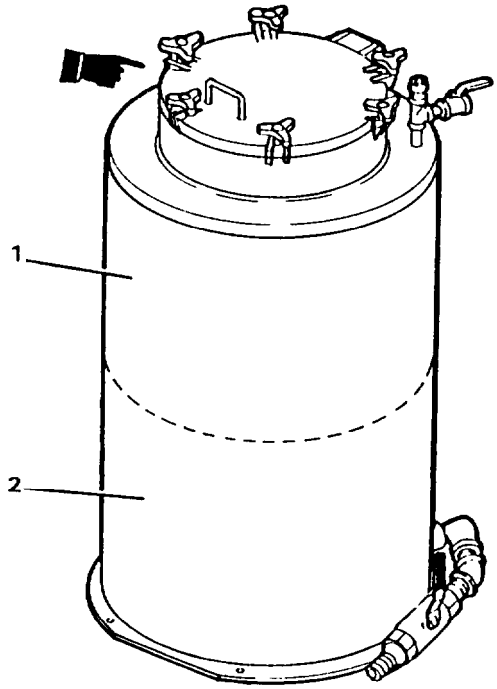


Figure 1-14. Operation of NBC Filter

f. *Chemical Treatment*

(1) Chemical Pumps and Tanks (Figure 1- 15). There are three chemical injection pumps; one for polyelectrolyte (1), one for sequestrant (2), and one for hypochlorite (3). Each pump can be adjusted to control its delivery or to turn it off. Each of the three chemicals is contained in a tank. Each tank is labeled by name and corresponding identifying symbol:

Polyelectrolyte — triangle (4)
Sequestrant — square (5)
Hypochlorite — circle (6)

The tanks are manually filled with potable water from the utility hose. The polyelectrolyte and sequestrant are each supplied in a one gallon container with graduated dispensing neck to allow proper addition to the chemical tanks. Hypochlorite is added by emptying premeasured packages of dry chemical and adding water.

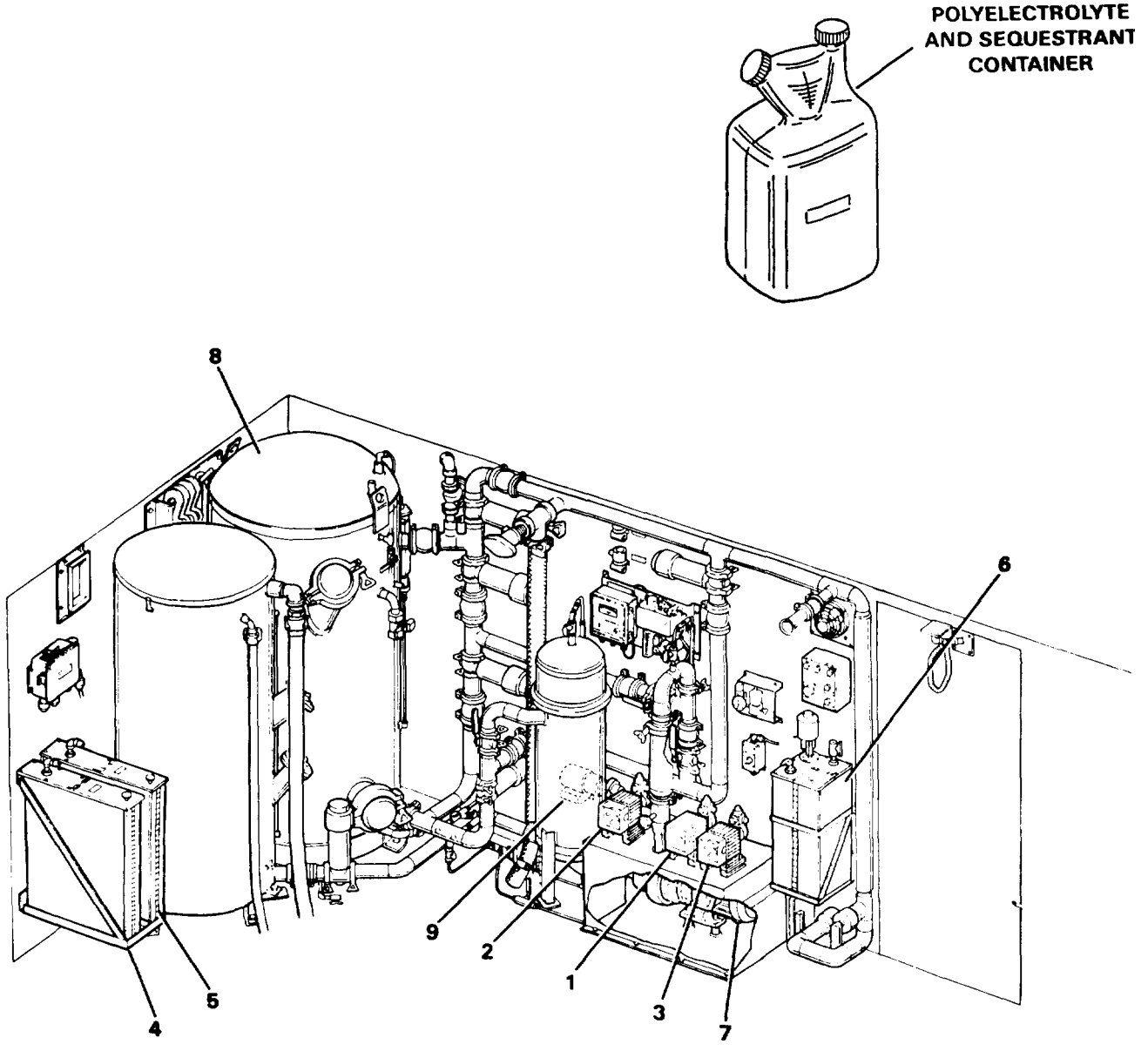


Figure 1-15. Chemical Treatment Components

(2) *Polyelectrolyle.* This chemical is pumped from the polyelectrolyte tank (4) by the polyelectrolyte pump (1). It is injected under pressure into the feed water at the feed water booster pump(7) inlet. The polyelectrolyte acts to trap the very fine dirt particles in the media filter(8). These particles, normally will not form larger particles because of electrical charges within their structures. The polyelectrolyte is a long string like molecule which also has electrical charges along its length. As a polyelectrolyte string contacts the fine particles, the electrical charges hold them and larger sticky floe particles are formed. When a floe particle contacts a grain of filter media, it has a good chance of sticking. Some polyelectrolyte strings will stick to media grains and then trap fine dirt particles as they pass through the media filter. The amount of polyelectrolyte is very important. If there is not enough polyelectrolyte, too many fine particles escape. If there is too much polyelectrolyte, the electrical charges interfere with each other and many of the fine particles and some polyelectrolyte as well escape from the filter. The amount of polyelectrolyte used must be carefully optimized to give the best removal of fine particles,

(3) *Sequestrant.* This chemical is pumped from the sequestrant tank(5) by the sequestrant pump (2). Sequestrant (scale inhibitor) is injected into the feed water after the media filter to minimize or avoid the formation of scale in the RO elements. The amount of sequestrant (if needed at all) depends on the raw water source.

(4) *Hypochlorite.* This chemical is pumped from the hypochlorite tank (6) by the hypochlorite backwash pump (9) and injected into the water flow during media filter backwash. It acts to kill algae and bacteria which can form a sticky matt on top of the filter media. If hypochlorite is not used, the algae will make the AG media in the media filter so sticky that backwashing will not remove the suspended solids and algae. The tank and chemical packets are marked with a circle for easy identification. During operation hypochlorite is pumped by the hypochlorite pump(3) and injected into the product water, This provides the chlorine residual amount needed to keep the water safe to drink (potable) during distribution and use.

g. Air Supply(Figure 1- 16). The air compressor(1), mounted in the high pressure pump package(2), is the source of air pressure to operate automatic valves and aid in media filter backwash. Compressed air is stored in the air reservoir (3) which provides 1800 psig (12,400 kPa) service air. An inlet air filter is located at the air compressor. A high pressure outlet air filter (4) is inside the van. An air system low pressure regulator valve (5), reduces the air pressure to 85 psig (585 kPa) for service use. An air dryer (6) further reduces moisture from the low pressure air used for valves and instruments. Air manifolds (7) and (8) distribute the process and utility air,

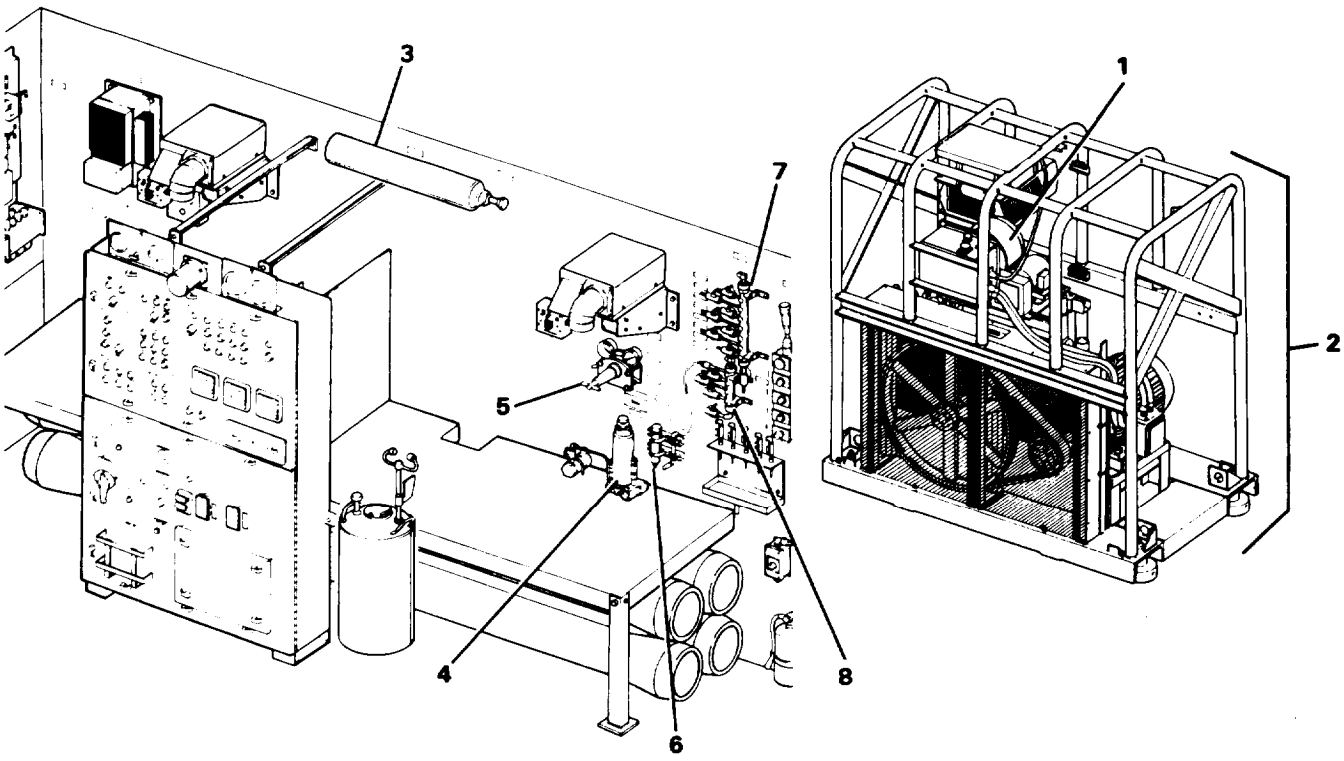


Figure 1-16. Air Supply Components

h. *Electrical Controls (Figure 1-17).*

(1) *Main Control Panel.* Almost all the electrical switching gear, electrical controls, and indicating lights you need to operate the ROWPU are located on the main control panel(1). Flow meters(2) are also mounted in this panel. The main circuit breaker (3) on this panel controls power to all circuits within the ROWPU. Relays and timers are used for control logic. A warning horn sounds and yellow lights go on when operator attention is needed. An alert horn sounds continuously and red lights goon when an automatic shutdown occurs. Blue indicator lights indicate open automatic valves and green lights indicate operating pumps or operating mode.

(2) *Switch Panel No. 1 (4).* This panel contains distribution pump ON/OFF pushbuttons, a distribution pump ON indicator light, a van interior light switch and a utility outlet.

(3) *Switch Panel No. 2 (5).* This contains the warning and alert horns, a van interior light switch, hypochlorite tank mixer ON/OFF switch, vent fan switch, and a utility outlet.

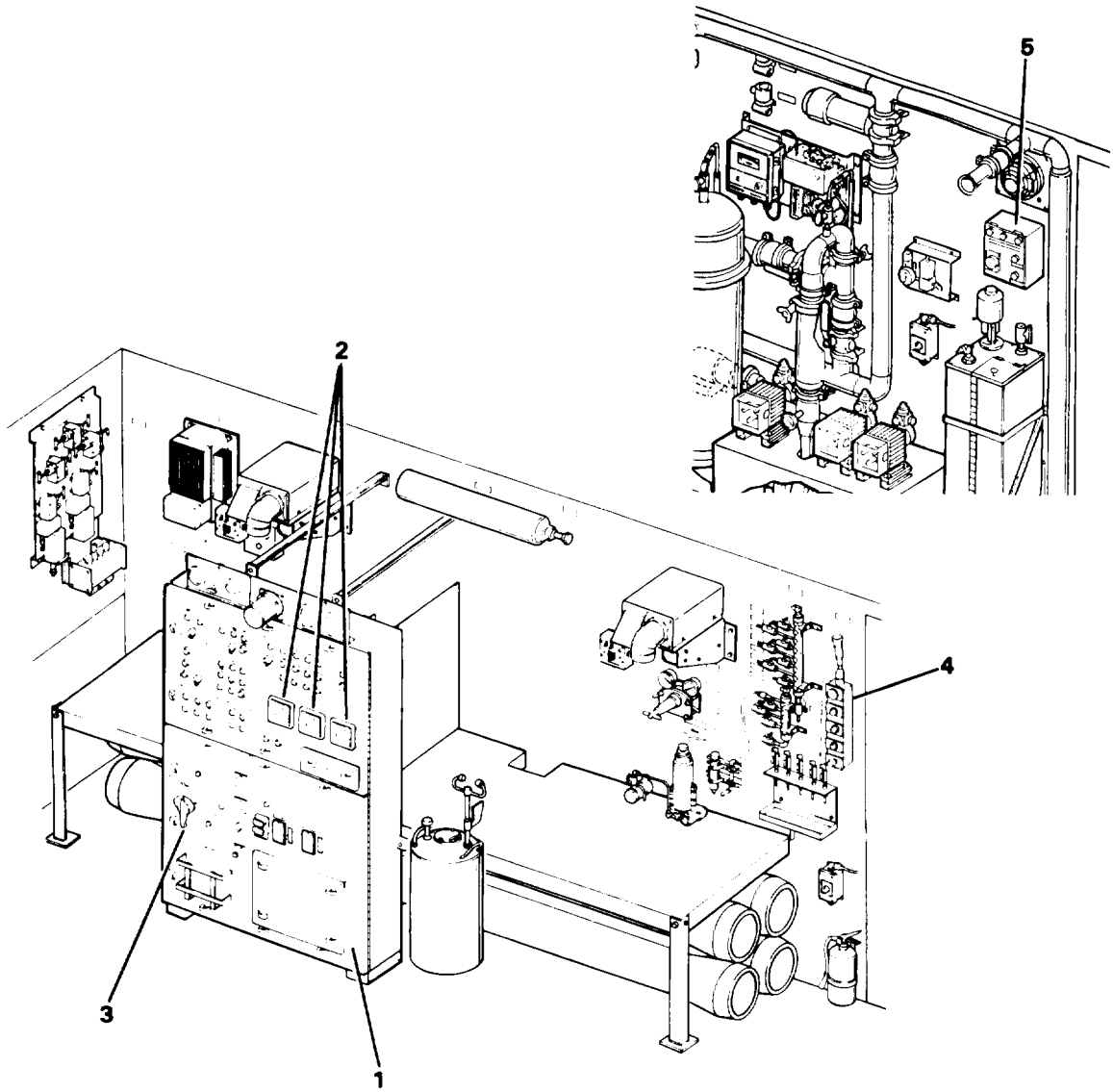


Figure 1-17. Electrical Controls

1-15. POTABLE WATER DISTRIBUTION SYSTEM (Figure 1-18). This system handles and stores the potable water produced by the ROWPU.

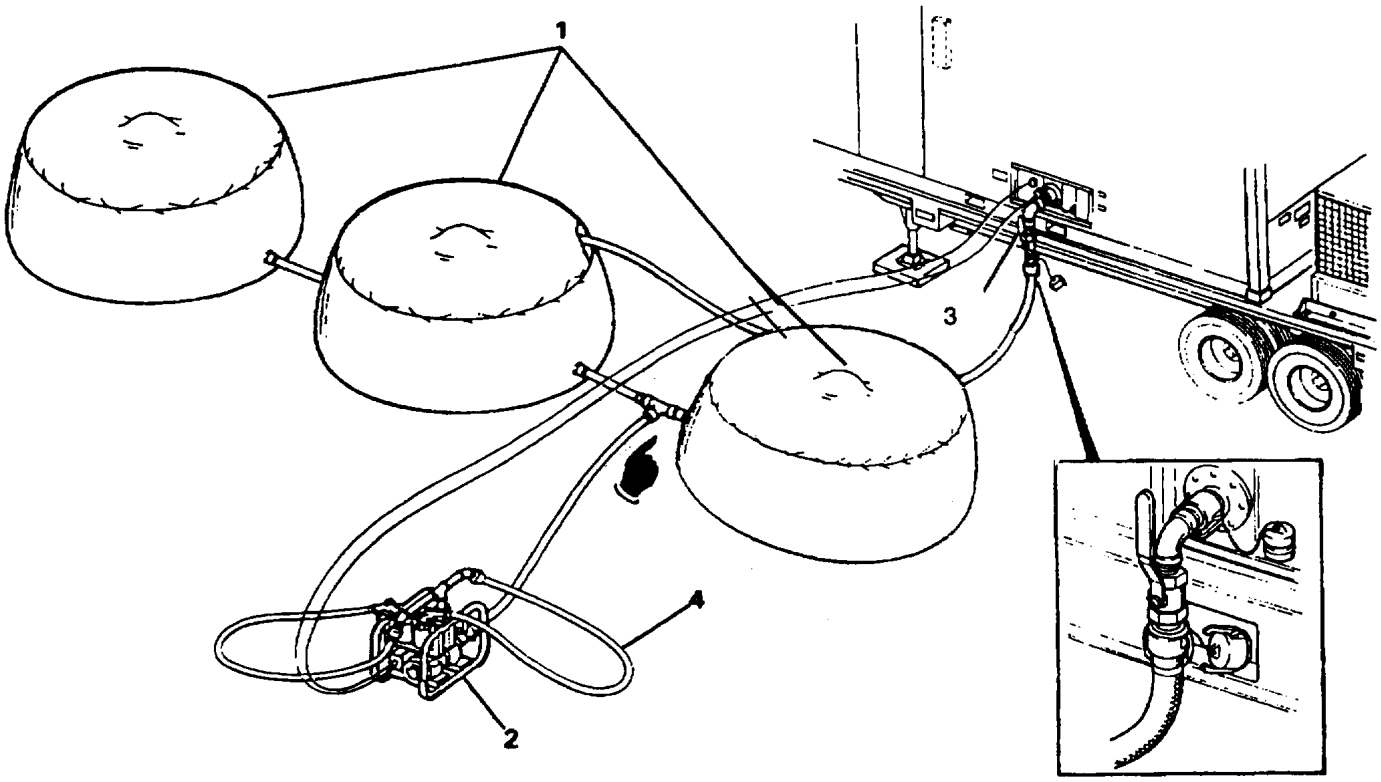


Figure 1-18. Potable Water Distribution System

a. *Storage Tanks* (7). Three 3000 gallon (11,355 l) storage tanks provide temporary water storage. The tanks are of air collar (onion tank) design.

b. *Distribution Pump* (2). This pump provides water for distribution through two hoses with dispensing nozzles. The start-stop station for this pump is mounted inside the "rear" door of the van (on distribution system side). A local switch at the pump must be in the ON position before the pump can be turned on. This switch also turns the pump off/on as long as the start button has been pushed.

c. *Product Shut-Off Valve* (3). This valve blocks water loss during cleaning and can be used to provide sufficient back pressure for the utility hose when filling tanks.

d. *Dispensing Hoses and Nozzles* (4). These hoses, with attached nozzles, are pressurized by the distribution pump to deliver potable water from the storage tanks.

CHAPTER 2. OPERATING INSTRUCTIONS

SECTION I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.

2-1. General. The operator needs to know and understand the function of controls, indicator lights, and manually operated valves used in operation and operator maintenance of the ROWPU. This section describes and shows all the operator controls. In addition to controls, indicator lights, and manually operated valves, there are portable meters and gages used to measure water quality outside the ISO container at the raw water intake and distribution points. During certain operational phases of the ROWPU hose hook-ups must be changed.

a. *Raw Water Pump Controls and Indicators (Refer to Table 2-1)*.

b. *Electrical Switch Panels 1 and 2 (Refer to Table 2-2)*.

c. *Main Control Panel Controls and Indicators (Refer to Table 2-3)*.

(1) Controls. There are four selector switches, fourteen pushbuttons, and eight resets on the main control panel; the function of each is described in Table 2-3.

(2) Gages and Instruments. There are four pressure gages, three flowmeters, and two hourmeters on the panel.

(3) Circuit Breakers. There is one MAIN circuit breaker which totally activates or shuts down the panel. This MAIN circuit breaker is also a door interlock. The breaker is opened and all electrical power to the panel is interrupted when the door is opened. There are eight overload circuit breakers on the panel.

(4) Indicator Lights. Green lights indicate switch ON positions, blue lights indicate automatic valve positions. Yellow lights indicate when operator action is required, red lights indicate conditions which will automatically shut the ROWPU down. When yellow lights go on, a pulsed (WARNING) horn on switch panel 2 goes on, when red lights go on, a steady horn sound (ALERT) goes on (this horn is also on switch panel 2).

d. *Remote Meters and Gages*. In-line meters and gages not associated with chemical and water status are described in Table 2-4.

e. *Manual Water Valves*. The manual water flow control and drain valves with which the operator has interface are described in Table 2-5.

f. *Manual Chemical Controls (Refer to Table 2-6)*.

g. *Air Supply Controls and Indicators (Refer to Table 2-7)*.

h. *Oil Drain Plugs, Drain Valves and Oil Level Indicators (Refer to Table 2-8)*.

i. *Diesel Heater Controls and Carbon Monoxide Monitor (Refer to Table 2-9)*.

j. *Potable Water Distribution System Controls and Indicators (Refer to Table 2-10)*.

k. *Portable Testing Meters and Gages (Refer to para. 2-5 thru 2-8)*.

l. *Deleted*. ■

m. *Hose Connections During Operation*. The operator must perform a number of hose hook-ups during operation of the ROWPU; an understanding of the flow pattern for each of these hook-ups is essential to the operation of the ROWPU (see Figure 2-1).

NOTE

Cleaning of filters and RO elements is par of the operation of the ROWPU. The in-operation cleaning functions are media filter backwash (para. 2-21) and RO element cleaning (para. 2-25), and changing basket strainer and cartridge filters (para. 2-24). Chemical tank and system flushing procedures are part of shutdown. Hoses used for cleaning and flushing are identified and illustrated in their appropriate procedures paragraphs.

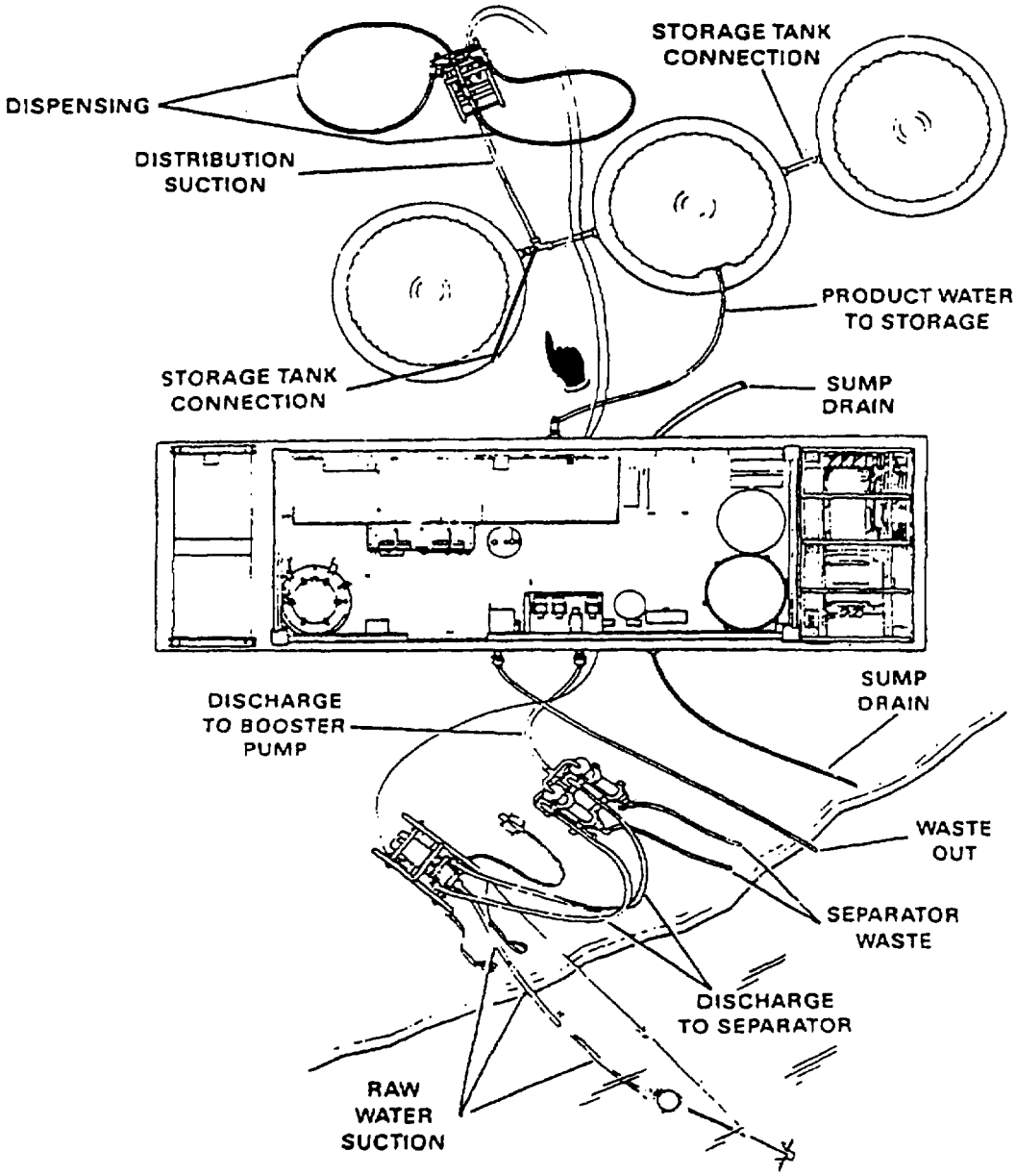


Figure 2-1. Hose Identification (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

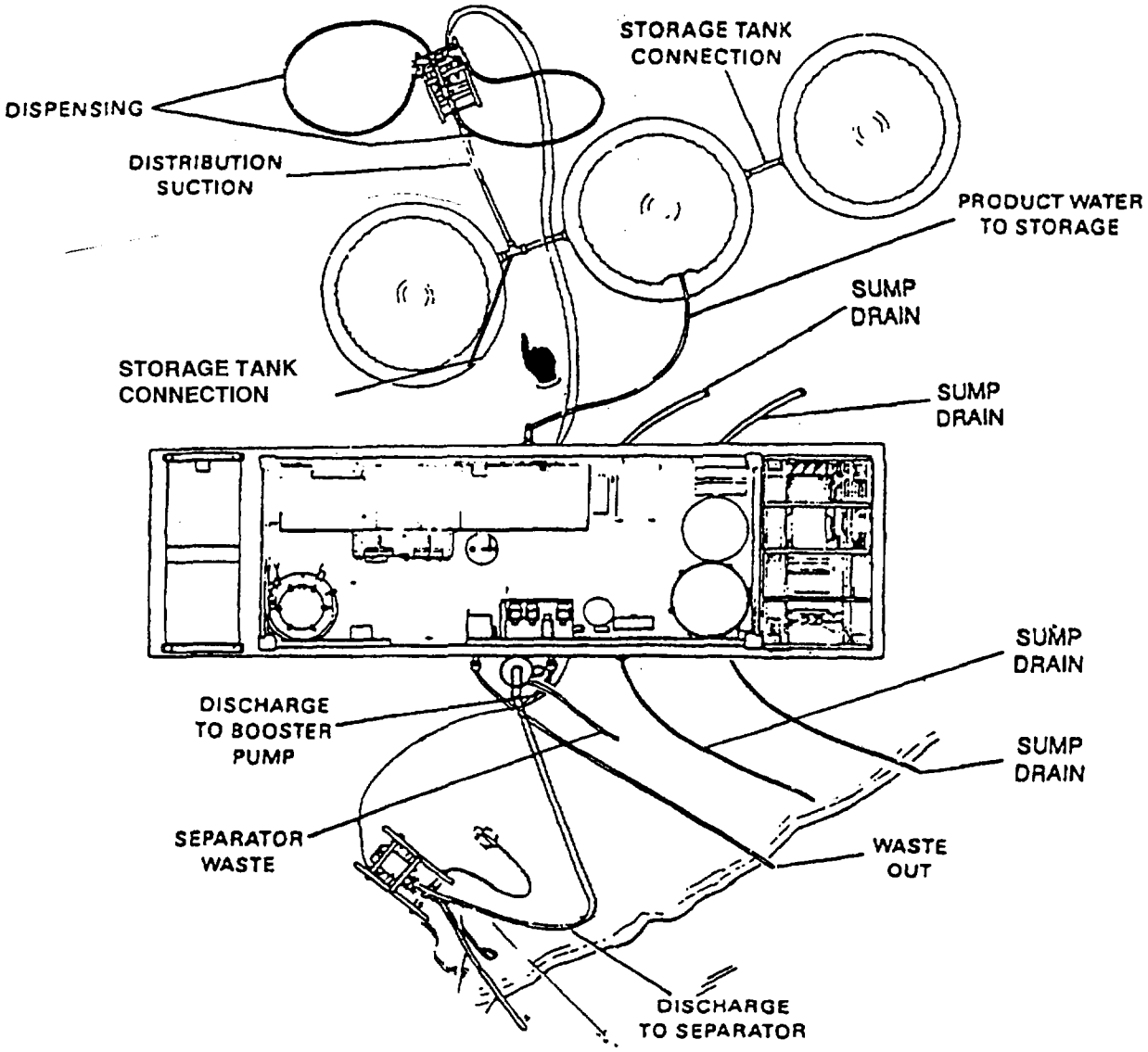


Figure 2-1. Hose Identification (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

2-2. Raw Water Intake System Controls and Indicators

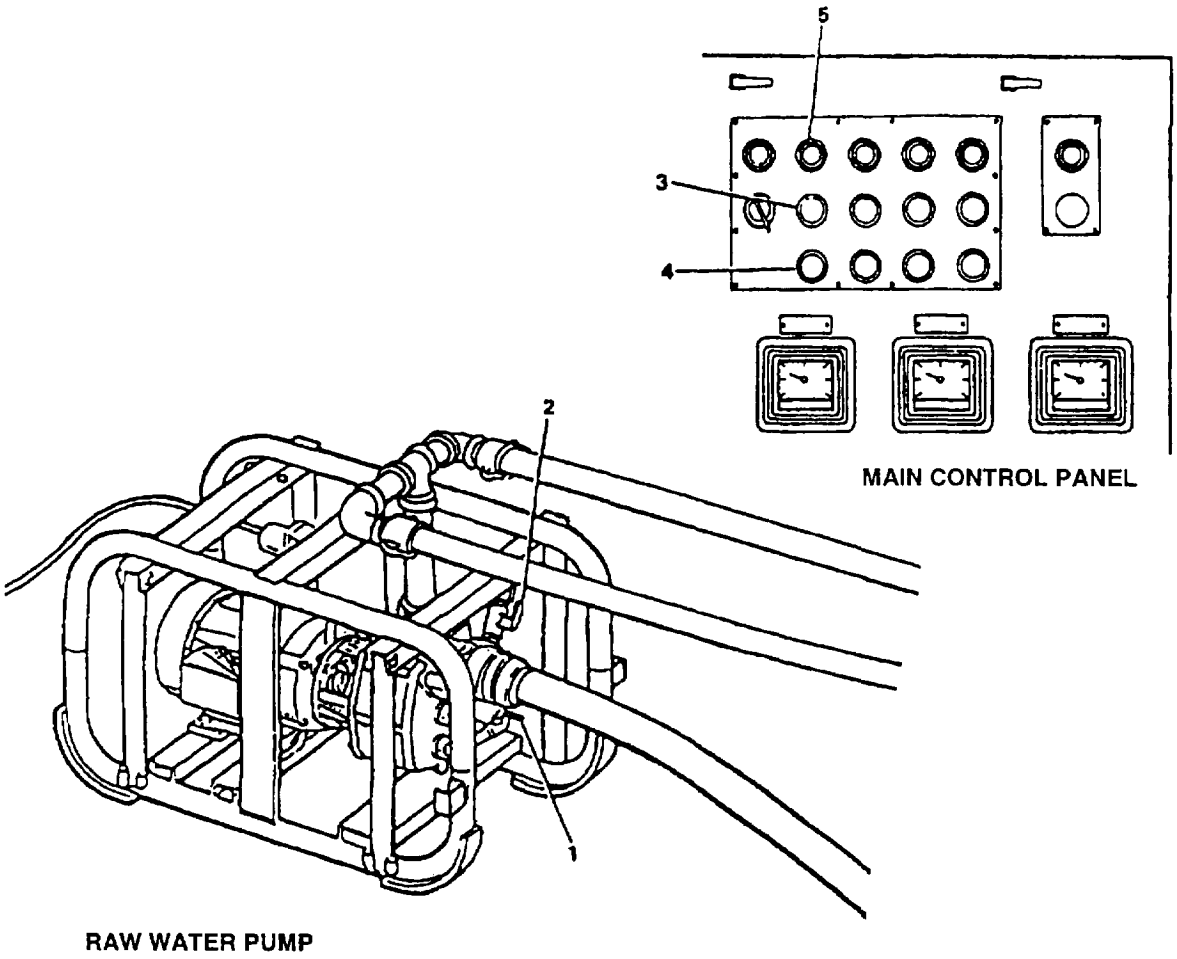


Figure 2-2. Raw Water Pump Controls (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

Table 2-1. Raw Water Pump Controls
(Item numbers are keyed to Figure 2-2)

Item Number	Control/Indicator	Function
1	RAW WATER PUMP DRAIN VALVE - V1	Drains water from pump Closed during normal operation, open for draining.
2	PRIME PUMP ASSIST VALVE	Blocks pressure from hand pump after priming; closed during normal operation, open for hand priming.
3	RAW WATER PUMP START	Pushbutton starts raw water pump.
4	RAW WATER PUMP STOP	Pushbutton stops raw water pump
5	RAW WATER PUMP ON	Green light ON when raw water pump is running.

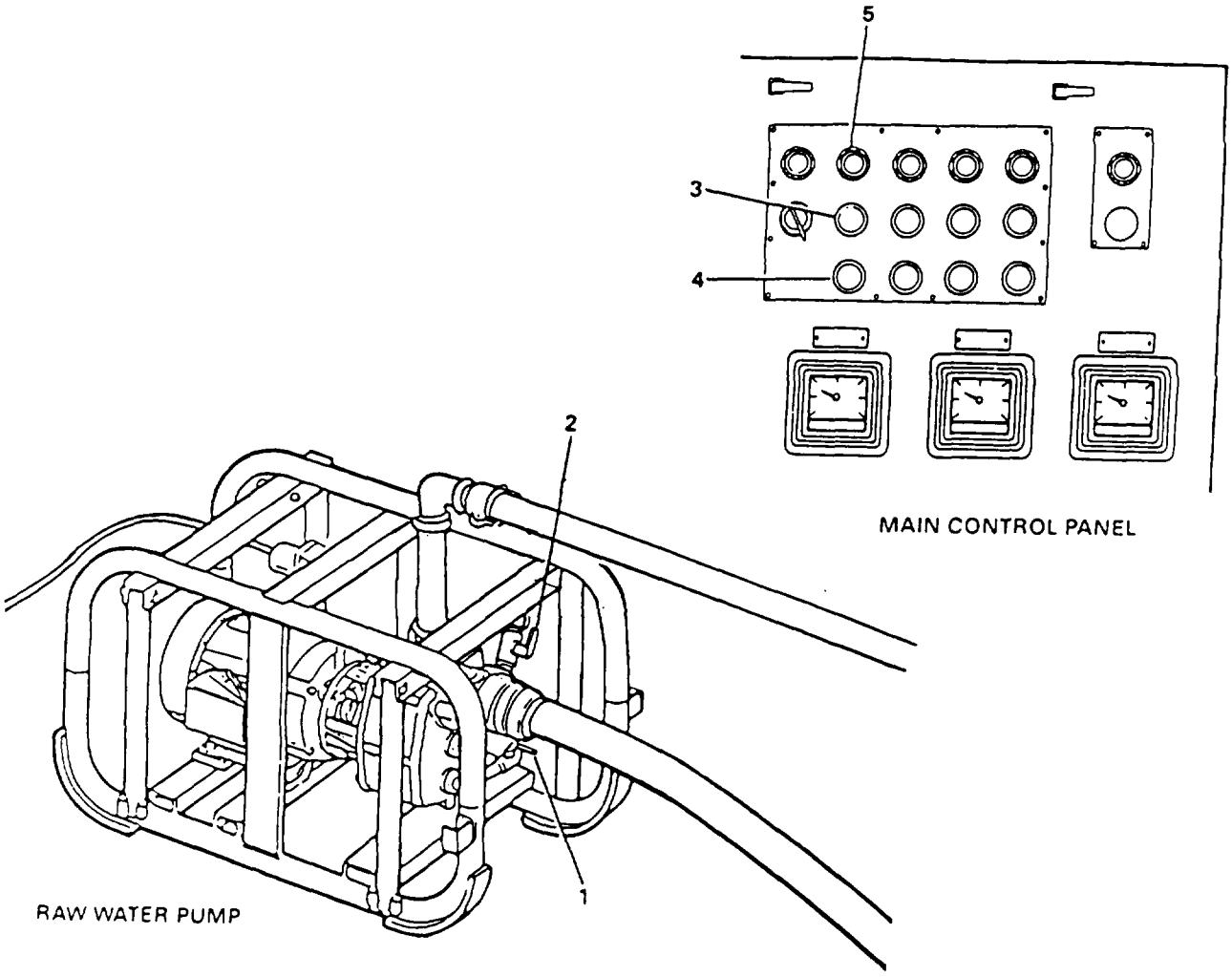


Figure 2-2. Raw Water Pump Controls (Sheet 2 of 2)
☛ (MODEL ROWPU-1 ONLY)

2-3. Water Purification System Controls and Indicators. Most oft he controls and indicators for the ROWPU are within the ISO container.

a. *Switch Pane/s.* A switch panel is located at each door to the Water Purification System ISO container, The controls and indicators for switch panels no. 1 and no. 2 are shown in Figure 2-3 and listed in Table 2-2.

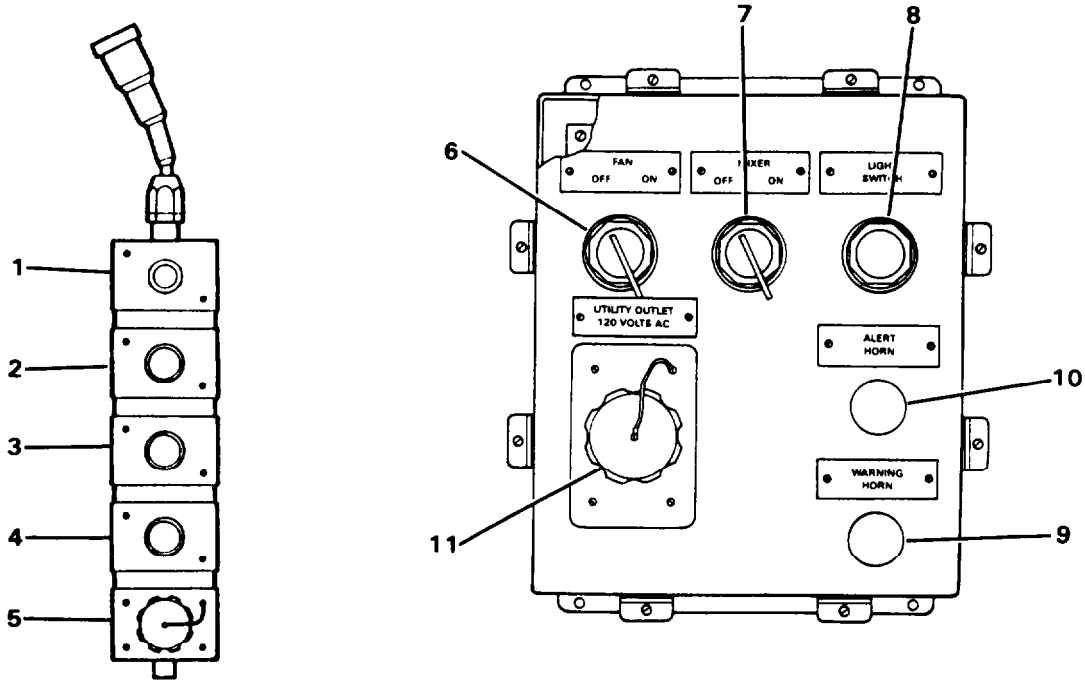


Figure 2-3. Switch Panels No. 1 (Left) and No. 2 (Right)

Table 2-2. Switch Panel Controls and Indicators
(Item numbers are keyed to Figure 2-3)

Item	Control or Indicator	Function
1	DISTRIBUTION PUMP POWER ON	Pilot light glows when distribution pump control power is ON.
2	DISTRIBUTION PUMP ON	Pushbutton to turn distribution pump ON.
3	DISTRIBUTION PUMP OFF	Pushbutton to turn distribution pump OFF.
4	LIGHT SWITCH	Pushbutton to turn interior lights on and off as needed,
5	UTILITY OUTLET	Waterproof electrical receptacle and cover for use as needed,
6	FAN OFF-ON	Selector switch for turning fan OFF and ON.
7	MIXER OFF-ON	Selector switch for turning hypochlorite tank mixer OFF and ON.
8	LIGHT SWITCH	Pushbutton to turn interior lights on and off as needed.
9	WARNING HORN	Pulsing sound comes on when chemical levels are low or when filters are plugged.
10	ALERT HORN	Steady sound comes on when ROWPU shuts down automatically due to an alarm condition.
11	UTILITY OUTLET	Waterproof electrical receptacle and cover for use as needed.

b. *Main Control Pane*. The main control panel contains most of the electrical controls and Indicators for the ROWPU These controls and indicators are shown in Figure 2-4 and listed in Table 2-3.

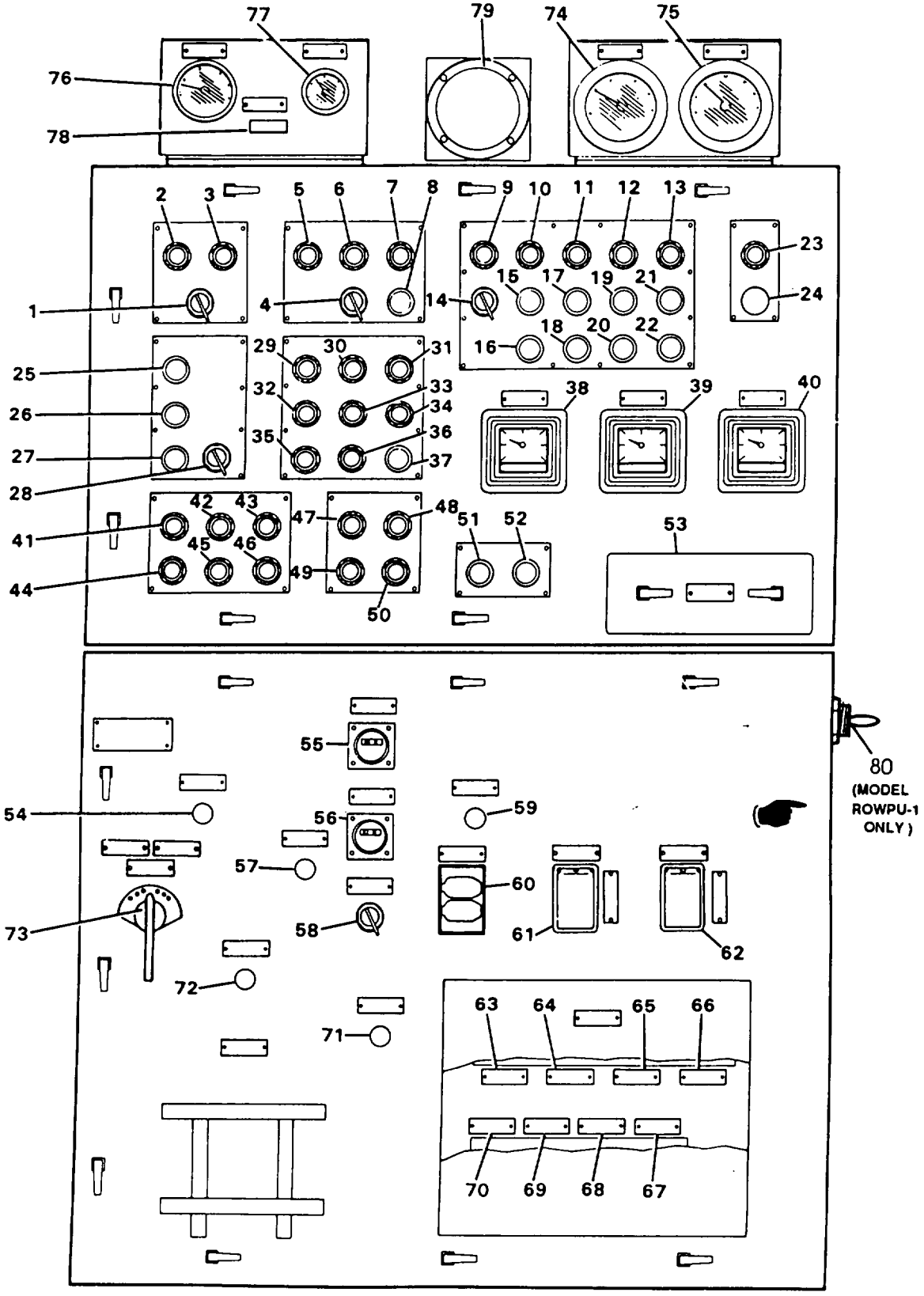


Figure 2-4. Main Control Panel Controls and Indicators

Table 2-3. Main Control Panel Controls and Indicators
(Item numbers are keyed to Figure 2-4)

Item	Control or Indicator	Function
1	SYSTEM MODE SWITCH (TWO POSITION)	in the SYSTEM ON position, this switch allows operation as selected by the OPERATION MODE switch. In the SYSTEM SHUTDOWN position, this switch initiates a flush from the clean/flush tank and stops the high pressure pump and booster pump when the flush is complete.
2	SYSTEM ON	Green light ON when the system switch is set to normal ON for operation.
3	SYSTEM SHUTDOWN	Green light ON when normal operation has been stopped and automatic flush cycle has been started.
4	OPERATION MODE SWITCH (THREE POSITION)	In FILTER NORMAL position, this switch sets all automatic valves to the normal operating position, In the FILTER BACKWASH position it sets all valves to the filter backwash initial positions and starts the automatic backwash steps. In the SYSTEM CLEAN position it sets all automatic valves for chemical cleaning,
5	FILTER NORMAL	Green light ON when in normal operating mode,
6	FILTER BACKWASH	Green light ON when in filter backwash mode.
7	SYSTEM CLEAN	Green light ON when in system clean mode.
		NOTE
		The control mode selected will only proceed after the INITIATE button is pushed.
8	INITIATE	Starts automatic valve switching after OPERATION MODE switch has been changed from one mode to another, or at start-up after SYSTEM MODE switch is set to SYSTEM ON.
		NOTE
		Pumps cannot be started until INITIATE has been pushed when restarting after a shutdown.
9	COMPRESSOR ON	Green light indicates that the on/off switch for the air compressor is in the ON position, Compressor will go on and off automatically to keep air pressure of 1545 to 1775 psi (10,660.5 to 12,247.5 kPa) in the air reservoir tank.
10	RAW WATER PUMP ON	Green light ON when raw water pump is running.
11	CHEMICAL PUMPS ON	Green light ON when chemical pumps have power to be operated,
12	BOOSTER PUMP ON	Green light ON when feedwater booster pump is running.
13	HIGH PRESSURE PUMP ON	Green light ON when high pressure pump is running.
14	COMPRESSOR ON/OFF	ON/OFF two position selector switch. ON position allows compressor operation in response to automatic controls,

Table 2-3. Main Control Panel Controls and Indicators (Continued)
(Item numbers are keyed to Figure 2-4)

Item	Control or Indicator	Function
15	RAW WATER PUMP START	Starts raw water pump.
16	RAW WATER PUMP STOP	Stops raw water pump.
17	CHEMICAL PUMPS START	Starts chemical pumps if individual pumps are set to run.
18	CHEMICAL PUMPS STOP	Stops chemical pumps.
19	BOOSTER PUMP START	Starts feedwater booster pump.
20	BOOSTER PUMP STOP	Stops feedwater booster pump.
21	HIGH PRESSURE PUMP START	Starts high pressure pump. Will not start while FEED PRESSURE LOW light is on.
22	HIGH PRESSURE PUMP STOP	Stops high pressure pump.
23	PANEL ENERGIZED	Green light ON when generator set is on and the main circuit breaker for the process control panel is closed (ON) and the EMERGENCY STOP is pulled out.
24	EMERGENCY STOP	Stops operation of all motors and automatic controls, when pushed in.
25	ALARM TEST	For use during preoperational checks.
26	LIGHT TEST	For use during preoperational checks. Replace any panel lights that do not come on when this button is pushed.
27	PANEL LIGHT ON/OFF	Turns main control panel utility light on.
28	SUMP HEAT/PUMP HEAT OFF/ON	ON/OFF two position selector switch. ON position turns on the heat tracing and pump heaters for cold weather protection (does not operate high pressure pump assembly heater).
		NOTE
		Lights 29 thru 36 indicate open or closed status of automatic valves. Light ON indicates an OPEN VALVE.
29	MEDIA FILTER INLET — V16	Blue light ON when media filter inlet valve is in its normally open position (normal operation). The light goes off (valve is closed) during media filter backwash sequence.
30	BACKWASH INLET — V15	Blue light ON when valve is open, during second, third and fourth steps of filter backwash, to let backwash water into filter.
31	CLEAN/FLUSH OUTLET — V5	Blue light ON when the clean/flush tank outlet valve has opened. Open during automatic flush at shutdown, during final step of filter backwash, and during RO element cleaning.
32	MEDIA FILTER OUTLET — V35	Blue light ON when media filter outlet valve is in its normally open position (normal operation). Light goes off during media filter backwash sequence.
33	BACKWASH OUTLET —V17	Blue light ON (valve open) during backwash. Light is off during normal operation.
34	MEDIA FILTER FLUSH – V36	Blue light is ON when valve has been opened. Closed (OFF) for normal operation.

Table 2-3. Main Control Panel Controls and Indicators (Continued)
(Item numbers are keyed to Figure 2-4)

Item	Control or Indicator	Function
35	AIR BLANKET — V20	Blue light ON when air blanket is activated in media filter during high pressure pump operation.
36	BACKWASH AIR INLET — V22	Blue light ON (valve open) when air is going into media filter during second step of media filter backwash, Light is off during normal operation.
37	MEDIA FILTER FORWARD FLUSH	Opens or closes media filter flush valve, V36.
38	FLOWMETER — FEED FLOW — FI 1	Meter measures the feedwater flow rate in gallons per minute (gpm). Should be 100 to 105 gpm during normal operation.
39	FLOWMETER — PRODUCT FLOW — FI 2	Meter measures product water flow rate in gallons per minute (gpm).
40	FLOWMETER — WASTE FLOW — FI 3	Meter measures RO waste water flow rate in gallons per minute (gpm).
41	POLYELECTROLYTE TANK LOW LEVEL	Yellow warning light and horn signal ON when polyelectrolyte tank needs to be filled.
42	SEQUESTRANT TANK LOW LEVEL	Yellow warning light and horn signal ON when the sequestrant/bisulfite tank needs to be filled.
43	HYPOCHLORITE TANK LOW LEVEL	Yellow warning light and horn signal ON when the hypochlorite tank needs to be filled.
44	STRAINER PLUGGED	Yellow warning light and horn signal ON when the basket strainer needs to be removed and cleaned.
45	MEDIA FILTER PLUGGED	Yellow warning light and horn signal ON when a routine backwash of the media filter is needed.
46	CARTRIDGE FILTER PLUGGED	Yellow warning light and horn signal ON when the cartridge filter elements need to be changed.
47	CLEAN/FLUSH TANK LOW LEVEL	Red alarm light and horn signal ON when the clean/flush tank has emptied.
48	FEED PRESSURE LOW	Red alarm light and horn signal ON if pressure is low (or there is a lack of water) at inlet of high pressure pump. Booster and high pressure pumps stop.
49	HIGH PRESSURE PUMP PRESSURE HIGH	Red alarm light and horn signal ON if pressure at outlet (discharge) of high pressure pump is too high. All pumps will automatically stop.
50	PRODUCT PRESSURE HIGH	Red alarm light and horn signal ON if product water pressure is too high. All pumps will automatically stop.
51	ALARM SILENCE	Push button to shut off alert or warning horn while the problem is being corrected.
52	SYSTEM RESET	Used to reset relays that turn on warning horn, alert horn, and red and yellow lights. Push after problem that triggered alarm has been corrected,
53	CIRCUIT BREAKERS	120 VAC circuit breakers (CB7, CB8, CB9, CB10, CB11, CB12, CB13 and CB14).

Table 2-3. Main Control Panel Controls and Indicators (Continued)
(Item numbers are keyed to Figure 2-4)

Item	Control/Indicator	Function
54	BOOSTER PUMP STARTER RESET	Starter overload reset.
55	HIGH PRESSURE PUMP HOURMETER	Measures high pressure pump total run time.
56	AIR COMPRESSOR HOURMETER	Measures compressor total run time.
57	HIGH PRESSURE PUMP RESET	Starter overload reset.
58	HEATER POWER SUPPLY STARTER OFF/ON	Controls 120 VAC power to power supply for van heaters.
59	AIR COMPRESSOR STARTER RESET	Starter overload reset.
60	UTILITY OUTLET 120 VOLT AC	120 VAC duplex receptacle.
61	DISTRIBUTION PUMP GROUND FAULT RESET	Resets ground fault isolators.
62	RAW WATER PUMP GROUND FAULT RESET	Resets ground fault isolators.
63	HIGH PRESSURE PUMP CB6 125 AMP	High pressure pump circuit breaker (CB6).
64	AIR COMPRESSOR CB2 15 AMP	Air compressor circuit breaker (CB2).
65	DISTRIBUTION PUMP CB3 15 AMP	Distribution pump circuit breaker (CB3).
66	RAW WATER PUMP CB4 15 AMP	Raw water pump circuit breaker (CB4).
67	PUMP SKID HEATER CB17 10 AMP	Pump skid heater circuit breaker (CB17).
68	3 KVA T2 CB16 10 AMP	3 KVA circuit breaker (CB16).
69	BOOSTER PUMP CB5 20 AMP	Feedwater booster pump circuit breaker (CB5)
70	5 KVA T1 CB15 15 AMP	5 KVA circuit breaker (CB15).
71	RAW WATER PUMP STARTER RESET	Starter overload reset.
72	DISTRIBUTION PUMP STARTER RESET	Starter overload reset.
73	MAIN CIRCUIT BREAKER CB1 150 AMP	Controls all power to process control panel and opens door.
74	MEDIA INLET/OUTLET PRESSURE GAGE - PD11	Shows the pressure before and after the media filter and the pressure drop (differential).
75	CARTRIDGE INLET/OUTLET PRESSURE GAGE - PD12	Shows the pressure before and after the cartridge filter and the pressure drop (differential).
76	REVERSE OSMOSIS PRESSURE GAGE - P13	Shows the system operating pressure (the pressure at the inlet of the first set of RO vessels, or the pressure at the outlet of the second set of RO vessels.
77	PRODUCT WATER PRESSURE GAGE - P14	Shows the pressure of product water coming out of the RO elements. Should be less than 20 psig (138 kPa).
78	REVERSE OSMOSIS PRESSURE SELECT VALVE - V47	Used to select which pressure is shown by the REVERSE OSMOSIS pressure gage.
79	CONTROL PANEL LIGHT	Provides ambient light for operators.
80	HIGH PRESSURE PUMP JOG SWITCH (MODEL ROWPU-1 ONLY)	Used to remove any remaining water inside the high pressure pump case before storage of the ROWPU.

c. Remote Meters and Gages. The meters and gages not mounted on the main control panel are shown in Figure 2-5 and listed in Table 2-4.

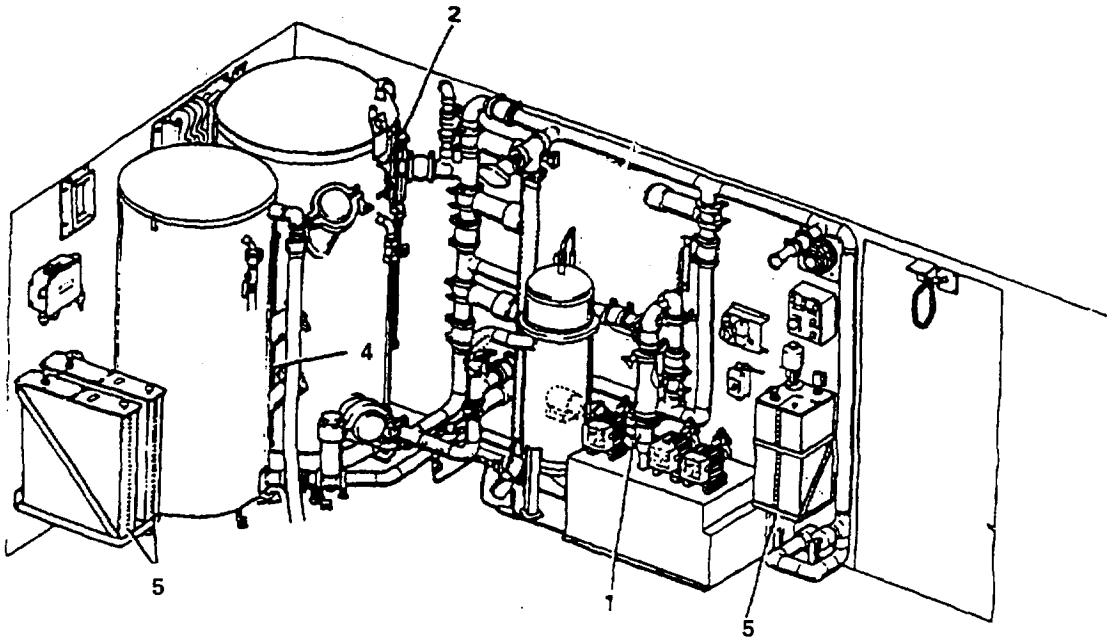


Figure 2-5. Remote Meters and Gages (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

Table 2-4. Remote Meters and Gages
(Item numbers are keyed to Figure 2-5)

Item	Control/Indicator	Function
1	FEED WATER TEMPERATURE GAGE	This gage shows the raw water temperature and Is used to determine the amount of drinkable water the ROWPU should be able to produce. (Water production changes as water temperature changes.) It is also used to show chemical cleaning solution temperatures.
2	AIR BLANKET LEVEL INDICATOR	This shows the level of the air blanket in the media filter. Red flags indicate water level; white flags indicate air level. Sensors in this level switch send electrical signals to maintain the air level.
■ 3	DELETED	
4	CLEAN/FLUSH TANK LEVEL GAGE	This sight gage shows how much water is in the clean flush tank.
5	CHEMICAL TANK LEVEL GAGES	Indicate liquid level in tanks.
■ 6	DELETED	

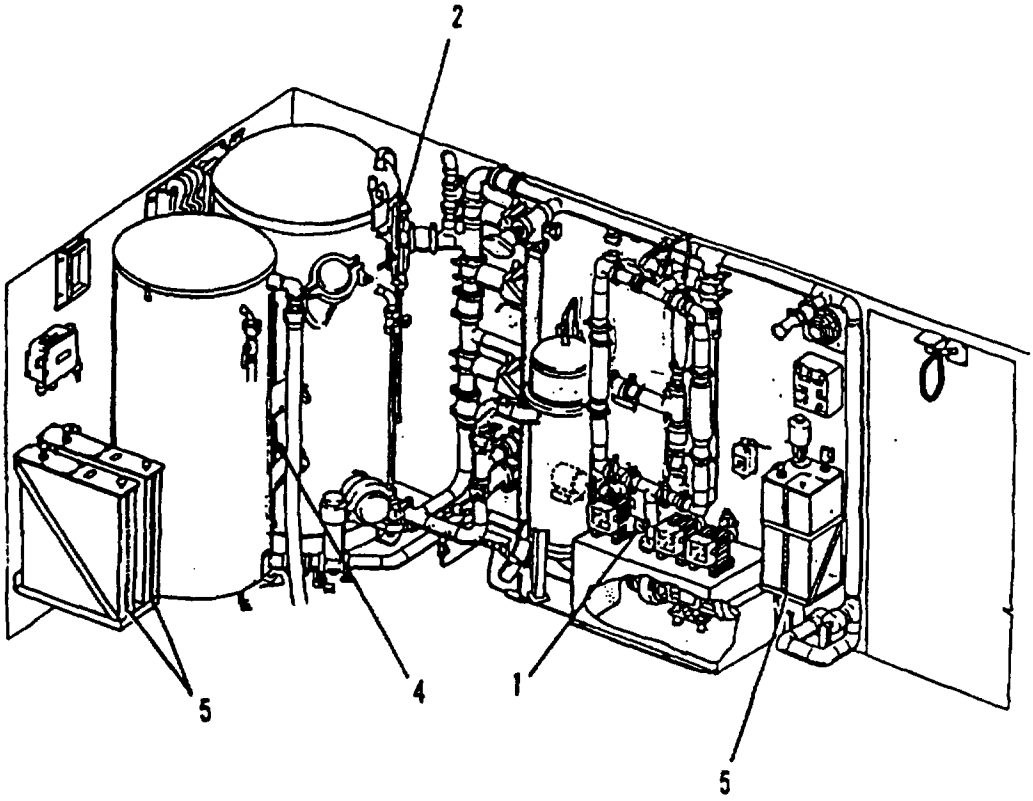


Figure 2-5. Remote Meters and Gages (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

d. Manual Water Valves. The manual water valves are shown in Figure 2-6 and listed in Table 2.5

NOTE

A valve is closed when the handle is at right angles to the piping or hose (See insert on Figure 2-6).

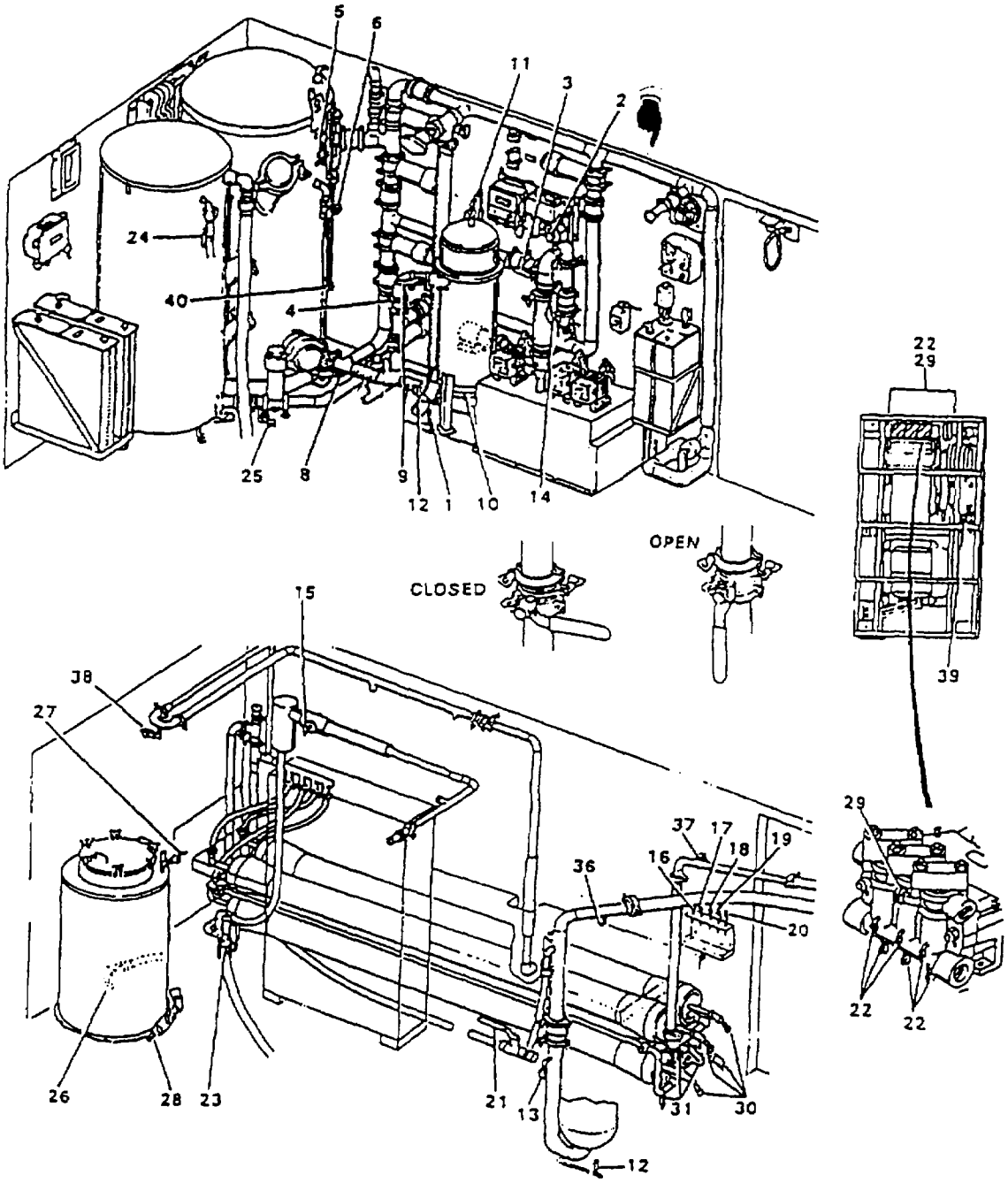


Figure 2-6. Manual Water Valves (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

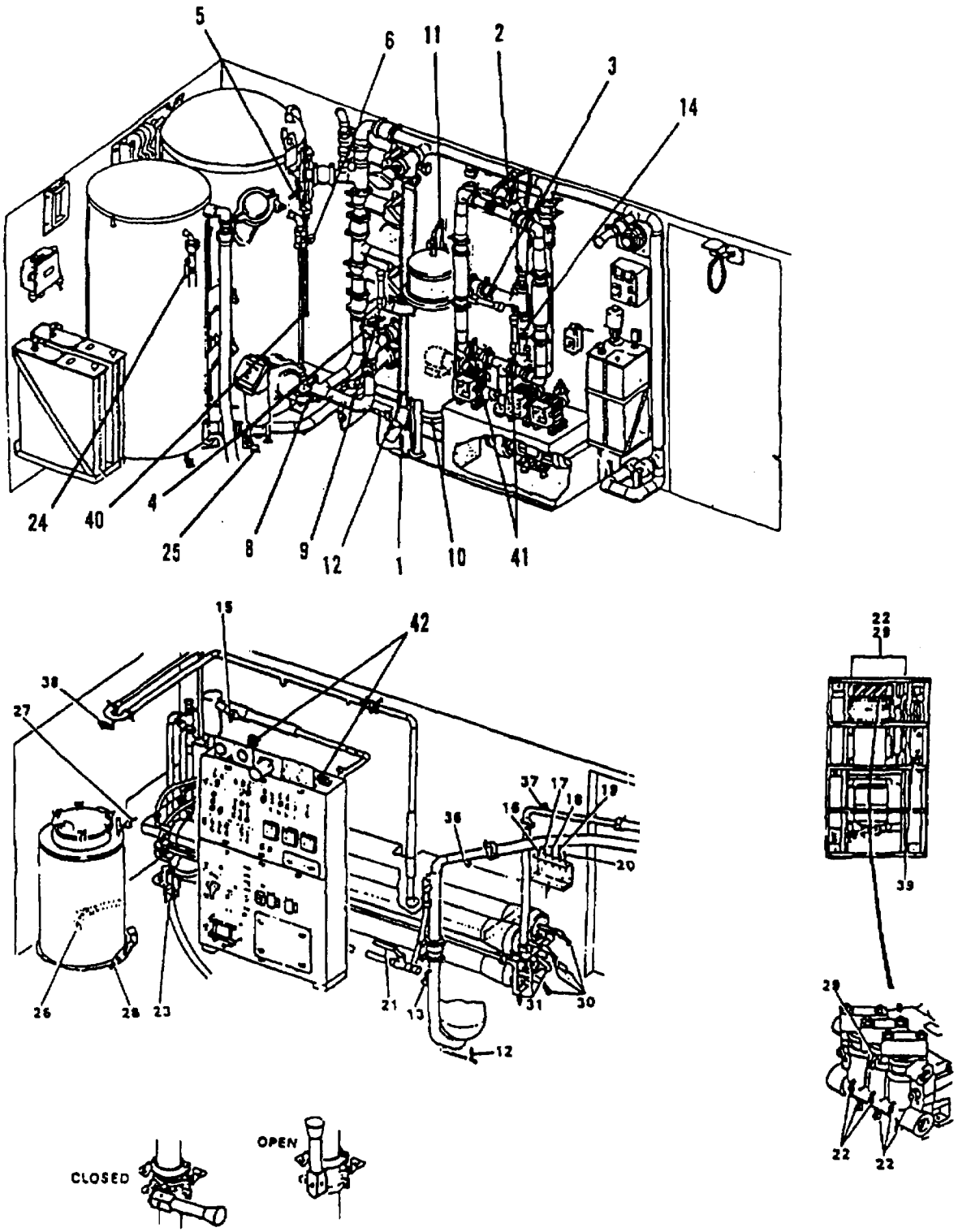


Figure 2-6. Manual Water Valves (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

Table 2-5. Manual Water Valves
(Item numbers are keyed to Figure 2-6)

Item	Control/Indicator	Function
1	FEED WATER BOOSTER PUMP DRAIN VALVE - V9	This valve is opened to drain the pump when securing the ROWPU and is also used to drain the in-line strainer.
2	RAW WATER SAMPLE/VENT VALVE - V11	This valve is used to take samples of raw water and to vent water before opening the strainer.
3	FEED VALVE - V14	This valve is used to control the flow of water during media filter backwash. Also closed before changing the strainer basket.
4	MEDIA FILTER OUTLET SAMPLE VALVE - V33	This valve is used to take water samples after the media filter.
5	MEDIA FILTER VENT VALVE - V19	This manual valve is opened when the system is first started. It allows air to be released from the media filter.
6	MEDIA FILTER UPPER DRAIN VALVE - V25	This valve is used to help drain the filter for secured shutdowns. May also be used to establish proper water level for first backwash step.
7	(DELETED)	
8	MEDIA FILTER LOWER DRAIN VALVE - V24	This manual valve is used to drain the media filer for secured shutdowns.
9	CARTRIDGE FILTER BLOCK VALVE - V37	This manual valve is closed before opening the cartridge filter to remove and replace the filter cartridges.
10	CARTRIDGE FILTER DRAIN VALVE - V39	This manual valve is used to drain cartridge filter for secured shutdowns and whenever the cartridge filters are being replaced.
11	CARTRIDGE FILTER VENT VALVE - V38	This manual valve is opened when the system is first started. It allows air to be released from the cartridge filter. This valve must always be opened to relieve any pressure before removing filter top for maintenance.
12	PIPING DRAIN VALVE - V40	This valve is opened when securing the ROWPU.
13	CARTRIDGE FILTER OUTLET SAMPLE VALVE - V41	This valve is used to take water samples after water passes through the cartridge filter. Monitoring of samples from this point is routine.
14	CLEANING BYPASS VALVE - V13	This manual valve is opened to bypass the media filter when cleaning the RO elements.
15	SYSTEM PRESSURE CONTROL VALVE - V51	This manual valve controls the feedwater pressure to the RO elements. It should be fully closed during start-up.
16	PRODUCT (WATER SAMPLE) TOP WALL VESSEL - V54	Items 16 thru 19 allow the product water from each of the four RO vessels to be sampled for water quality (TDS).
17	PRODUCT (WATER SAMPLE) TOP AISLE VESSEL - V55	
18	PRODUCT (WATER SAMPLE) BOTTOM WALL VESSEL - V56	
19	PRODUCT (WATER SAMPLE) BOTTOM AISLE VESSEL - V57	

Table 2-5. Manual Water Valves (Continued)
(Item numbers are keyed to Figure 2-6)

Item	Control/Indicator	Function
20	COMBINED PRODUCT SAMPLE - V59	This manual valve provides a combined product water sample, as delivered to the storage tanks.
21	PRODUCT UTILITY HOSE VALVE - V10	This manual valve controls product water flow from the utility hose.
22	HIGH PRESSURE PUMP HEAD DRAINS - V43	Open these six high pressure pump drain valves when securing the ROWPU.
23	CLEAN RETURN VALVE - V50	This manual valve is opened during cleaning procedures. It is normally closed.
24	CLEAN/FLUSH TANK FILL - V52	This manual valve is used to fill the clean/flush tank with water filtered by the cartridge filter before back washing the media filter. Normally closed.
25	CLEAN/FLUSH TANK DRAIN VALVE - V4	This valve is used to drain the clean/flush tank.
26	NBC FILTER DRAIN - V95	This manual valve is used to drain the NBC filter when securing the ROWPU during an NBC mission or prior to removing the media from the filter Normally closed.
27	NBC FILTER VENT - V94	This manual valve is opened to vent the NBC filter during initial start-up of the filter.
28	NBC MEDIA BLOWOUT VALVE - V97	This valve is opened to flush out spent NBC media. Normally closed.
29	H.P. HEAD DRAIN - V44	This high pressure pump drain valve is opened when securing the ROWPU. Normally closed.
30	PRODUCT DRAIN VALVES - V48	These four valves are normally dosed.
31	WASTE DRAIN VALVES - V49	These three valves are normally closed.
32	(DELETED)	
33	(DELETED)	
34	(DELETED)	
35	(DELETED)	
36	HIGH PRESSURE PUMP SUCTION VENT	Open this valve when draining ROWPU for secured shutdown.
37	HIGH PRESSURE PUMP DISCHARGE VENT	Open this valve when draining ROWPU for secured shutdown.
38	PRODUCT VENT	Open this valve when draining product water piping.
39	HIGH PRESSURE/PIPING DRAIN VALVE/PULSE DAMPENER	Open when securing for long term shutdown Normally closed.
40	AIR BLANKET LEVEL INDICATOR DRAIN VALVE	Open during media filter drain down or when securing for long term shutdown. Normally closed.
41	DUAL STRAINER SELECTION VALVES	Used to select which of the dual strainers will be placed into use. (MODEL ROWPU-1 ONLY)
42	PRESSURE GAGE DRAIN VALVES	Opened to drain water from gages to prevent gages from freezing for secured shutdown. (MODEL ROWPU-1 ONLY)

e. *Manual Chemical Controls*. The manual chemical valves are shown in Figure 2-7 and listed in Table 2-6.

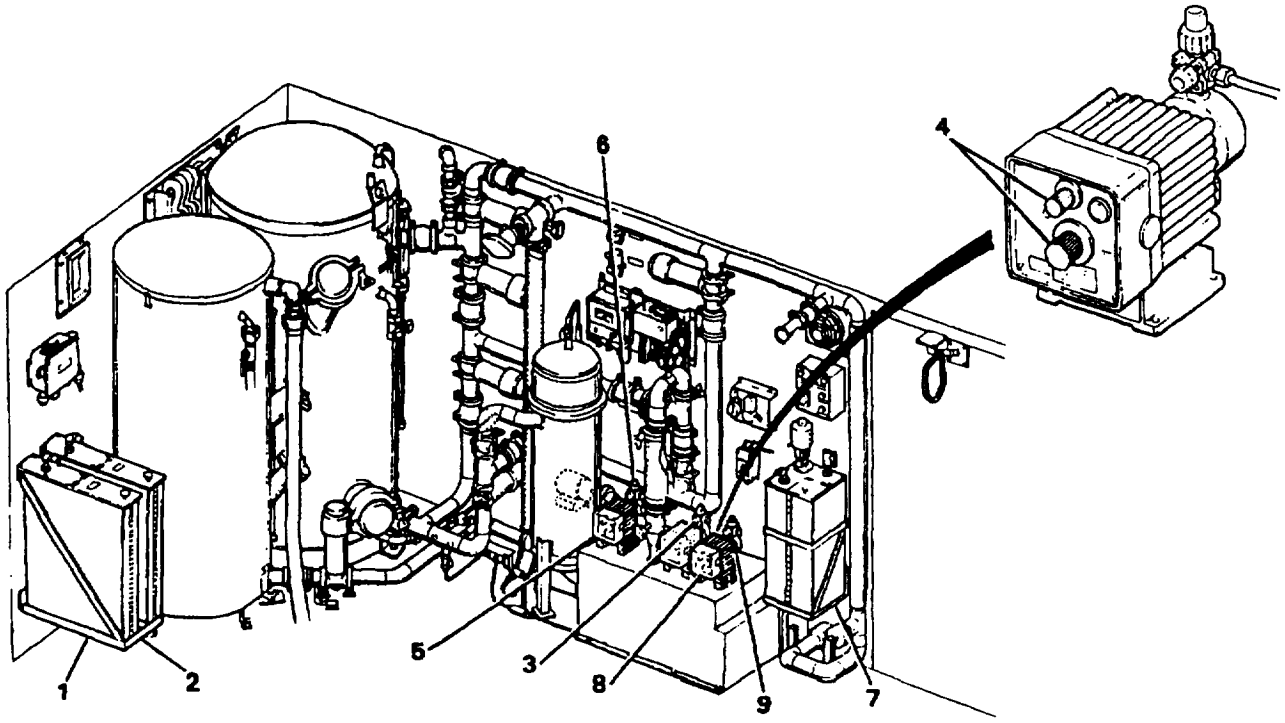


Figure 2-7. Manual Chemical Controls

Table 2-6. Manual Chemical Controls
(Item numbers are keyed to Figure 2-7)

Item	Control/Indicator	Function
1	POLYELECTROLYTE TANK DRAIN VALVE - V6	This manual valve is opened to drain the tank when securing the ROWPU.
2	SEQUESTRANT TANK DRAIN VALVE - V30	This manual valve is opened to drain the tank when securing the ROWPU.
3	POLYELECTROLYTE PUMP LIQUID HANDLING ASSEMBLY	Pressure relief knobs are pulled open to prime the pump.
4	POLYELECTROLYTE PUMP STROKE AND SPEED CONTROLS	These controls are adjusted to provide the pump setting giving the best turbidity reduction.
5	SEQUESTRANT PUMP STROKE AND SPEED CONTROLS	These controls are set at fixed settings to pump one gallon/hour. (They look the same as item 4.)
6	SEQUESTRANT PUMP LIQUID HANDLING ASSEMBLY	Pressure relief knobs are pulled open to prime the pump.
7	HYPOCHLORITE TANK DRAIN VALVE - V53	Open to drain the hypochlorite tank. Normally closed.
8	PRODUCT HYPOCHLORITE STROKE AND SPEED CONTROLS	These are adjusted to provide the pump setting to give the required potable water chlorine level. (They look the same as item 4.)
9	HYPOCHLORITE PUMP LIQUID HANDLING ASSEMBLY	Pressure relief knobs are pulled out to prime the pump.

f. *Air Supply Controls and Indicators*. The air supply controls and indicators are shown in Figure 2-8 and listed in Table 2-7.

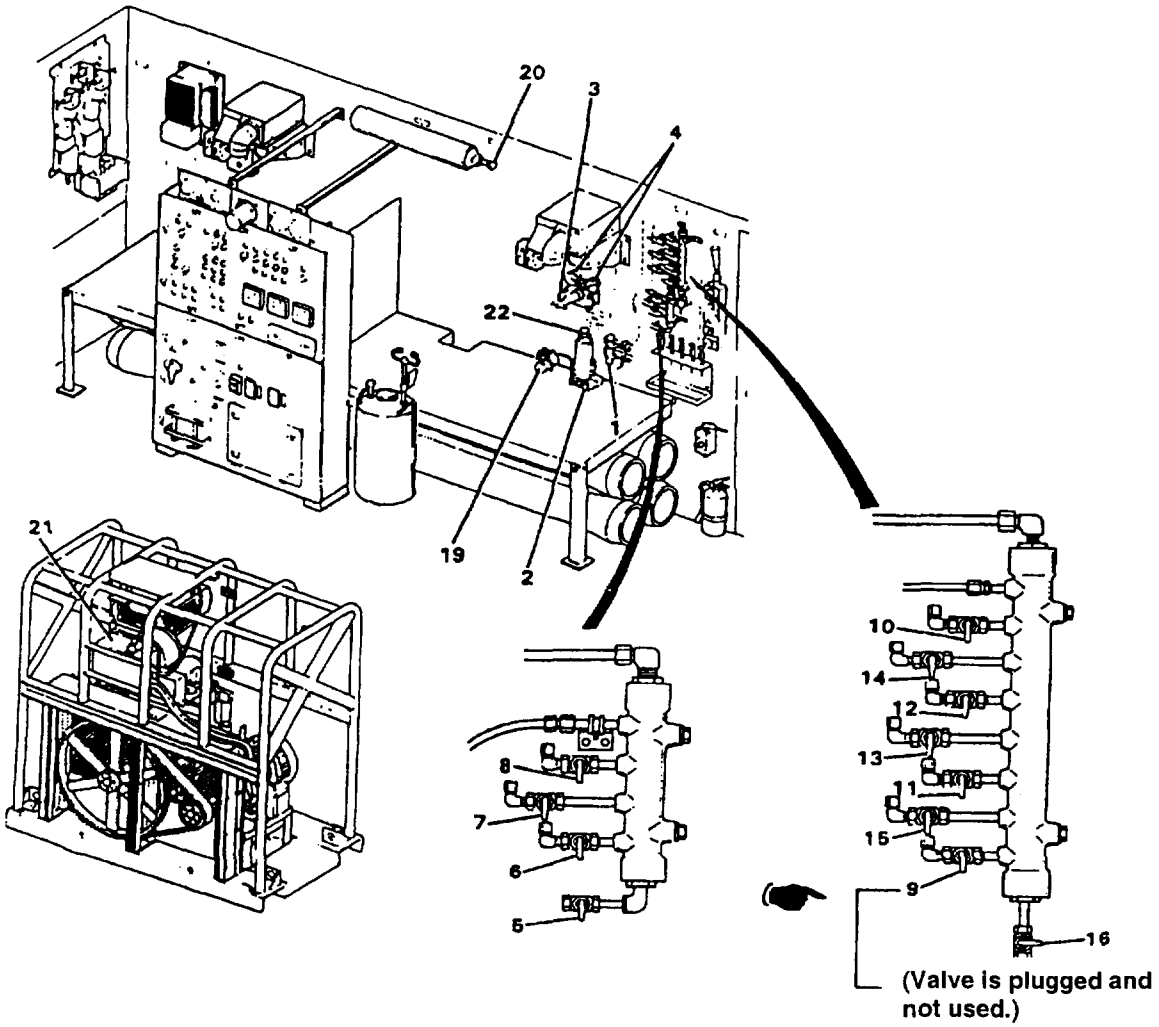


Figure 2-8. Air Supply Controls and Indicators

Table 2-7. Air Supply Controls and Indicators
(Item numbers are keyed to Figure 2-8)

Item	Control/Indicator	Function
1	AIR DRYER DRAIN VALVE - V79	This valve is manually opened to drain built up water from the low pressure air dryer.
2	AIR MANUAL BLOWDOWN VALVE - V69	Normally closed, this valve is opened to bleed pressure before changing filter.
3	LOW PRESSURE REGULATOR - V77	This regulator is adjusted as needed to obtain 85 psig (586 kPa) service air pressure.
4	AIR SYSTEM REGULATOR GAGES	These gages show air tank and air manifold air pressure.

Table 2-7. Air Supply Controls and Indicators (Continued)
(Item numbers are keyed to Figure 2-8)

Item	Control/Indicator	Function
5	MANIFOLD BLEED VALVE - V93	This valve is opened to bleed built up water from the manifold. It is normally closed.
6	AIR PURGE (V18) BLOCK VALVE - V91	This valve is opened to purge the media filter of water during cold weather secured shutdown. This valve is normally closed.
7	BACKWASH AIR (V22) BLOCK VALVE - V90	This valve is closed to shut off the air supply to the automatic backwash air supply valve (V22). This valve is open for normal operation.
8	AIR BLANKET (V20) BLOCK VALVE - V89	This valve is closed to shut off the air supply to the air blanket valve (V20). It is normally open.
9	(NOT USED)	This valve is plugged and not used.
10	MEDIA FILTER FLUSH (V36) BLOCK VALVE - V85	This valve is closed to shut off the air supply to the automatic air-operated media filter flush valve (V36). It is normally open.
11	MEDIA FILTER OUTLET (V35) BLOCK VALVE - V84	This valve is closed to shut off the air supply to the automatic air-operated media filter outlet valve (V35). This valve is open for normal operation.
12	MEDIA FILTER BW OUTLET (V17) BLOCK VALVE - V83	This valve is closed to shut off the air supply to the automatic air-operated media filter backwash water outlet valve (V17). This valve is open for normal operation.
13	MEDIA FILTER INLET (V16) BLOCK VALVE - V82	This valve is closed to shut off the air supply to the automatic air-operated media filter upper inlet valve (V16). This valve is open for normal operation.
14	MEDIA FILTER BW INLET (V15) BLOCK VALVE - V81	This valve is closed to shut off the air supply to the automatic air-operated media filter backwash inlet valve (V15).This valve is open during normal operation.
15	CLEAN/FLUSH OUTLET (V5) BLOCK VALVE - V80	This valve shuts off air to the clean/flush tank automatic air-operated valve (V5). This block valve is normally open.
16	MANIFOLD BLEED VALVE - V87	This valve is opened to bleed off air pressure for maintenance and before transport. It is normally closed.
17	(DELETED)	
18	(DELETED)	
19	HIGH PRESSURE AIR AUTO BLOWDOWN BLOCK - V67	Normally open. Used as back-up to automatic valve if valve fails to shut-off tight.
20	AIR STORAGE VALVE - V72	Shuts off air from the reservoir tank.
21	AIR COMPRESSOR BLEED VALVE	Open this valve to bleed off air pressure and accumulated water for secured shutdown.
22	OUTLET FILTER VENT	Normally closed (turned fully clockwise when closed).

g. *Oil Drain Plugs, Level Indicators and Valves.* The oil drain plugs, level indicators and valves are shown in Figure 2-9 and listed in Table 2-8.

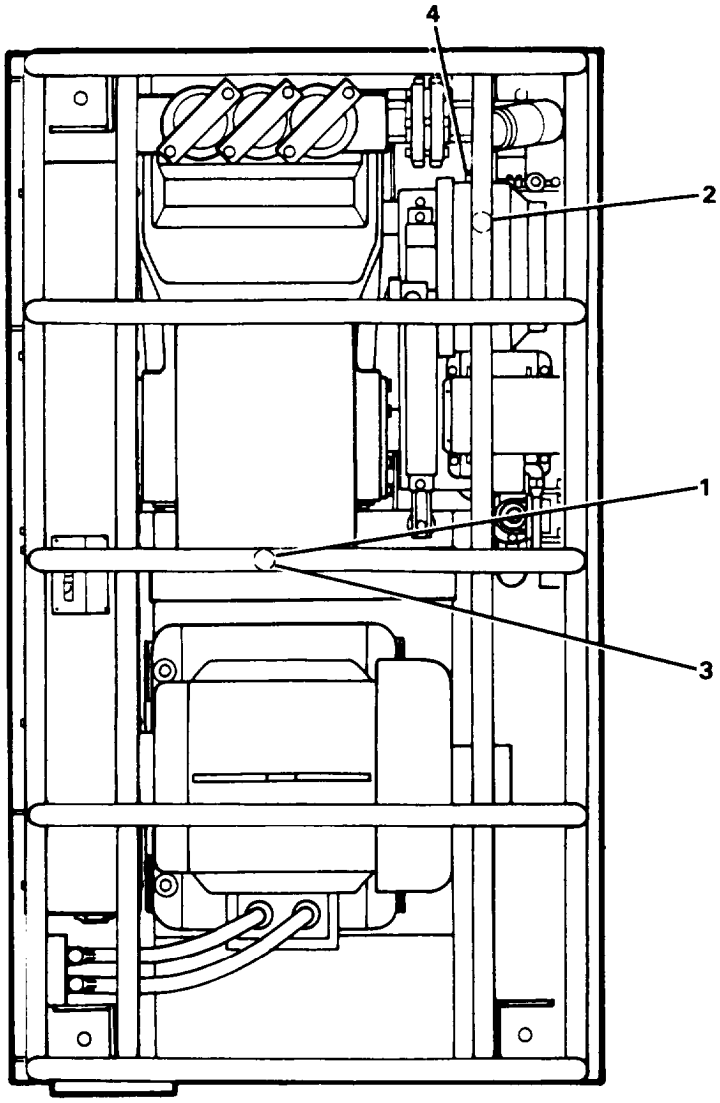


Figure 2-9. Oil Drain Plugs, Level Indicators and Valves

Table 2-8. Oil Drain Plugs, Level Indicators and Valves
(Item numbers are keyed to Figure 2-9)

Item	Control or Indicator	Function
1	HIGH PRESSURE PUMP OIL LEVEL INDICATOR	Sight gage for high pressure pump oil level check
2	AIR COMPRESSOR OIL LEVEL INDICATOR	Dipstick for compressor oil level check.
3	HIGH PRESSURE PUMP OIL DRAIN	Drains oil for oil change.
4	AIR COMPRESSOR OIL DRAIN	Drains oil for oil change.

h. *Diesel Heater and Carbon Monoxide Monitor Controls*. Each diesel fuel heater is equipped with a fuel pump and fuel filter. The heater and carbon monoxide monitor controls and indicators are shown on Figure 2-10 and listed In Table 2-9. The HEATER POWER SUPPLY ON/OFF switch is item 58 on Table 2-3.

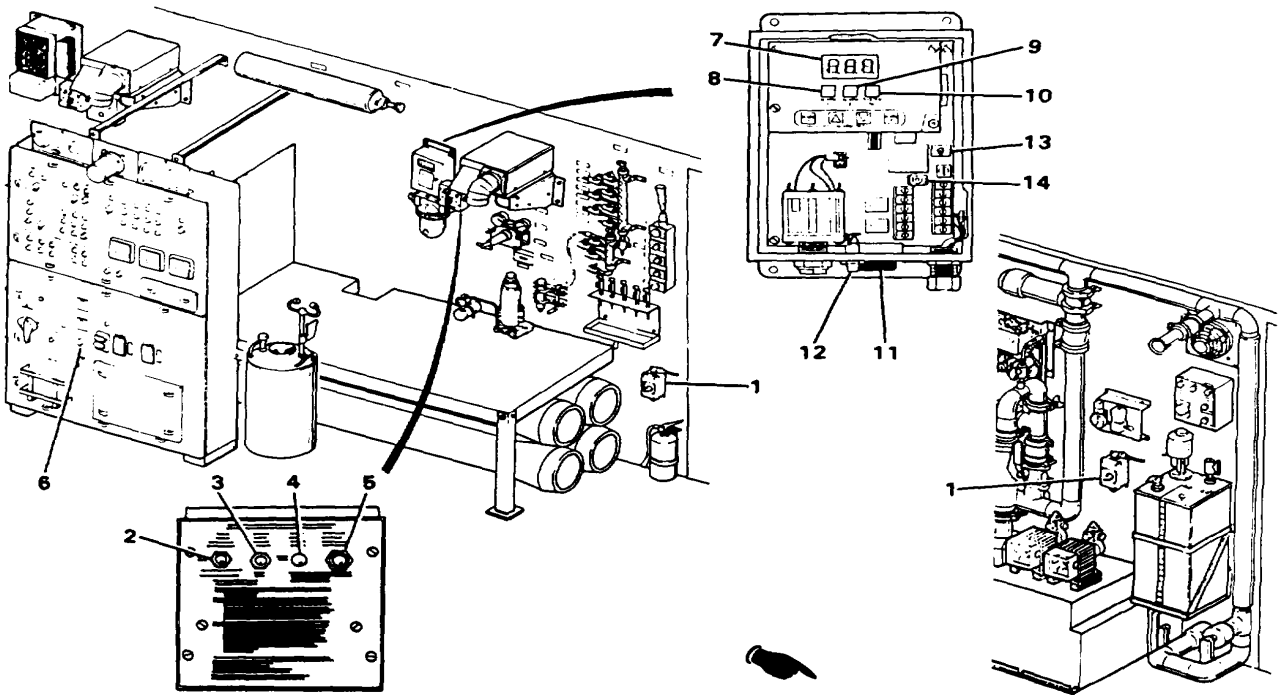


Figure 2-10, Diesel Heater Controls (Sheet 1 of 2)
(MODEL WTA'O ONLY)n

Table 2-9. Diesel Heater Controls (Item numbers are keyed to Figure 2-10)

Item	Control/Indicator	Function
1	THERMOSTATS	The thermostat dials can be set for proper temperature level within the ISO container Each thermostat controls one heater.
2	AUX	Operates preheater or fan only; OFF in down position.
3	MAIN	Turns heater on START, RUN, or OFF Controls fuel flow to heater.
4	HTR OPER	Green light indicates when heater is running.
5	CIRCUIT BREAKER	Press after power interruption or overheating automatic shut-down of heater.
6	HEATER POWER SUPPLY ON/OFF	Controls 120 VAC power supply for heater.
7	MAIN DISPLAY	Digital read out of concentration of carbon monoxide sensed by the carbon monoxide (CO) monitor.
8	ALARM 1 INDICATOR	Yellow indicator that lights up when carbon monoxide level in the van exceeds 25 ppm.
9	ALARM 2 INDICATOR	Red indicator that lights up when carbon monoxide is over 50 ppm.
10	SYSTEM OK	Green indicator that remains lit when system is functioning prop-erly.
11	AUDIO ALARM	Sounds whenever level of carbon monoxide exceeds 25 ppm or system failure occurs.
12	ALARM RESET	Silences audio alarm when pressed and resets system after fault.
13	POWER ON/OFF	Turn CO monitor on and off, used during troubleshooting.
14	AC CIRCUIT BREAKER	Circuit breaker for monitor, used during troubleshooting.

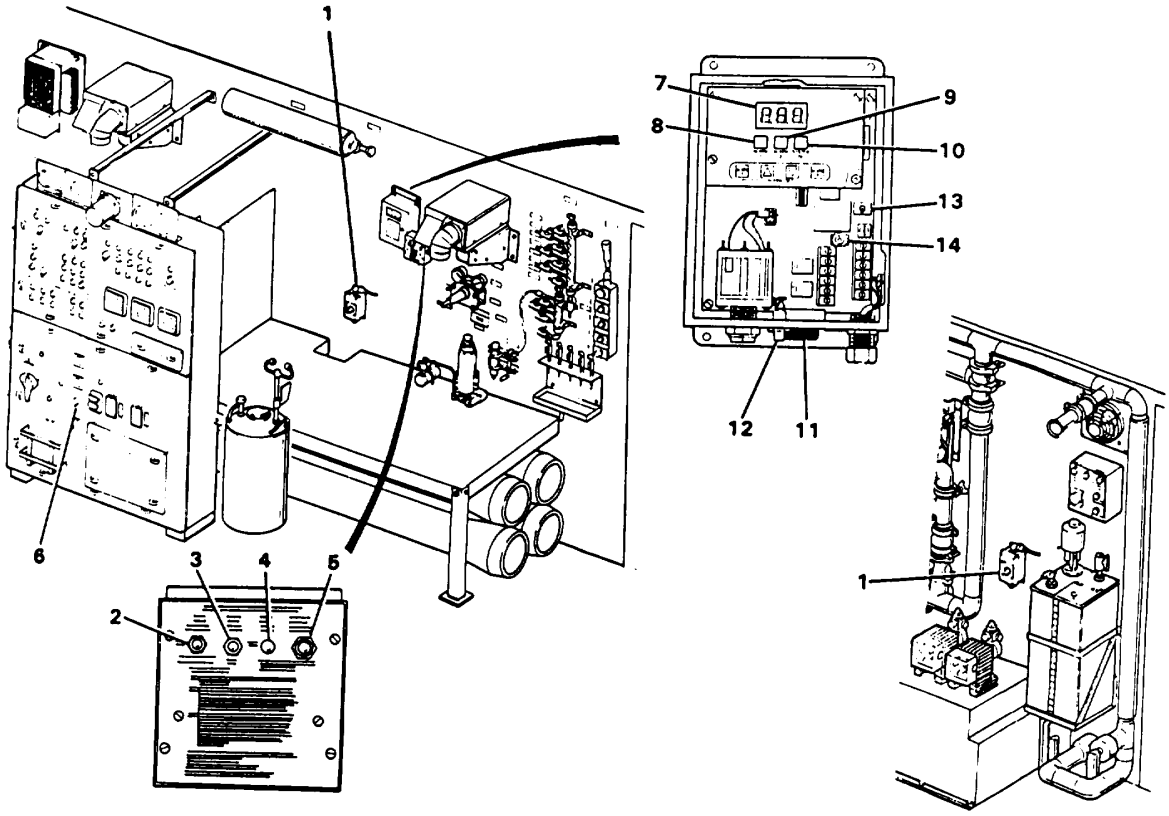


Figure 2-10. Diesel Heater Controls (Sheet 2 of 2)

(MODEL ROWPU-1 ONLY)

2-4. Potable Water Distribution System Controls and Indicators

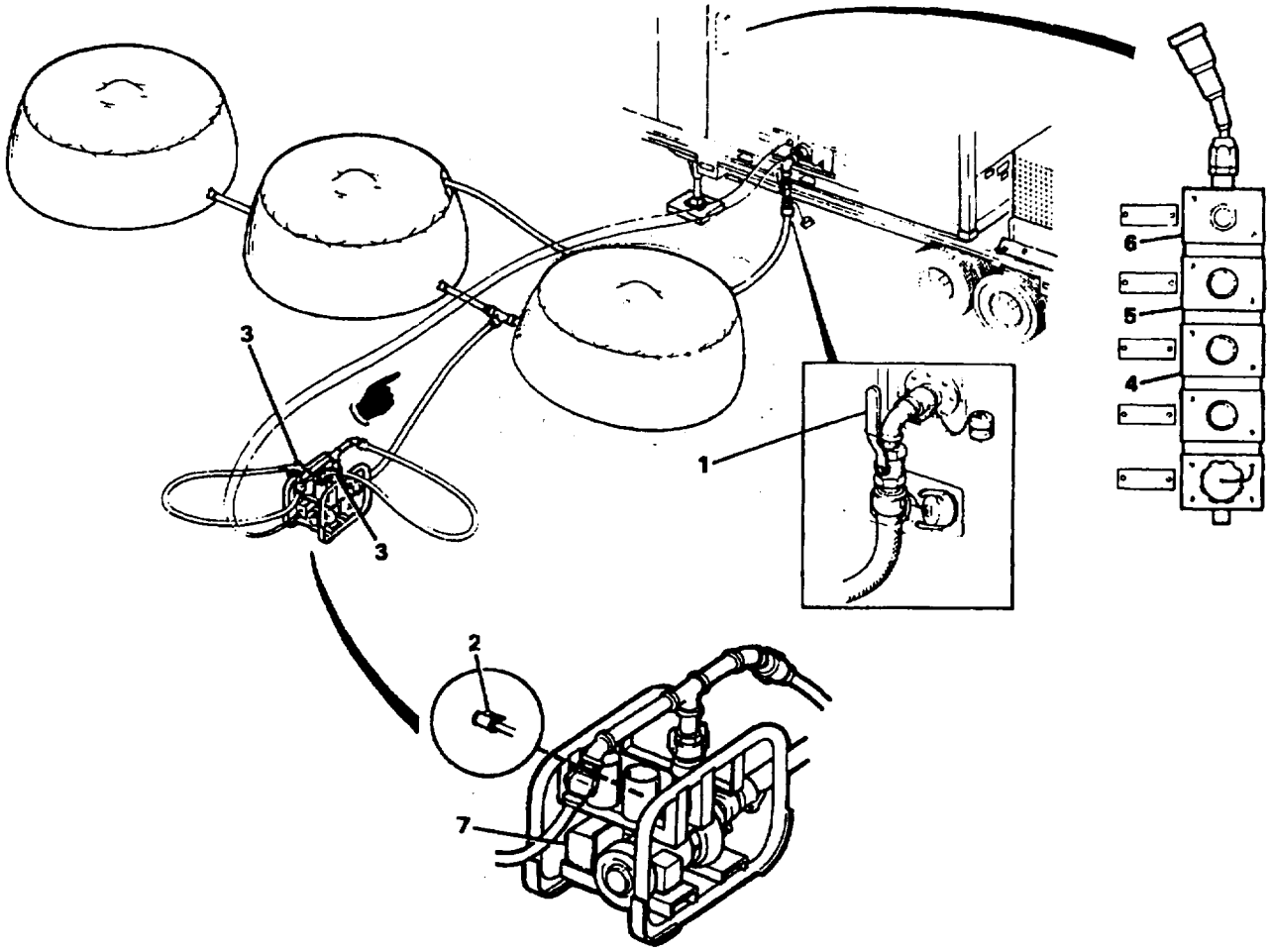


Figure 2-11. Potable Water Distribution System Controls and Indicators

Table 2-10. Potable Water Distribution System Controls and Indicators
(Item numbers are keyed to Figure 2-11)

Item	Control/Indicator	Function
1	PRODUCT SHUT-OFF VALVE - V64	This manual valve is opened during operation.
2	DISTRIBUTION PUMP DRAIN VALVE - V66	This manual valve is used to drain the distribution pump.
3	DISPENSING NOZZLE - V65	These nozzles are used for filling user tanks.
4	DISTRIBUTION PUMP OFF	Pushbutton to turn distribution pump OFF.
5	DISTRIBUTION PUMP ON	Pushbutton to turn distribution pump ON.
6	DISTRIBUTION PUMP POWER ON	Pilot light glows when distribution pump has control system power
7	DISTRIBUTION PUMP ON/OFF SWITCH	Selector switch at pump to allow operation at pump when pushbutton (item 4) is ON.

All data on pages 2-20 thru 2-23 deleted. ■

2-5. Differential Gages

Differential Pressure Gages (Figure 2-15)

(1) There are two needles and two dials on each gage. They are used to read the inlet and outlet pressure on the media filter and cartridge filter.

(2) The outer dial (1) indicates the actual pressure each filter is working at. The inner dial (2) indicates the difference (or differential pressure) from the inlet to the outlet of each filter.

(3) The black needle (3) shows the pressure going into the filer and the red needle (4) shows the pressure after the filter. Both pressures are read on the outer dial (1).

NOTE
The further apart the red and black needles are, the dirtier the filters.

(4) There are two ways to obtain the differential pressure; subtract the red needle pressure from the black needle pressure (as read on the outer dial) or read the inner dial differential pressure under the black needle. Either way will allow the correct differential pressure to be obtained.

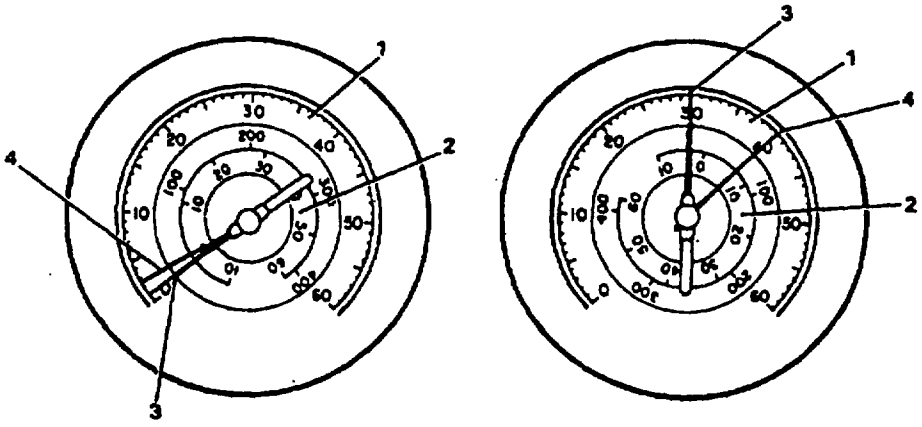


Figure 2-15. Differential Pressure Gages

2-6. PORTABLE TURBIDITY METER (Figure 2-16).

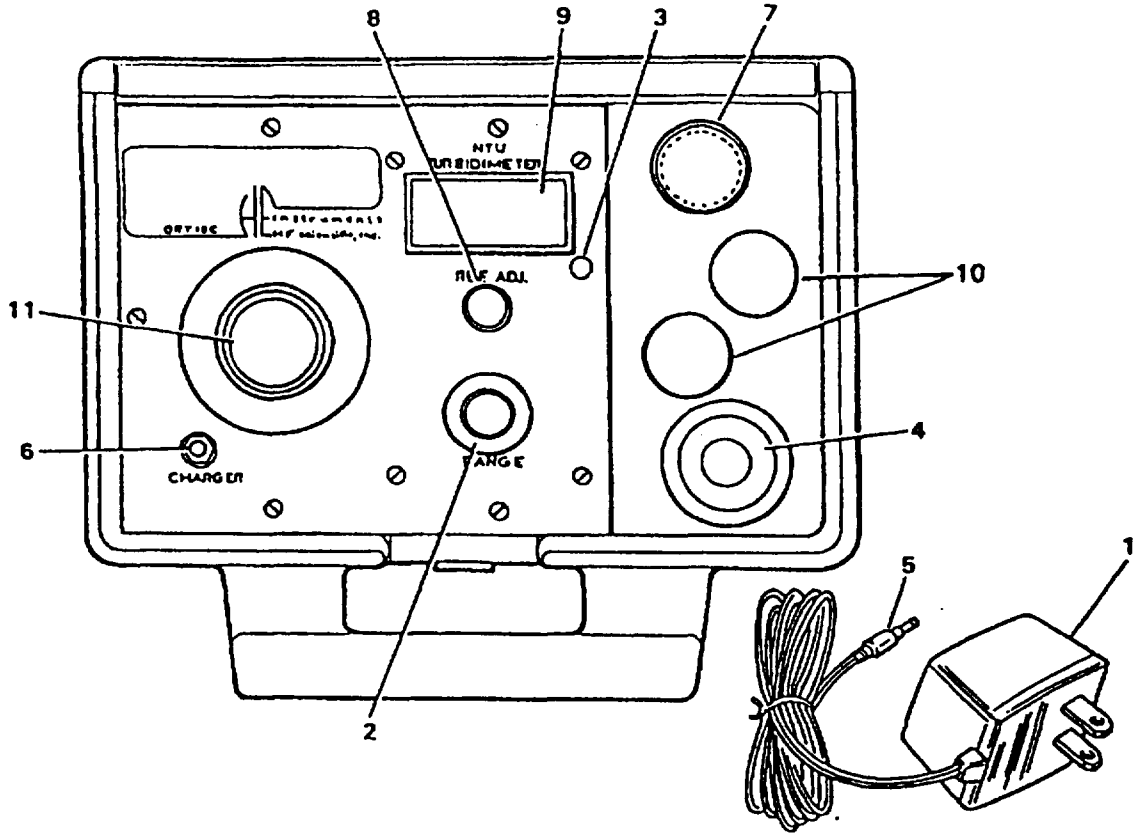


Figure 2-16. Portable Turbidity Meter (MODEL ROWPU-1 ONLY)

a. *General*. The portable (hand-held) turbidity meter is a rechargeable battery powered digital instrument which is used to measure raw water turbidity and turbidity at sample points (valves) in the water purification process. It is used whenever turbidity readings are required or when the in-line turbidity meter is not operating.

b. *Pre-Operational Check Out.*

CAUTION

Extra care should be taken when handling reference standard or sample cuvettes (Figure 2-13). Surface scratches or finger smudges will cause analysis errors. Handle these items by the top only.

NOTE

The instrument is to be connected to the battery charger and the charger is to be kept on whenever the ROWPU is operated. The turbidity meter is to be operated only when readings are required.

(1) With the instrument not connected to the battery charger (1), turn range selector switch (2) to any range position in order to observe condition of battery. When charged, the red low battery light (3) will be OFF. If light is on, battery should be charged overnight before using instrument on battery.

NOTE

New batteries usually require several cycles of discharging and recharging in order to obtain maximum life between charges.

(2) The instrument may be operated on a rechargeable battery. The unit does not require any warm-up time before taking readings. Turn unit OFF between readings for longer battery life between recharges.

NOTE
The turbidity meter provides up to 4-1/2 hours of constant operation as a portable, battery-operated unit between charges.

(3) The instrument may be operated while battery charger is being used.

c. *Adjustment Prior to Use.* Operating adjustment is checked by the operator each time unit is used. This is a minor adjustment and is checked as follows:

CAUTION
Fingerprints, grease, dirt and water on the reference standard will cause incorrect readings

(1) Remove reference standard (7) (0.2 NTU) from case and carefully wipe clean.

(2) Remove black light shield (4). Place reference standard in optical well (11). Place black light shield over well.

(3) Set range selector (2) to 20.

(4) Adjust reference adjust knob (8) until meter (9) reads 0.10. Unit is now ready for use in all ranges.

d. *Use of Meter.* To make a measurement of a sample use the following procedure:

CAUTION
If instrument has been in cold temperatures [below 10°C (50°F)] and brought indoors it should be allowed to warm up before use, since condensation may form on lenses. Leaving case open and the instrument ON for 30 minutes will help it warm up faster.

NOTE
Make sure the inside of the cuvette is clean.

(1) Clean one of the cuvettes (10) by rinsing several times with the water to be tested.

(2) Fill cuvette to top. Replace cap.

CAUTION
Be careful not to scratch cuvette.

(3) Wipe cuvette clean and dry.

(4) Rotate cuvette to remove all air bubbles.

(5) Remove black light shield. Place cuvette in well (11) with light shield (4) over the cuvette.

(6) Set the range setting to lowest setting where the indicator stays within scale. Record reading after reading stops changing.

NOTE
Critical measuring area of sample cuvettes is the 3/4 in. band starting 5/8 in. above bottom. Keep this area clean and free of scratches. Handle by top part above band only as shown in Figure 2-13

NOTE
Moisture may form on cuvette sides. This results in an incorrect high reading. If noted, wipe again and repeat measurement.

e. *Meter Care.* Portable turbidity meter should not be serviced in the field. Any major problems should be taken care of by maintenance personnel. Keep instrument clean and dry. Do not drop instrument.

2-7. PORTABLE TDS METER (Figure 2-17).

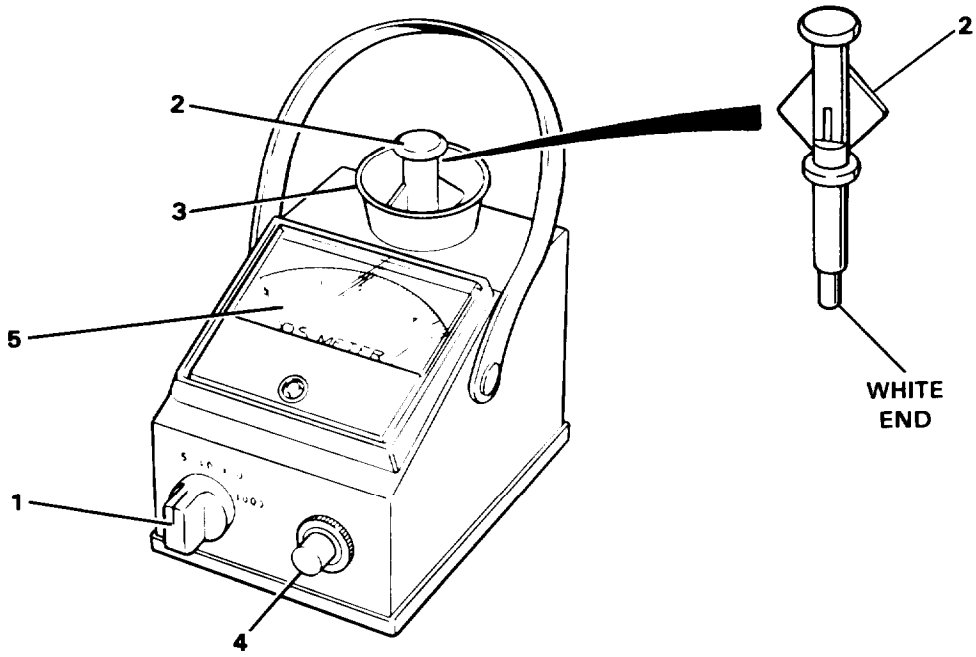


Figure 2-17. Portable TDS Mater

a. *Purpose and Function.*

(1) The portable TDS meter is a portable, hand-held meter used to measure total dissolved solids at water sampling points. This unit is used to check the in-line TDS meter (para. 2-5b). It allows measuring TDS from each RO vessel.

(2) The portable TDS meter is read in parts per million (ppm) dissolved solids.

(3) The portable TDS meter is equipped with a scale (5) and range selector (1). Table 2-12 shows range selector settings, scale readings, and when each is used.

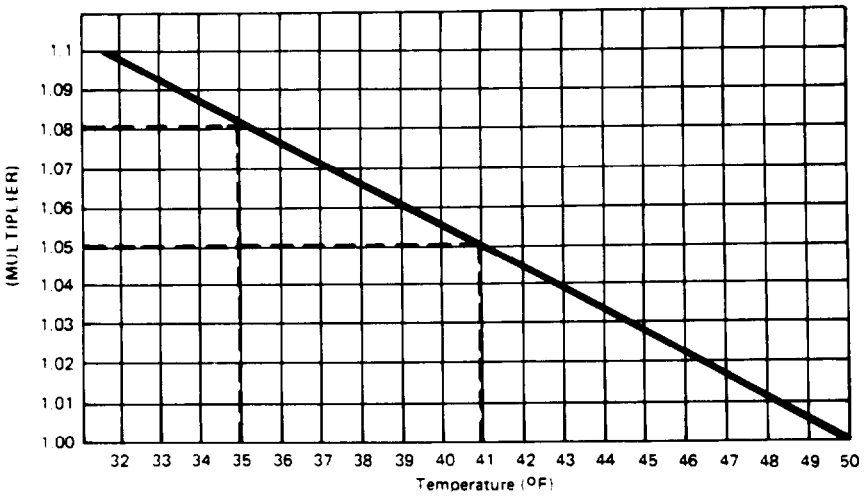
Table 2-11. Range Selector

Range Selector Setting	Each Scale Line (ppm)	When Used
S		To find internal standard reading.
10	1	Product from river and lake water.
100	10	Raw rivers and lake water or product from river and lake water.
1,000	100	Raw rivers and lake water or product from sea water.
10,000*	1,000	Raw sea water.

*RANGE EXTENDER (2) must be used.

(4) The TDS meter is designed for use with water temperatures of 50°F (10°C) and above. If water being tested is below 50°F, then reading obtained must be adjusted. Use water temperature along base of graph (Table 2-12)toobtain the multiplier on the left side of the graph. Multiply reading by the multiplier obtained to correct the reading for temperature. (Example: 35°F = 1.08 multiplier, 41°F = 1.05 multiplier.)

Table 2-12. TDS Temperature Graph



b. *Pre-Operation Check Out.*

(1) Before operating TDS meter make sure cell cup (3) is clean.

CAUTION

If internal standard reading cannot be obtained by the methods below, including battery change, do not use the unit.

NOTE

The internal standard will vary from meter to meter.

(2) TDS meter should read the same as the internal standard reading (1, Figure 2-18) stamped on back of meter.

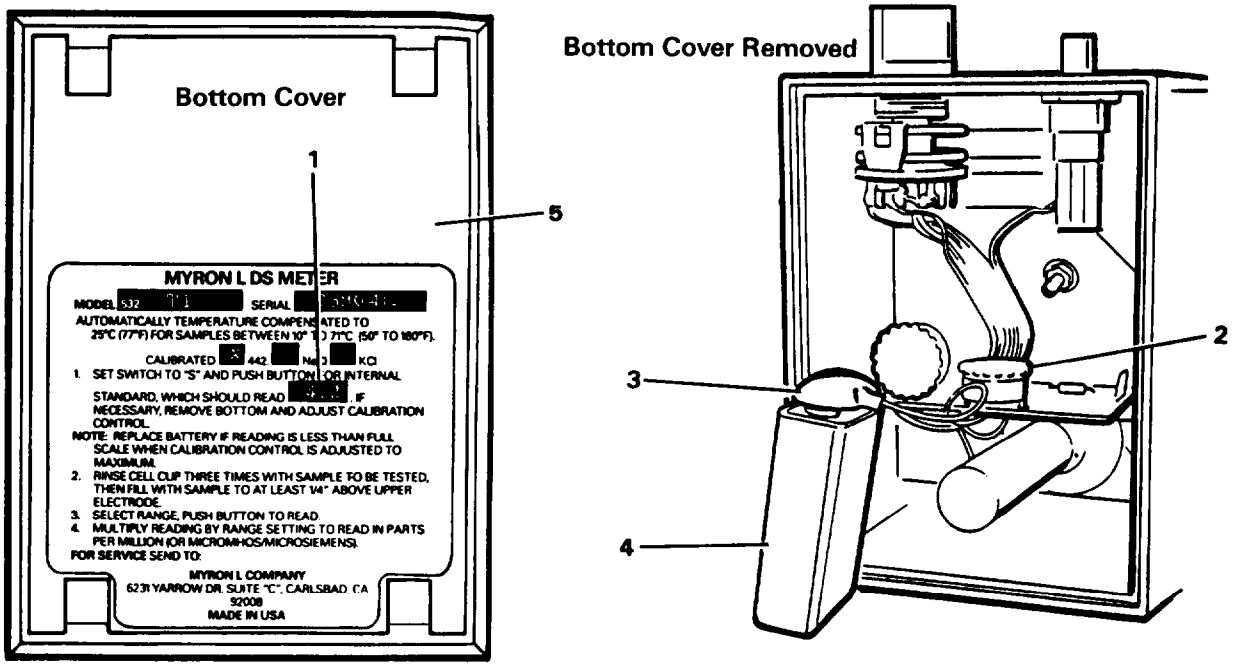


Figure 2-18. Bottom View of Portable TDS Meter

(3) Check internal standard reading before using TDS meter as follows:

(a) Turn TDS meter upside down and note internal standard reading stamped number(1).

(b) Set range selector (1, Figure 2-17) to S.

(c) Push button (4) to right of range selector and note reading. For this check each line on the scale is 0.1. Unit is now internally calibrated and ready to use.

(4) At times the internal standard reading may differ from the stamped number on bottom of unit. If this occurs use the following procedures.

(a) Turn TDS meter upside down.

(b) Unsnap bottom plastic cover (5) and note position of adjusting wheel (2, Figure 2-18).

(c) Turn unit right side up. Hold TDS meter in one hand.

(d) Push button (4, Figure 2-17).

(e) Turn adjusting wheel (2, Figure 2-18) until correct internal standard reading is obtained.

NOTE

Disconnect cable (3) and replace battery (4) if reading is less than internal standard at maximum setting of the adjusting wheel.

(f) Replace bottom cover. Meter is now ready to use.

c. *Adjustment of Meter Extender (Figure 2-17).* When using range extender with the unit use the following adjustment steps:

NOTE

When using TDS meter without range extender no further adjustment is needed.

(1) Fill cell cup (3) halfway with product water. Fill the rest of the way with water to be tested.

(2) Set range selector (1) to 1000, push button and note meter reading.

NOTE

Diluted water should be between 1000-4000 ppm

(3) Insert range extender (2) into cell cup and push down until it snaps in place.

(4) Set range selector to 100 and push button (4). Reading should be the same as previous reading.

(5) If reading is high, remove range extender and push the white end in slightly. If reading is low, push white end out slightly. Reinstall extender. Repeat reading. Repeat Steps 1, 2, 3 and *4* as needed until the readings are the same.

d. *Use of Meter.*

(1) Testing without range extender:

(a) Rinse cell cup several times with water to be tested.

(b) Fill cell cup slowly until water is about 3/8 in. from top.

(c) Set range selector to 1000.

(d) Push button and read scale. If reading is less than 500 ppm, set range selector to 100 and read scale. If reading is less than 50 ppm, set range selector to 10 and read.

NOTE

If range selector is set to 1000 and meter needle travels to 5000, the RANGE EXTENDER is required for an accurate reading.

(2) Testing with range extender:

(a) Rinse cell cup and extender several times with water to be tested.

(b) Fill cell cup slowly until water is about 3/8 in. from the top.

(c) Insert range extender and push down until it snaps in place.

(d) Set range selector to 1000.

(e) Push button and read. Scale is 0 to 50,000 ppm. Each line is 1000 ppm. Be sure to use temperature correction Table 2-12 if water temperature is less than 50°F (10°C).

e. *TDS Meter Care.*

(1) Keep TDS meter clean and dry when not in use.

CAUTION

Do not submerse meter in water. Do not get meter body or face wet when taking samples.

CAUTION

If TDS meter does not work properly after installation of new battery, replace meter.

(2) If the meter reading is less than internal standard at maximum setting of appropriate adjusting wheel, the battery may need to be changed. See Figure 2-18 and use the following procedure:

(a) Turn TDS meter upside down and remove bottom cover.

(b) Note position of battery (4) and battery cable (5).

CAUTION

Do not use mercury or alkaline batteries. Use of these batteries will cause inaccurate readings. Refer to Appendix E for correct battery.

(c) Install a nine volt transistor battery to battery connector.

(d) Replace back of instrument.

2-8. **COLOR TEST KIT (Figure 2-19).** This test kit is used to check the color of the raw water at each new operating site when the turbidity is less than 8 NTU, See paragraph 2-15.

WARNING

Avoid prolonged or repeated skin contact with the color solution. Wash with soap and water. In the event of eye contact, wash eyes for 15 minutes using the eyewash.

a. *General.* This test is made by comparing the color of a measured amount of the raw water with an identical amount of color-free potable water to which an accurately measured amount of standardized color solution has been added. The readings are made by looking down through the column of liquid.

b. *Procedure,* Use of color test kit.

(1) Fill a cup with raw water and let it sit for 15 minutes. Then slowly fill one color column to the top mark with the raw water to be tested.

(2) Fill second column with potable water.

(3) Place the two columns side by side and note the difference of color.

NOTE

Keep track of how many times the color solution has been added to the potable water column.

(4) Use the eye dropper and draw color solution up to the 0.5 ml line. Add the color solution to the potable water column. Mix contents by shaking with thumb over open top of column.

(5) Look down through both columns and compare. If the color in the raw water column is greater than the potable water column, repeat step (4), If not, proceed to step (6).

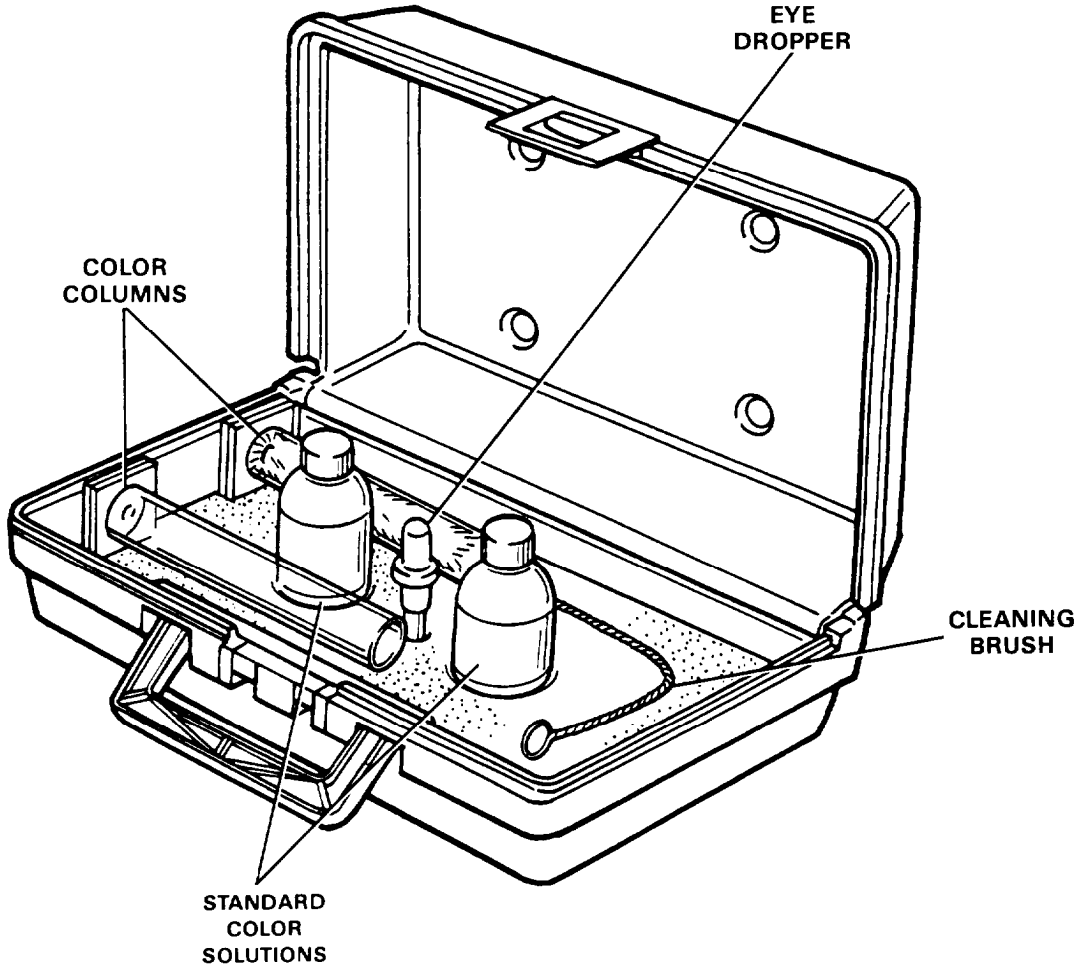


Figure 2-19. Color Test Kit

(6) Determine the raw water color.

Number of 0.5 ml Additions	Total Volume of Addition (ml)	Color Level	Number of 0.5 ml Additions	Total Volume of Addition (ml)	Color Level
1	0.5	5	6	3.0	30
2	1.0	10	7	3.5	35
3	1.5	15	8	4.0	40
4	2.0	20	9	4.5	45
5	2.5	25	10	5.0	50

(7) Rinse and dry both columns with potable water.

c. *Color Test Kit Care.*

(1) Replace color columns if broken.

(2) Replace color solution as needed.

(3) Use cleaning brush to clean color columns as needed.

2-9. AVAILABLE CHLORINE COLOR COMPARATOR TEST KIT (Figure 2-20). This test is used to check amount of available chlorine, in parts per million (ppm), in potable (drinkable) water in storage (distribution) tanks. This test also determines if the final water reaching reverse osmosis (RO) elements has been dechlorinated.

WARNING

Wear gloves. Chemicals contained in this kit may be hazardous. If chemical gets on skin wash with plenty of soap and water.

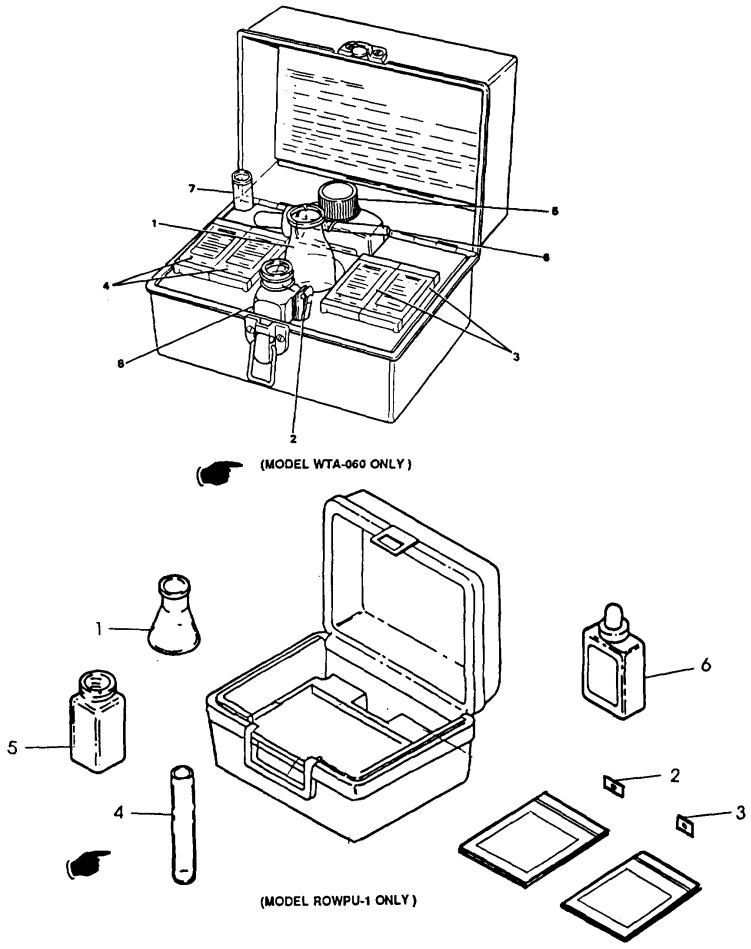


Figure 2-20. Chlorine Color Comparator Test Kit

a. Model WTA-060 Chlorine Test Kit Procedures.

(1) Low Range Available Chlorine. Use this test when checking raw water for chlorine.

(a) Fill Flask (1) to the 40 ml mark with water to be tested.
(b) Use clippers (2) to open one sulfite 1 reagent powder pillow (3). Add contents of pillow to flask. Swirl the flask to mix.
(c) Use clippers to open one sulfamic acid reagent powder pillow (4). Add contents of pillow to flask. Swirl flask to mix. This is the prepared sample.

NOTE

A blue color will develop after the addition of the sulfamic acid if chlorine is present.

(d) Pour off contents of flask until level just reaches the 30 ml mark on the flask.

CAUTION

DO NOT allow titrant (5) to stand in direct sunlight. Titrant decomposes in direct sunlight and cannot be used if exposed.

(e) Add Utrant (5) drop by drop to the flask using the eye dropper (6). Swirl flask constantly while adding the drops and count each drop as it is added. Continue to add titrant until sample becomes colorless.
(f) Each drop of titrant used to bring about color change is equal to 0.2 ppm chlorine.

(2) *Medium Range Available Chlorine*. Use this test when checking product water for chlorine.

(a) Fill flask (1) to the 40 ml mark with water to be tested.
(b) Use clippers (2) to open one sulfite 1 reagent powder pillow (3). Add contents of pillow to flask. Swirl the flask to mix.
(c) Use clippers to open one sulfamic acid reagent powder pillow (4). Add contents of pillow to flask. Swirl flask to mix. This is the prepared sample.

NOTE

A blue color will develop after the addition of the sulfamic acid if chlorine is present.

(d) Fill plastic measuring tube (7) full level with prepared sample. Pour sample In square mixing bottle (8).

CAUTION

DO NOT allow titrant (5) to stand in direct sunlight. Titrant decomposes in direct sunlight and cannot be used if exposed.

(e) Add titrant (5) drop by drop to the flask using the eye dropper (6). Hold dropper vertically above the bottle to add drops. Swirl flask constantly while adding the drops and count each drop as it is added. Continue to add titrant until sample becomes colorless.
(f) Each drop of titrant used to bring about color change is equal to 0.2 ppm chlorine.

(3) *Chlorine Kit Care.*
(a) Replace flask, mixing bottle or eye dropper if cracked or broken.
(b) Replace sulfite 1 reagent, sulfamic acid reagent and titrant as needed.

b. Model ROWPU-1 Chlorine Test Kit Procedures.

(1) Medium Range Test Instructions.

(a) Fill the flask (1) to the 40 ml mark with the water to be tested.

(b) Tear open one sulfite 1 reagent powder pillow (2). Add the contents of the pillow to the flask (1). Swirl gently to mix.

(c) Tear open one sulfamic acid powder pillow (3). Add the contents of the pillow to the flask (1). Swirl gently to mix. This is the prepared sample.

NOTE

A blue color will develop after the addition of the sulfamic acid if chlorine is present.

(d) Fill the plastic measuring tube (4) level full with the prepared sample. Pour the sample into the square mixing bottle (5).

(e) Add sodium thiosulfate standard solution (6) drop by drop to the mixing bottle (5). Hold the dropper vertically above the bottle to add drops. Swirl the bottle constantly while adding drops and count each drop as it is added. Continue to add titrant until the sample is colorless.

(f) Each drop used to bring about the color change in step (e) is equal to 1 mg/L chlorine (Cl).

(2) Low Range Test Instructions. If the result from step (e) of the Medium Range test is low (2 mg/L or less), it is advisable to test a larger sample to obtain a more sensitive test. This may be done directly in the flask by performing the following instructions.

(a) Using the sample left over from step 3 in the medium range test, pour off the contents of the flask (1) until the level just reaches the 30 ml mark on the flask.

(b) Add sodium thiosulfate (6) drop by drop to the flask (1). Hold the dropper vertically above the flask to add drops. Swirl the flask constantly while adding drops and count each drop as it is added. Continue to add titrant until the sample is colorless.

(c) Each drop of sodium thiosulfate titrant (6) used to bring about the color change in step 2 is equal to 0.2 mg/l chlorine (Cl).

(3) Chlorine Kit Care.

(a) Replace flask, mixing bottle or eye dropper if cracked or broken.

(b) Replace sulfite 1 reagent, sulfamic acid reagent and sodium thiosulfate titrant as needed.

SECTION II. OPERATOR'S PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-10. GENERAL. The operator's PMCS table lists the inspections and service procedures to properly maintain the ROWPU in good operating condition. Items covered here are appropriate for operator level only. Always keep in mind the CAUTIONS and WARNINGS before performing checks and services listed in the PMCS table.

a. *PMCS Table Format*. The following columns make up the PMCS table.

(1) *Item No.* Each maintenance check is identified by a separate item number. The item column will be used as a source of item numbers for the 'TM Number" column on DA Form 2404 Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

(2) *Interval.* The interval column of the PMCS table identifies when to perform the service check or maintenance.

Before	After	Monthly
During	Weekly	See Procedure for Hours

(3) Item to Be Inspected/Procedure. This column identifies how to perform the required checks and services. Carefully follow these instructions. If appropriate tools are not available to operator, unit maintenance should perform the work. If your equipment does not perform as required, refer to Chapter 3, Section IV. Troubleshooting for possible problems. Report any malfunctions or failures-to your supervisor or unit maintenance.

(4) Not Fully Mission Capable If. This column indicates when and why equipment cannot be used after completing the specific PMCS.

NOTE

If the ROWPU fails to operate, troubleshot with the right equipment. Record any problems discovered on DA Form 2404 and give to your maintenance supervisor. See DA PAM 738-750.

b. *Special Instructions*.

(1) If the ROWPU must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the ROWPU can be shut down.

(2) "Before Operation (B)" checks should be limited to those required for consecutive application by an assigned operator/crew Perform "'Weekly (W)" as well as "Before Operation (B)" PMCS if:

(a) ROWPU has not been operated since the last weekly PMCS, or;

(b) ROWPU Is being operated for the first time.

(3) Leakage definitions for operator/crew PMCS are classified as follows:

Class I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked, inspected.

Class III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakages (Class I or II). Consider the fluid capacity in the Item system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or Class 11 leaks, continue to check fluid levels as required by PMCS table.

Class III leaks should be reported to your supervisor.

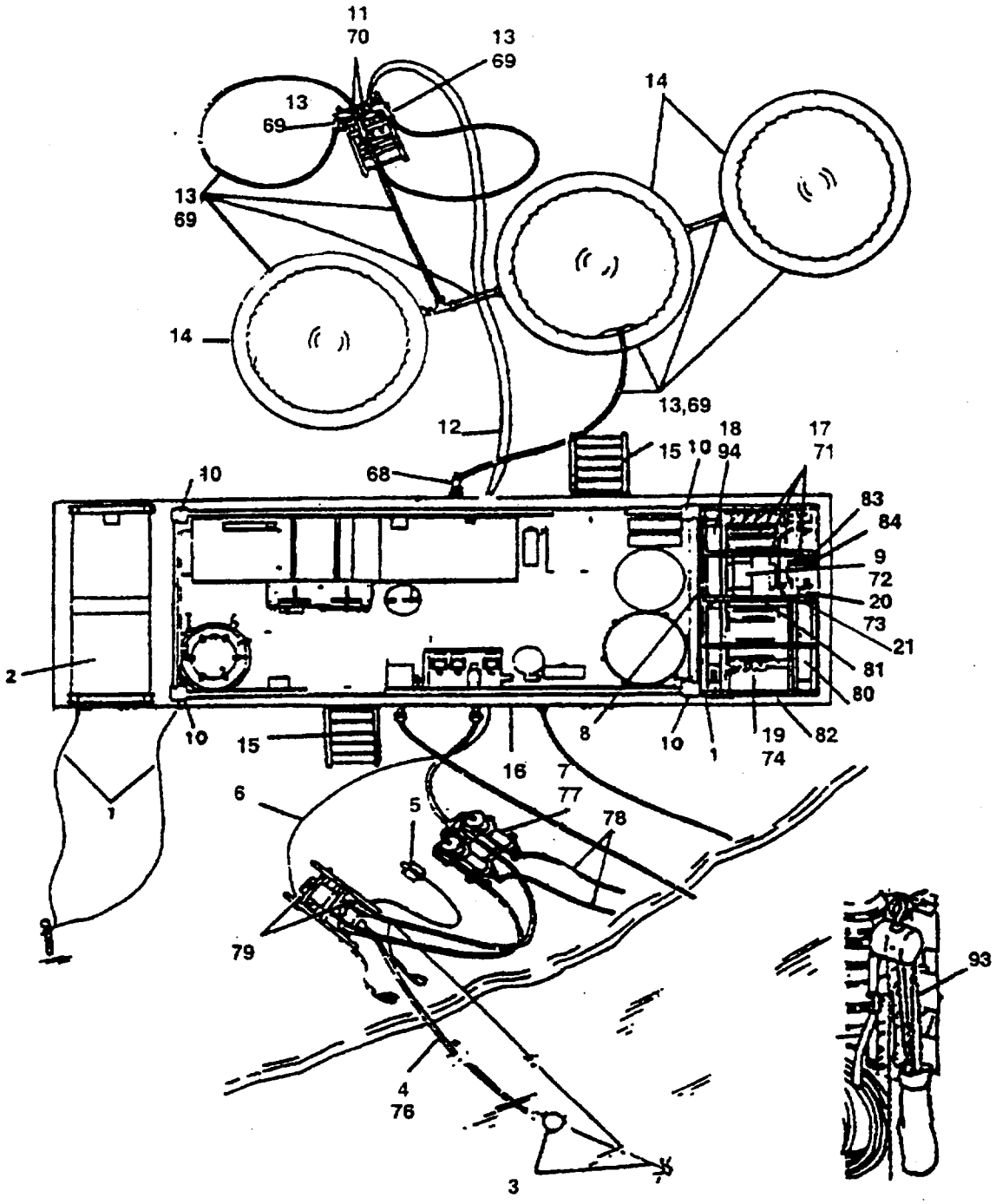


Figure 2-21. PMCS Routing Diagram. (Sheet 1 of 4)
(MODEL WTA-060 ONLY)

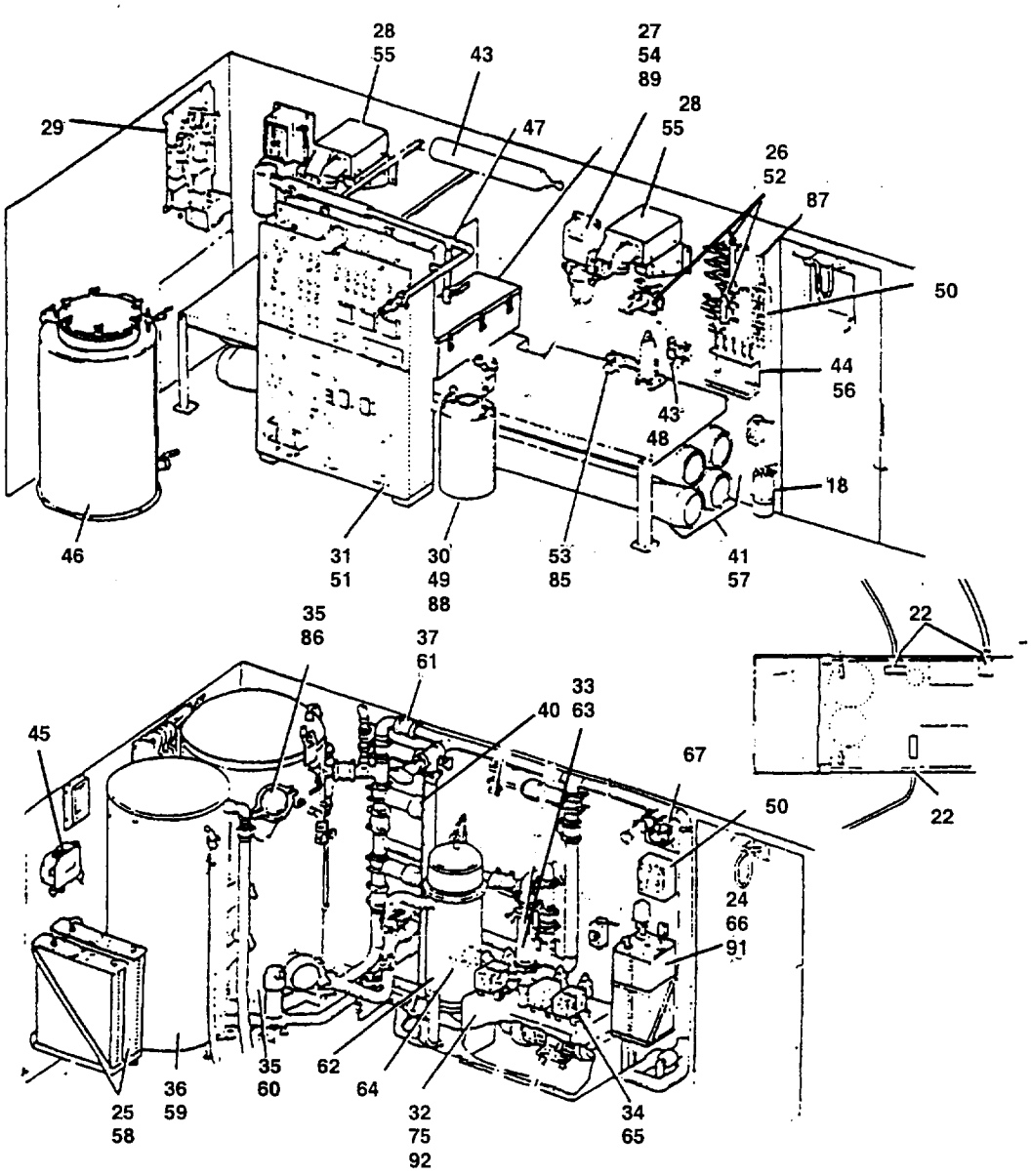


Figure 2-21. PMCS Routing Diagram (Sheet 2 of 4)
(MODEL WTA-060 ONLY)

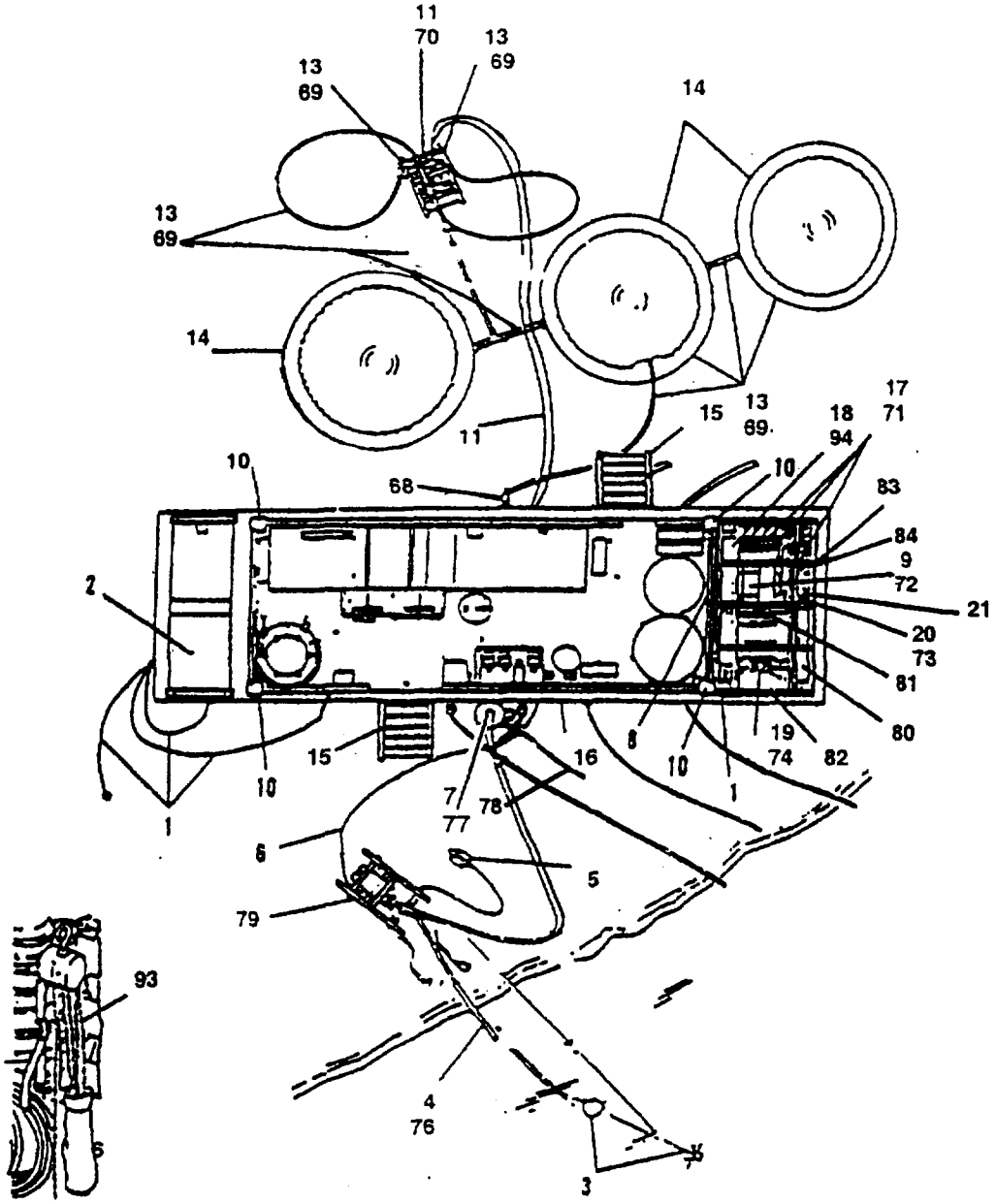


Figure 2-21. PMCS Routing Diagram (Sheet 3 of 4)
(MODEL ROWPU-1 ONLY)

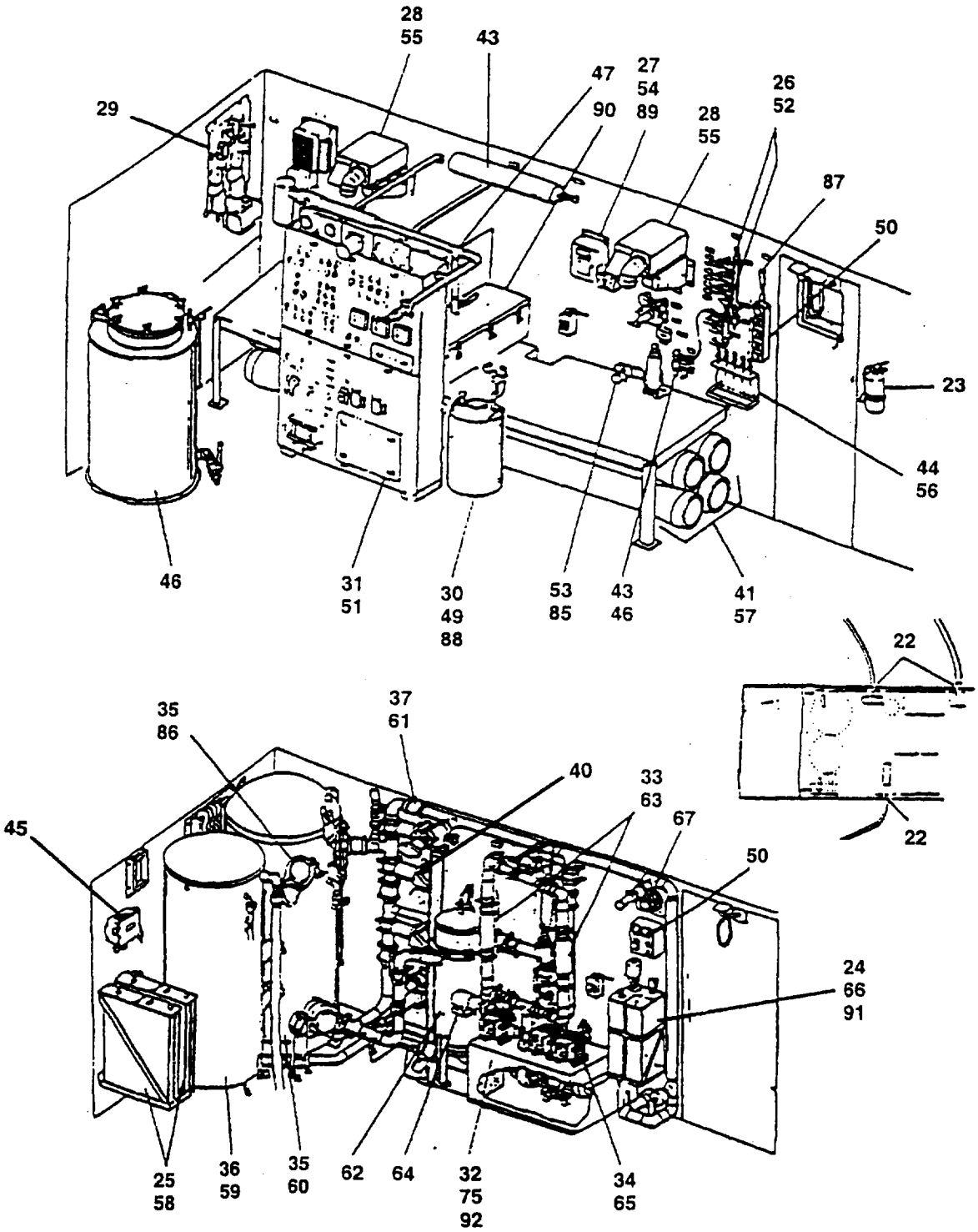


Figure 2-21. PMCS Routing Diagram (Sheet 4 of 4)
(MODEL ROWPU-1 ONLY)

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS)

Note: If the ROWPU must be kept in continuous operation, check and serve only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
1.	Before	Main Power Cable and Grounding Cables	a. Check for cuts, loose connections, and damaged connectors. b. Check for loose or broken grounding cables.	Damage that would prevent operation.
2.	Before	Generator 60Kw	Perform PMCS IAW TM 5-6116-545-12 or TM 9-6115-645-10.	Generator inoperative.
3.	Before	Anchor, Anchor Rope, and Intake Strainer	a. Check anchor for broken weldments. b. Inspect strainer for obvious damage allowing large debris to enter. Inspect coupler for dents. Inspect strainer screen for holes, damage, and plugged condition. c. Inspect anchor rope for fraying, missing d-rings, and proper length.	Missing anchor. Strainer has large holes, tears, or cracks. Improper length or missing rope.
4.	Before	Raw Water & Suction and Discharge Drain Hoses	a. Inspect inner casing, hose assemblies, and connector gaskets for wear, leaks, crimps, damage, cuts, and clogging. b. Inspect for missing caps and plugs.	Damage that would prevent operation. Missing plugs or caps or cut hoses.
5.	Before	Prime Assist Pump	a. Inspect pump and hoses for damage. b. Inspect hose for cuts. c. Inspect coupler for damage. **WARNING** **Make sure the circuit breaker for the raw water pump and the winter kit heat lamp is turned off before proceeding. Failure to do so could result in electrocution.**	Damage that would prevent operation.
6.	Before	Raw Water Pump and Power Cable	a. Inspect pump housing, motor and frame for cracks, damage, and missing hardware and parts. b. Check cables for cuts, loose connectors, and damaged connectors. c. If winter kit heater is installed, check it for damage or loose connections.	Damage or missing parts that would prevent operation.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

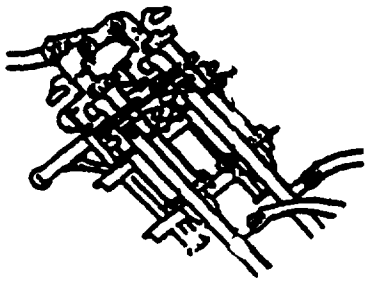
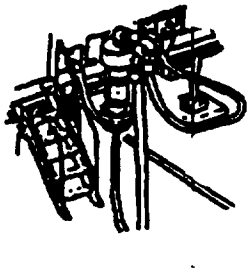
Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
7.	Before	Cyclone Separators	Check separators, piping, connectors, and check valves for damage.	Damage that would prevent operation.
		 **(MODEL WTA-060 Only)**	 **(MODEL ROWPU-1 Only)**	
8.	Before	Junction Box Enclosures (Outside)	Inspect for missing or damaged bolts, nuts, weather seals, and caps.	Damage that would prevent operation.
9.	Before	Electric Heater Assembly	a. Check switches and wiring for damage. **NOTE** **Heater only engages if it is 80°F (27°C) or less.** b. Check operation.	If heater does not work during cold weather operation.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
			CAUTION **Ensure latching pins are secure; otherwise, container could fall off trailer in rough terrain.**	
10.	Before	Container Bolster Locks	Check to make sure locks are properly set and safety chains are attached to trailer. Make sure wire ties are secured to locking devices.	Damage that would prevent operation or wire ties missing.
			WARNING **Make sure the circuit breaker for the distribution pump and the winter kit heat lamp is turned off before proceeding. Failure to do so could result in electrocution.**	
11.	Before	Distribution Pump and Motor	Inspect pump housing, motor, and frame for cracks, damage, and missing hardware and parts.	Damage or missing parts that would prevent operation.
12.	Before	Distribution Pump Power Cables and Remote Cable	a. Check for cuts, loose connections, and damaged connectors. b. If winter kit heater is installed, check it for damage, cable cuts, or loose connections	Damaged or missing power cable that would prevent operation.
13.	Before	Distribution Suction and Discharge Hoses, Caps, Plugs and Nozzles	a. Inspect exterior casings for wear and cuts. b. Inspect gaskets at connections. c. Inspect hoses for missing caps and plugs. d. Inspect nozzle/filter for damage. e. Inspect trigger, latches, and springs for damage.	Damage or missing parts that would prevent operation. Nozzle is inoperative or has missing parts.
14.	Before	Storage Tanks	Perform PMCS IAW TM 5-5430-225-12&P.	Storage tanks inoperative.
15.	Before	Ladders	Check for broken or cracked steps and loose hardware.	Damage presents a hazard to personnel or ladders missing.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
16.	Before	ISO Container Assembly	a. Visually inspect the container, doors, accesses, seals, fan louvers, and related parts for obvious damage, wear, and loose or missing hardware. b. Check for broken linkage, rust, and proper operation.	Damage presents a hazard to personnel.
17.	Before	High Pressure Pump Skid Assembly	a. Inspect pump cover for damaged and torn straps, broken zippers, holes, and tears. b. Check stabilizers for broken valve stems and missing caps. c. Inspect for missing or broken tie down straps. d. Check for missing or damaged brace assembly.	Stabilizers missing, broken, or will not hold air.
18.	Before	High Pressure Pump Belt Guard and Pump Assembly	a. Inspect for loose guards and missing mounting hardware and belt. b. Check belt tension for proper adjustment.	Loose guards or belt missing.
19.	Before	High Pressure Motor and Pump Assembly	a. Check for cracks to housing. b. Check pump cavity for evidence of oil and grease or excessive leakage. c. Check oil sight glass for damage and proper oil level.	Broken sight glass. Excessive oil seen in pump cavity. Bent piston rods.
20.	Before	Air Compressor	a. Check for loose mountings, beltguard, and missing belt. b. Check for proper oil level and contamination. c. Check belt for proper adjustment. d. Inspect for loose fittings and damaged fan.	Missing belt, damaged fan, or contaminated oil.
21.	Before	Pulse Dampener	a. Inspect for cracked or damaged piping. b. Check for loose or broken mountings. c. Check for broken drain cock.	Piping cracked or loose and broken mounting bracket.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
			WARNING **Do not touch sump heaters while testing. They are hot and can cause serious burns.**	
22.	Before	Sump Heaters And Heat Lamps	a. Check for broken lens or heat lamp. b. Check that lamp is securely installed. **WARNING** **Make sure no plastic tubes are laying against heaters. Failure to do so will result in damage to tubing and can present a fire hazard.** c. Inspect cables for damage	Broken heat lamp or other damage that would prevent operation.
23.	Before	Fire Extinguishers	a. Check for proper charge (green zone) on extinguisher Pressure gage. b. Inspect for loose mounts or Brackets. **WARNING** **Wear protective face shield and chemical gloves when handling calcium hypochlorite. Hypochlorite will give off chlorine vapor which will burn your nose, throat and lungs. Keep head away from top of tank while inspecting it. See a medic if fumes am inhaled.**	Charge in red zone.
24.	Before	Hypochlorite Tank	a. Inspect tank for cracks and punctures. b. Check for missing or discon-nected quick-disconnect fittings and strainer	Damage that would prevent operation. Fittings or strainer loose or missing.
25.	Before	Polyelectrolyte and Sequestrant Chemical Tanks and Frame	a. Inspect polyelectrolyte tank/ frame and sequestrant tank/ frame for cracks and punctures. b. Check for missing or discon-nected quick-disconnect fittings and strainer.	Damage that would prevent operation. Fittings or strainer loose or missing.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

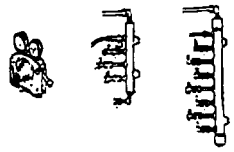
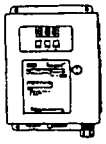
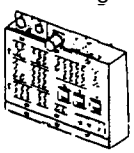
Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
26.	Before	Air Regulator, Manifolds, and Tubing	Check for loose connections, missing knobs, cracked manifolds, and loose mounting hardware. 	Cracked manifolds or missing knobs.
27.	Before	Carbon Monoxide (CO) Monitor	a. Inspect for loose mountings and missing or damaged weather seal and glass. b. Check for loose connectors and missing sensor plug. 	Sensor plug missing or damage that would prevent operation.
28.	Before	Diesel Heaters And Fuel Pumps	a. Check for missing exhaust pipe. b. Inspect for damaged housings and thermostats. c. Inspect electrical cables for damage. d. Check for damage to control boxes. e. Inspect for damage to pump housings and sight glasses and for loose and broken mountings.	Missing or damaged parts that would prevent operation.
29.	Before	Pressure Switch Panel Assembly	Check for loose connections and mounting hardware.	Damage that would prevent operation.
30.	Before	Eyewash Station	Check for damaged or missing cover seal and broken gage glasses.	Seal damaged or missing.
31.	Before	Main Control Panel Switches, Relays, Pilot Lights, Pressure and Differential Gages, and Flowmeters.	a. Check for loose connectors and electrical cables. b. Inspect for loose or missing mounting hardware. c. Check for broken gages, latches, or damaged and missing weather seals. 	Any damage to panel that would prevent operation.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
32.	Before	Booster Pump and Housing Box	a. Check for loose or missing mounting hardware. b. Check housing for cracks. c. Check polyelectrolyte injector for obvious damage.	Housing is cracked or injector damaged.
33.	Before	Basket Strainer(s)	a. Inspect for dents or damage to housing, missing basket strainer(s), and damaged or missing gaskets and packings. b. Check hand valves for proper operation.	Damaged or missing gaskets and packings. Sheared stop pins on strainer(s) cap(s).
34.	Before	Chemical Injection Pumps and Chemical Tubing	a. Check for obvious damage to pump housings. b. Inspect for loose or damaged mounting brackets and tubing connections. c. Check for missing control knobs.	Will not prime or operate.
35.	Before	Media Filer	a. Check for loose or missing mountings and cracked housing. b. Inspect for broken level indicator. c. Check media level (between 14"-18").	Cracked housing or not mounted. Media level above or below the limits.
36.	Before	Clean/Flush Tank	a. Inspect housing for cracks, damage, and loose mountings. b. Check for damage to sight level and sensor.	Cracked housing. Low level sensor is damaged.
37.	Before	Raw Water Piping System	a. Check temperature gage for damage. b. Inspect all vents and drains for broken handles. c. Inspect piping for cracks. d. Check flow meter for loose mountings or damaged wiring. e. Check for damaged or missing piping seals and gaskets.	Cracked piping or other damages that would prevent operation.
38.	Before	Cartridge Filter	a. Inspect for loose mountings and damage to housing. b. Check for broken drain fittings.	Cracked housing or missing springs.
39.	Before	Filter Water Piping	a. Check for damage to vents, drains, and manual valves. b. Inspect for damaged or missing pipe seals and gaskets. c. Check piping for cracks.	Cracked piping.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
40.	Before	Automatic Valves	a. Check for loose mountings and cracks in housing. b. Inspect for loose or broken air lines and damaged electrical cables. c. Check for loose or broken indicator needles.	Damaged electrical cables.
41.	Before	R.O. Vessels and Piping	a. Inspect for loose or missing mountings and pads. b. Inspect for cracks and damage to vessel housing and piping. c. Check for damaged drain lines and missing knobs.	Cracked vessels or piping or leaking end cap seals.
42.	Before	Product Water Piping	a. Inspect for cracked piping and product water manifold. b. Inspect for broken vents, drains, or injectors.	Cracked piping or manifold.
43.	Before	Air Tank and Air Dryer	a. Inspect for broke, loose, or missing mountings and air fittings. b. Check for missing bottle guard. c. Inspect for broken drain cock.	Missing mounting brackets and fittings.
44.	Before	Product Water Sample Trough, Valves, and Tubing	Check for loose or missing mountings, tubing, and knobs.	Loose or broken tubing or missing knobs.
45.	Before	Junction Box Enclosures JB1 and JB3 (Inside)	Inspect for missing or damaged bolts, nuts, weather seals, and caps.	Damage that would prevent operation.
46.	During	NBC Filter (Only During NBC Operation)	a. Inspect vessel and piping for leaks. b. Every 100 hours check high pressure pump hourmeter and replace carbon and resin beads.	Damage is observed or any leaks are found.
47.	During	High Pressure Water Piping, Hoses, and Manifolds	a. Inspect for leaks at connection points. b. Check for excessive vibration, broken vents, and drain lines.	Class III leaks are found.
48.	During	Air Dryer	Check for air leaks and clogs.	Air leaks found.
49.	During	Eyewash Station	a. Check for Eyewash operation. b. Check to make certain pressure gage reads 90 psig (621 kPa) (para. 3-5).	Eyewash does not operate or pressure is less than 85 psig (586 kPa).

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

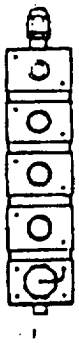
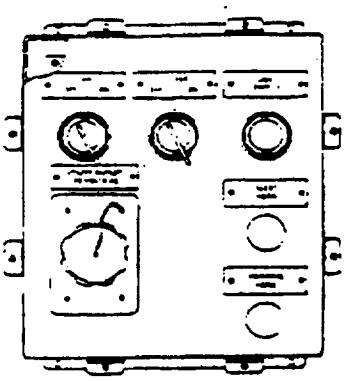
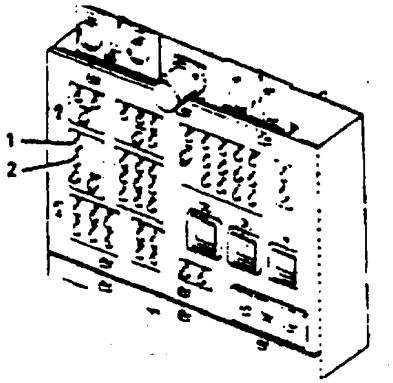
Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
50.	During	Switch Panel No. 1 & 2 and Cables Switch Panel No. 1	Turn light switch on. If lights do not come on, change light bulbs.  Switch Panel No. 2	
51.	During	Main Control Panel Switches, Relays, Pilot Lights, Pressure and Differential Gages, and Flowmeters	a. Check for obvious damage. Turn on switches and push buttons. Check lights, gages, and meters for proper operation. b. Push ALARM TEST pushbutton (1) on main control panel.  c. Push LIGHT TEST push button (2).	Components are inoperative.
52.	During	Air Regulator, Manifold, and Tubing	Check for leaks and proper gage readings (Table 2-7).	Air leaks detected.
53.	During	High Pressure Air Auto Blowdown Block (V67)	Check that it opens every 15 minutes.	Release of air pressure is not heard.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

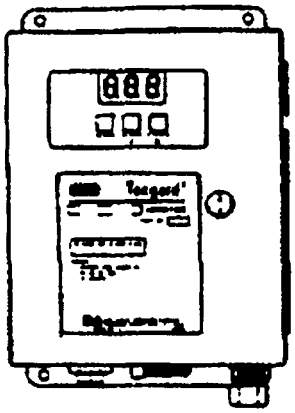
Item No.	Interval	Item to Check/Service	Crewmember/Procedure	Not Fully Mission Capable If:
54.	During	Carbon Monoxide (CO) Monitor	Check level of CO in van. 	Unable to perform test. Monitor does not operate, or level of CO exceeds safe limits.
55.	During	Diesel Heaters and Fuel Pumps	Check heater operation (para. 2-31). Check for fuel leakage.	Heaters do not work in cold weather operation. Any fuel leaks found.
56.	During	Product Water Sample Trough, Valves and Hoses	Check for leaks and clogs.	Damage creating a water flow that will degrade/abort the mission or create a hazardous condition.
57.	During	R/O Vessels and Elements	a. Inspect vessels and piping for leads. b. Check TDS level of each vessel.	Class III leaks are found, or TDS level exceeds maximum allowable level (Table 2-23).
58.	During	Polyelectrolyte and Sequestrant Chemical Tanks	a. Check chemical level. b. Check connections for leaks.	Damage that would prevent operation.
59.	During	Clean/Flush Tank and Stand	a. Check level and fill as necessary. b. Check for leakage, cracks, or punctures. c. Check for loose attaching hardware. d. Clean fill port after each chemical addition.	Damage that would prevent operation.
60.	During	Media Filer Assembly	a. Inspect for leaks or loose connections b. Check backwash air system by operating ROWPU in "backwash" and watch that the system air pressure gage drops about 400 psig, and that the BACKWASH AIR INLET light on the main control panel lights when the raw water pump starts. The valve should close when the booster pump starts.	Damage that would prevent operation.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

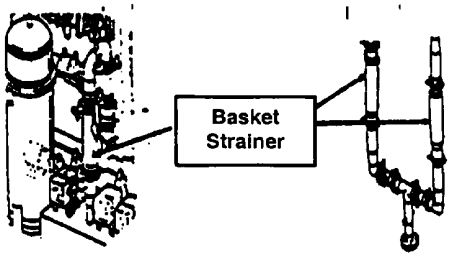
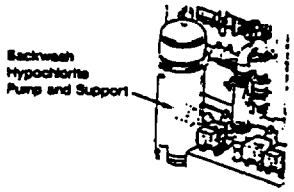
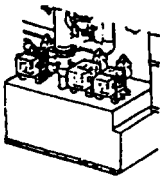
Item No.	Interval	Item to Check/Service	Procedure	Not Fully Mission Capable If:
61.	During	Low Pressure Raw Water and Filtered Piping, and Valves	Inspect for leaks or loose clamps.	Damage that would prevent operation.
62.	During	Cartridge Filter Assembly	a. Inspect for leaks or loose connections. b. Open the cartridge filter drain for 3 seconds: 1. Every 4 hours while operating. 2. Twice during each detergent cleaning 10 minute circulation.	Damage that would prevent operation.
63.	During	Basket Strainer(s)	Inspect for leaks or loose connections.  **(MODEL WTA-060)** **(MODEL ROWPU-1)**	Damage that would prevent operation.
64.	During	Backwash Hypochlorite Pump and Support	a. Inspect for leaks, unusual noise, loose mounting, loose tube fittings, and loose hardware. b. Check hypochlorite level during backwash operations. 	Unusual noise is heard, or damage that would prevent operation.
65.	During	Chemical Injection Pumps and Chemical Tubing	a. Inspect for leaks, unusual noise, and loose mounting. b. Check for proper priming. 	Unusual noise is heard, or damage that would prevent operation. Pumps cannot be primed, or pump speed or strokes cannot be adjusted.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

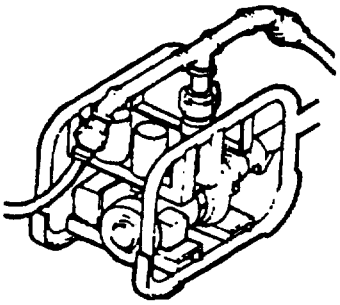
Item No.	Interval	Item to Check/Service	Procedure	Not Fully Mission Capable If:
66.	During	Hypochlorite Tank, Mixer, and Tubing	a. Inspect tank for cracks or punctures. b. Turn MIXER switch to ON, check mixer for unusual noise or vibration. c. Smell motor for possible burning. d. Check tubing for cracks, leaks, or clogs.	Unusual noise is heard, or damage that would prevent operation. Burning smell is detected.
67.	During	Vent Fan	Turn FAN switch to ON.	Fan or switch is inoperative.
68.	During	Product Shut-Off Valve	Inspect for leakage or damaged control handle.	Damage that would prevent operation.
69.	During	Distribution, Suction, and Discharge Hoses and Nozzles	Check for leaks and proper operation.	Leaks are found that would prevent operation.
70.	During	Distribution Pump and Motor	a. Inspect for leakage between the pump and motor and listen for unusual noise. b. Inspect piping and drain valve for damage or leaks. c. Inspect for obvious damage. d. Smell for possible burning. e. Check for proper rotation of fan (clockwise). 	Damage is observed, or burning smell is detected.
71.	During	High Pressure Pump and Skid Assembly, Piping, and Relief Valve	a. Check for severe plunger packing leakage and oil leakage. b. Listen for unusual noise. c. Inspect for obvious damage. d. Check for unusual vibration or leakage. e. Check Skid Assembly for excess vibration and noise. Slowly release air from assembly mounts until noise and vibration disappear. If noise does not go away, slowly inflate until noise goes away. f. Check for proper rotation of pump (clockwise).	Unusual noise is heard or damage is observed. Tubing vibrates excessively.
72.	During	Electric Heater Assembly	Check operation of fan.	If heater does not work in cold weather operation.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

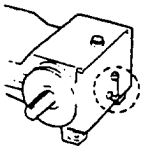
Item No.	Interval	Item to Check/Service	Procedure	Not Fully Mission Capable If:
73.	During	Air Compressor Operation and Motor	a. Check air compressor operation. It normally starts when the air pressure drops to 1500-1550 psig and stops when pressure reaches 1700-1800 psig. Open the vent valve on the utility air manifold to drop pressure to the start level. Listen for unusual noise in rotor and smell for possible burning. b. Check air compressor hourmeter, replace inlet filter at every 250 hour interval. c. Check actuator valve pressure for 85 psig.	Compressor doesn't start. Unusual noise is heard, or burning smell is detected. Pressure is less than 85 psig.
74.	During	High Pressure Pump Motor	Listen for unusual noise and smell for possible burning.	Unusual noise is heard or burning smell is detected.
75.	During	Booster Pump and Motor	a. Inspect for leakage between the pump and motor. b. Listen for unusual noise. c. Smell for possible burning.	Unusual noise is heard or burning smell is detected. Damage is detected.
76.	During	Raw Water Suction and Discharge Hoses	Check for leaks.	Leaks are found that would prevent operation.
77.	During	Cyclone Separator(s)	Check for leaks.	Leaks are found that would prevent operation.
78.	During	Waste Water Hoses	Check for leaks.	Leaks are found that would prevent operation.
79.	During	Raw Water Pump and Motor	a. Listen to motor and pump for unusual noise. Smell for possible burning. b. Inspect for leakage between the pump and rotor. c. Inspect piping and check vales for damage and leakage.	Unusual noise is heard. Burning smell is detected. Damage is observed. Check valve not operational, will not hold prime.
80.	After	High Pressure Pump Assembly Cover	Check for tears, inoperable zippers, damaged tiedown straps.	If damaged during cold weather operations.
81.	After	High Pressure Pump Oil Level	Visually inspect oil level in sight gage. Level should be half way up glass. 	Oil level is low.

Table 2-13. Operator Preventive Maintenance Checks and Services (PMCS) (Continued)

Item No.	Interval	Item to Check/Service	Procedure	Not Fully Mission Capable If:
82.	After	High Pressure Pump Tiedown Straps	a. Inspect ratchets for binding. b. Spray ratchets with silicone spray.	Damage is observed.
83.	After	Air Compressor Belt Guard	Inspect for loose or missing mounting hardware.	Guard is loose or damaged.
84.	After	Air Compressor Oil Level	Check oil level.	Oil level low.
85.	After	Air Blowdown Solenoid Valve	Check for air blowdown solenoid valve oil leakage.	Solenoid has oil leak.
86.	After	Media Filter	Check Media Filter level.	If measurement is less than 14 in. or more than 18 in.
87.	After	Interior Electrical Cables.	Check for cuts, loose connections/damaged connectors.	Damage that would prevent operation.
88.	After	Eyewash Station	If ROWPU has been in continuous operation for a month, replace solution.	Solution is not replaced monthly when in continuous operation.
89.	Weekly	Carbon Monoxide (CO) Monitor	Check CO Monitor weekly for proper calibration.	Test unable to be performed.
90.	Weekly	Storage Boxes	Check for lose mounting hardware or damage.	
91.	Weekly	Hypochlorite Tank, Mixer, and Tubing	Clean and flush weekly.	
92.	Weekly	Booster Pump Cover	Inspect for loose mounting hardware and damage to cover.	
93.	Monthly	Chain Hoist	Spray with silicon spray.	
94.	Monthly	High Pressure Pump Belt Guard	Inspect for loose mounting hardware.	Guard is loose or damaged.

SECTION III. OPERATION UNDER USUAL CONDITIONS.

2-12. SECTION INDEX.

2-13. WATER POINT REQUIREMENTS.

a. *General.*

b. *Water Depth.* Minimum is 3 ft (0.9 m), but 5 ft (1.5 m) or more is preferred.

c. *Work Site Dimensions (figure 2-22).*

NOTE

Before setup, refer to manuals FM10-52 Field Water Supply and TBMED5-77 Occupational and Environmental Health for specifications covering water point and source.

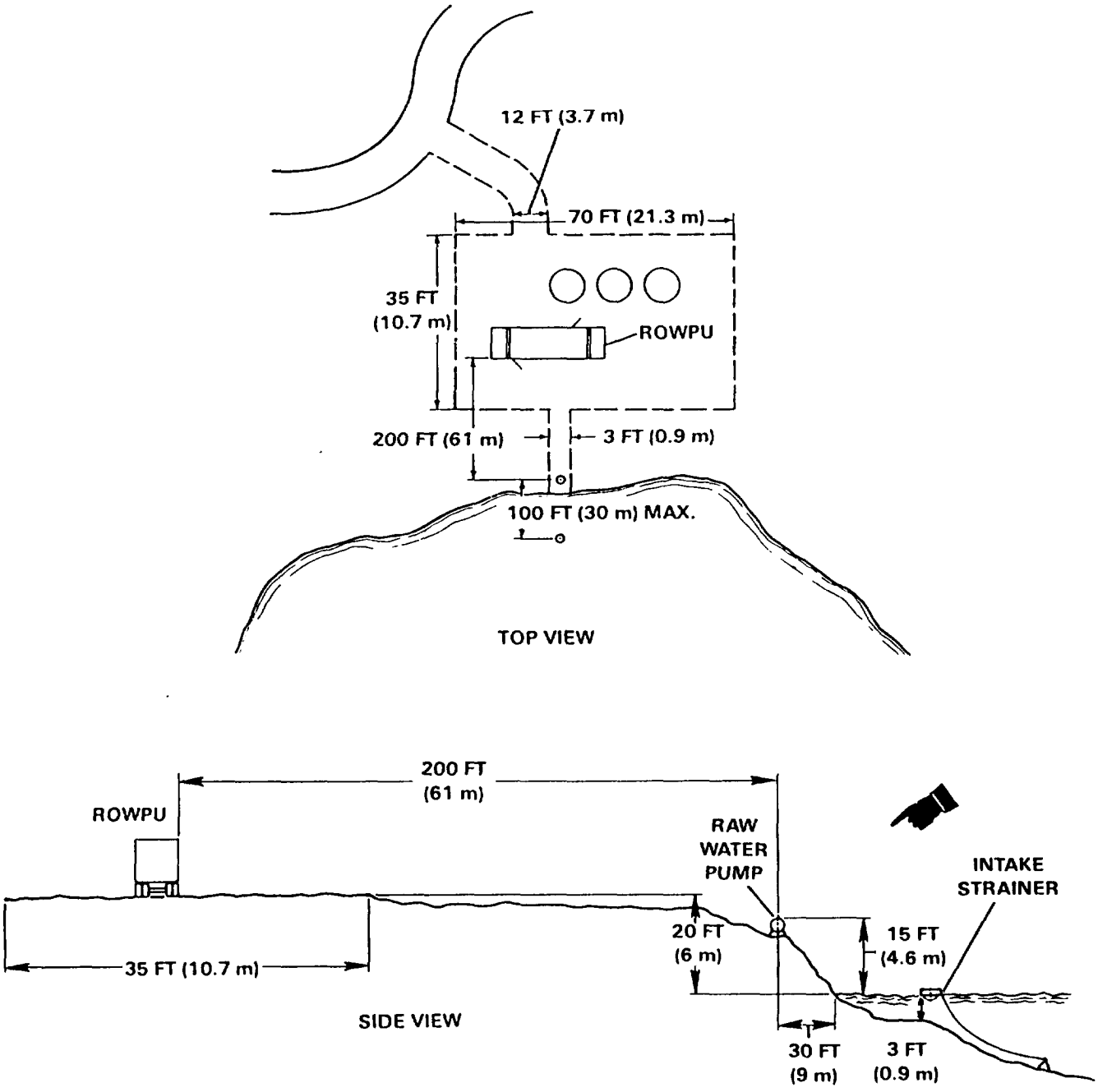


Figure 2-22. Work Site Dimensions

(1) Drive-in access for on-road equipment at least 12 ft (3.7 m) wide. The ground must be fairly smooth and clear.

(2) A work area at least 35 ft x 70 ft (10.7 m x 21.3 m) is required for equipment maneuvering and set-up.

(3) A cleared path to the water source at least 3 ft (0.9 m) wide.

(4) A work area no more than 20 ft (6 m) above the raw water source.

(5) A raw water pump level no more than 15 ft (4.6 m) above the surface of the water source.

(6) A parking surface for the Water Purification System mounted on the trailer no more than 200 ft (61 m) from the raw water pump. Grade of parking surface must not exceed 2° crosswise and 5° lengthwise. The storage tanks must also fit on this leveled surface.

(7) A place for the raw water pump 10-20 ft (3-6 m) but no more than 30 ft (9 m) from the waters edge.

(8) A water depth which will allow the intake strainer to be no less than 3 ft (0.9 m) from the bottom of the water source. A water depth of 5 ft (1.5 m) or more is preferred.

NOTE
When positioning the trailer, the raw water point is to be at the right of the truck cab.

d. *Well Water Source.* Avoid wells which are encased with steel or which use steel piping. Iron will rapidly foul the RO elements. Wells which smell of iron or sulfur must be avoided. Any well water observed to leave significant residues of salts must be avoided.

2-14. ASSEMBLY AND PREPARATION FOR USE. The purpose of these instructions is to provide procedures which will allow the full crew to unpack and fully deploy the ROWPU.

a. *Location of Loose Items.* Loose items are shown in Figure 2-24.

b. *Ready Trailer* (Figure 2-23).

NOTE
When positioning the trailer, the water point is to be at the driver's right.

(1) Move trailer into a position at the work site which will allow front end to be slightly lower than the rear for water drainage. Trailer must also be positioned so that there is no more than a 2° side-to-side grade. Place wheel chocks under wheels to prevent trailer movement.

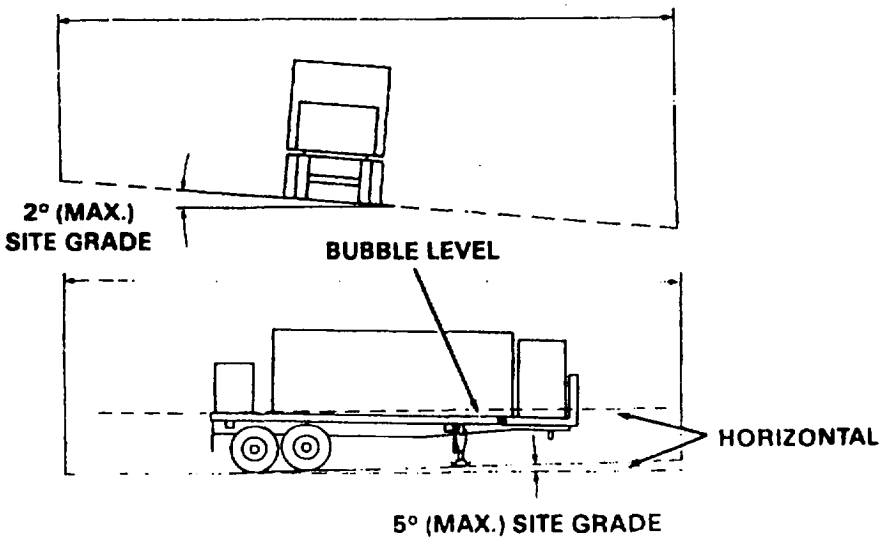


Figure 2-23. Positioning Trailer

(2) Place load boards under landing gear, lower landing gear and unhook trailer from tractor (refer to TM 9-2330-358-14).

(3) Adjust landing gear so that front of trailer is one-half (1/2) bubble lower than back of trailer.

c. Unloading.

(1) Unzip cover (1, Figure 2-24, sheet 1) on high pressure pump assembly (2) (raw water side) just enough to gain access to straps (3) holding generator ladder (4). Secure cover (1) using straps to prevent damage to zipper.

(2) Loosen straps (3) holding ladder (4).

(3) Disconnect snap ring (5) and using rope (6), slowly lower the generator ladder to the ground.

(4) Use the generator ladder to gain access to high pressure pump assembly. Loosen straps (7) and remove the hand rails (8) and place on ground.

(5) Loosen 3 inch straps (9) which secure high pressure pump assembly to the trailer.

(6) One crewmember climbs generator ladder, opens and secures door and enters van on raw water side. Two remaining crewmembers stay on ground.

(7) Crewmember in van unstraps tie-down straps (two straps #10 (Model WTA-060) Figure 2-24, Sheet 2) or (straps #2 and #3 (Model ROWPU-I), Figure 2-24, Sheet 2.1) on the raw water pump (10) and hands electrical cable (11) to outside crewmember.

(8) Crewmember in van removes bag (12) from around chain hoist.

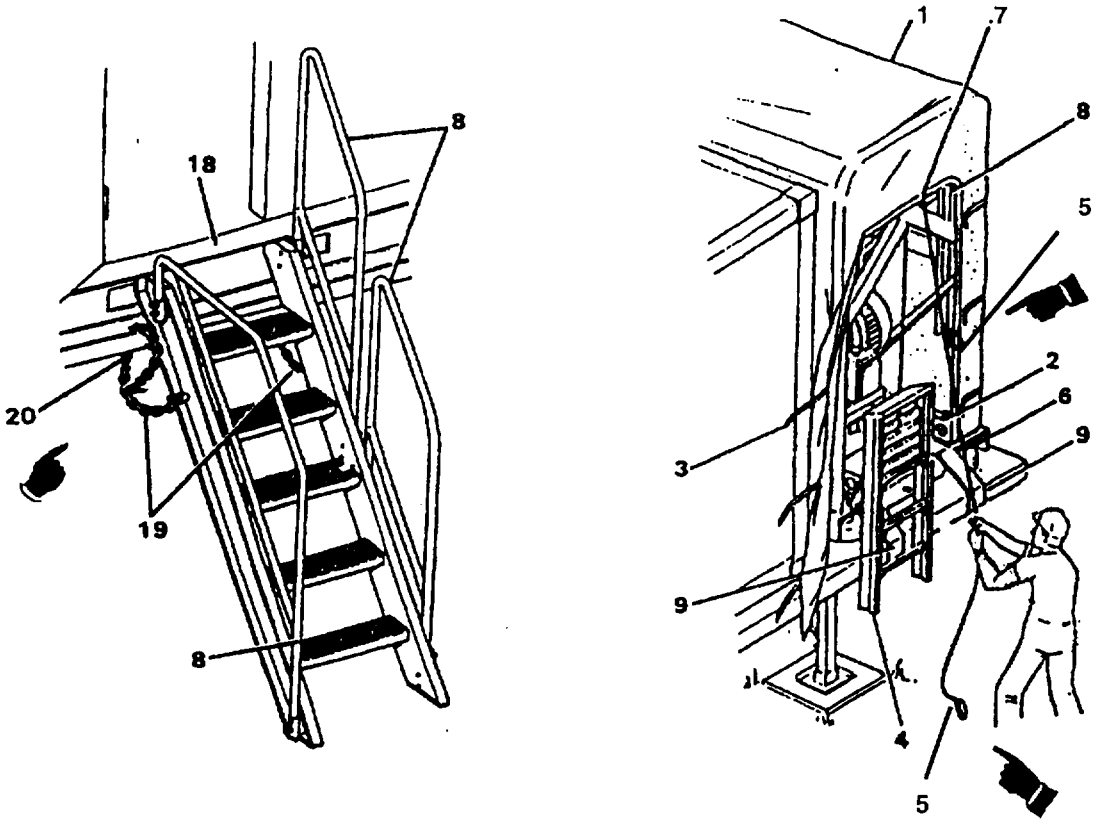


Figure 2-24. Unloading the ROWPU (Sheet 1 of 3)

NOTE

The chain hoist is wrapped in a canvas bag and tied during movement. When not in use, the chain hoist is placed in bag and hung on hook under face shield.

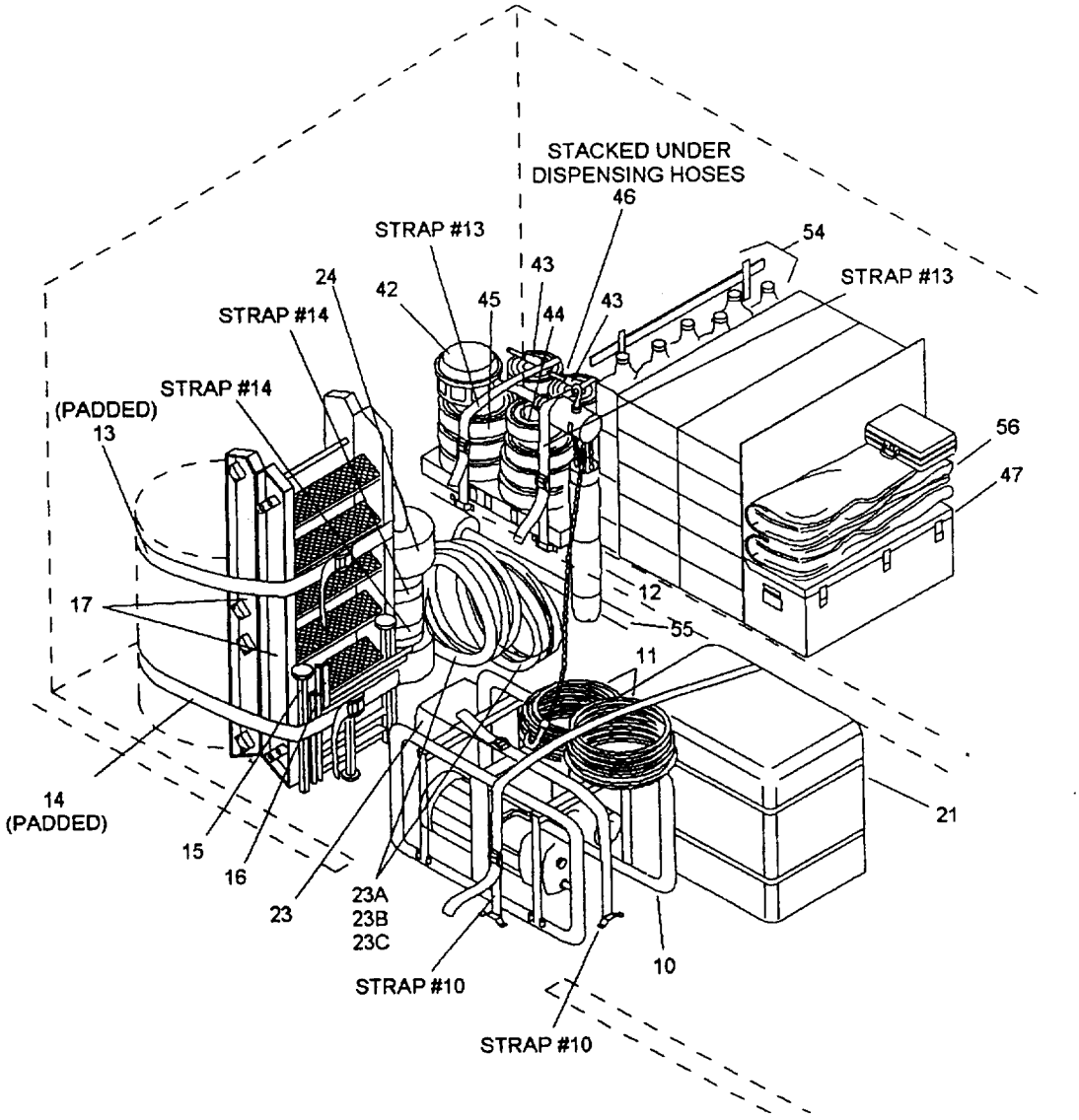


Figure 2-24. Unloading the ROWPU (Sheet 2 of 3)
(MODEL WTA-060 ONLY)

(a) The chain hoist is already attached to the eyebolt (1, Figure 2-25) on top of raw water pump.

(b) Pull down on one side of drive chain (2) to raise load hook (3). Pull down on other side of drive chain (4) to lower load hook

(c) Always latch the safety latches (5) after the hooks are attached to eyebolts.

NOTE
Apply silicone spray on strap ratchets and chain hoist monthly.

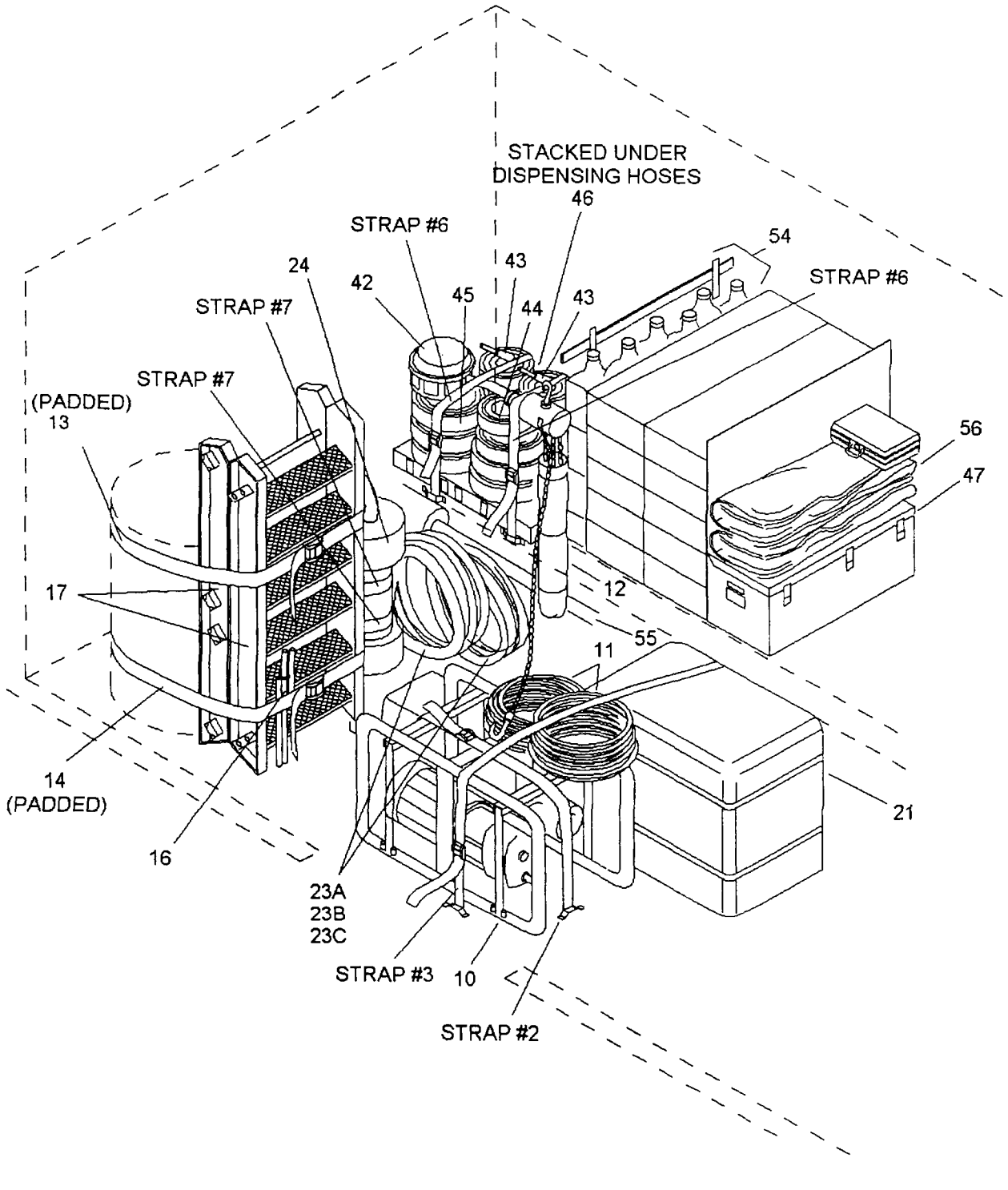


Figure 2-24. Unloading the ROWPU (Sheet 2.1 of 3)
(MODEL ROWPU-1 ONLY)

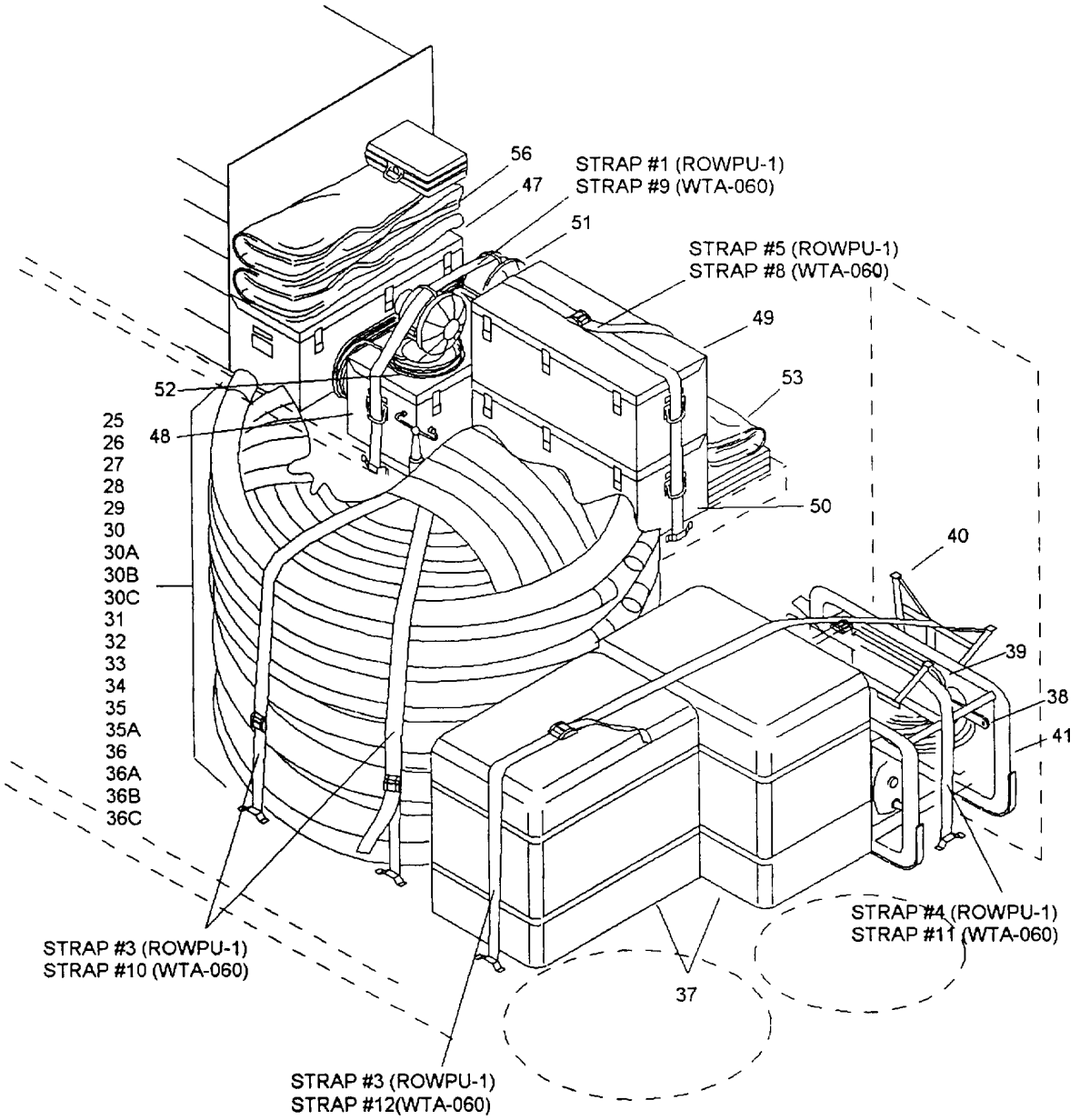


Figure 2-24. Unloading the ROWPU (Sheet 3 of 3)

WARNING

Check chains on hoist for link damage or wear regularly. Damaged or worn chains must be replaced immediately to prevent accidents. Notify unit maintenance.

(d) Lift raw water pump (10) off floor of ROWPU and guide it so that the straps on the raw water pump (10) face outward at doorway.

WARNING

Crewmember on ground should stand clear of pump frame to avoid being injured in event pump falls or is released too quickly.

Page 2-54 deleted

(8) Using hoist and pushing carefully on pump frame, crewmember in van with help from crewmember on ground "steers" the pump through the doorway and lowers it to the ground (Figure 2-25). Crewmembers on ground pull pump clear of access area.

(9) Crewmember in van removes padded straps (13 and 14, Figure 2-24, Sheets 2 or 2.1) from ground rods and hammer (16), access ladders (17), and funnel and hose and hands them to outside crewmember. On Model WTA-060, cyclone separator frame (15) is also removed and handed to outside crewmember.

(10) Crewmembers install one ROWPU access ladder at the door on the raw water side of the ROWPU (door closest to generator). Refer to Figure 2-24, Sheet 1.

NOTE
Make sure top step is touching the bottom side of deck on van.

WARNING
Ensure the slack is taken-up in the chain prior to hooking the snap or the ladder may slip and cause injury or death of the soldier using the ladder.

(a) Lean ladder against the trailer.

(b) Slide ladder up against the ROWPU floor deck plate (18).

(c) Loop chains (19) through trailer side stake pocket (20) and hook to itself with the snap hook.

(d) Pull bottom of ladder out until chains are tight.

(e) Install handrails (8) as shown and tighten wing nuts.

WARNING
Each storage tank weighs 130 lbs. (59 kg). Three people are required to carry each tank.

(11) Refer to Figure 2-24, Sheet 2. Remove storage tank (21).

(12) Deleted.

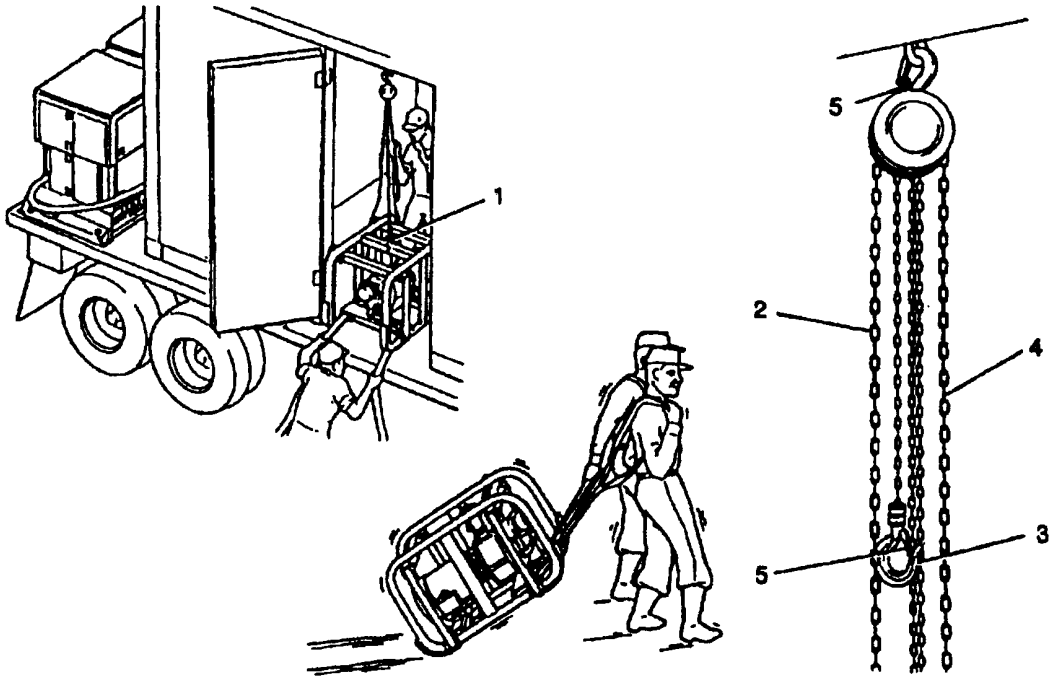


Figure 2-25. Unloading Raw Water Pump

(13) Move 5 gallon jug (23) close to door; it remains in van.

(13.1) Remove two NBC operation hoses (23A), NBC drain hose (23B), and funnel tubing (23C.)

(14) On Model WTA-060, remove two straps #14 (Figure 2-24, Sheet 2) and remove two cyclone separators (24).
On Model ROWPU-1, remove two straps #7 (Figure 2-24, Sheet 2.1) and remove one cyclone separator (24).

(15) On Model WTA-060, remove two straps #10 (Figure 2-24, Sheet 3). On Model ROWPU-1, remove two straps #3.

(16) Remove the following hoses.
- (a) On Model WTA-060, two raw water pump discharge to separator hoses (25). On Model ROWPU-1, one raw water pump discharge to separator hose (25).
- (b) Two 2 in. diameter distribution pump suction hoses (26).
- (c) Five 10 ft. product to storage hoses (27).
- (d) Two 3 in. diameter distribution pump suction hoses (28).
- (e) Ten raw water suction hoses (29).
- (f) Raw water and distribution pump drain hoses (30).
- (g) Two sump drain hoses with fittings (30A).
- (h) Two sump drain hoses without fittings (30B).
- (i) On Model ROWPU-1, one cyclone separator drain hose (30C). ON Model WTA-060, two cyclone separator drain hoses (30C).

(17) Remove the following couplings and accessories.
- (a) Priming pitcher (31).
- (b) Product out adapter and product shut-off valve (32).
- (c) Storage tank special tee (33).
- (d) Distribution pump discharge pipe section (34).
- (e) Raw water feed pipe section (35).
- (f) Raw water system pipe section (35A).
- (g) Prime assist pump (36).
- (h) Funnel (36A).
- (i) Separator out pipe section (36).
- (j) Waste out pipe section (36C).

(18) On Model ROWPU-1, remove strap #3 and strap #4 (Figure 2-24, Sheet 3). On Model WTA-060, remove strap #11 and strap #12.

WARNING
Each storage tank weighs 130 lbs. (59 kg). Three people are required to carry each tank.

(19) Remove two storage tanks (37).

(20) Remove anchor (38), anchor rope (39), stool (40). Set stool aside.

(21) Remove distribution pump (41) as follows:
- (a) Attach chain hoist to eyebolt (1, Figure 2-26).
- (b) Attach chain hoist to distribution pump eyebolt (2).
- (c) Use hoist to lift pump and guide it out of door.

(22) Install the second access ladder and hand rails on distribution side of van.

(23) On Model WTA-060, remove two straps #13 (Figure 2-24, Sheet 2). On Model ROWPU-1, remove two straps #6 (Figure 2-24, Sheet 2.1)

CAUTION
Hoses may be damaged if rolled or thrown from unit.

(24) Remove the following:
- (a) Strainer assembly (42).
- (b) Two dispensing hoses with nozzles (43).
- (c) 60 ft. auxiliary fill hose (44).
- (d) Six waste out hoses (45).

(e) Remove four raw water discharge hoses (46).

(f) On Model ROWPU-1, remove straps #1 and #5 (Figure 2-24, Sheet 3). On Model WTA-060, remove straps #8 and #9.

(g) Storage box #2 (47) is permanently mounted on lab table. Remove storage boxes (48), (49), and (50).

(h) Remove two heat lamps (51) and raw water pump and heat lamp extension cords (52).

(i) Remove three ground cloths (53).

(j) Remove raw water and distribution pump skids.

(24.1) Chemical dispensing bottles (54) and five gallon water jug (23, Figure 2-24, sheet 2) stay in place for use in start up. RO element pusher (55) stays in position under table until used. Store raw water and distribution coves (56) behind control panel until used.

NOTE
The cleaning heat-up hose remains in the van.

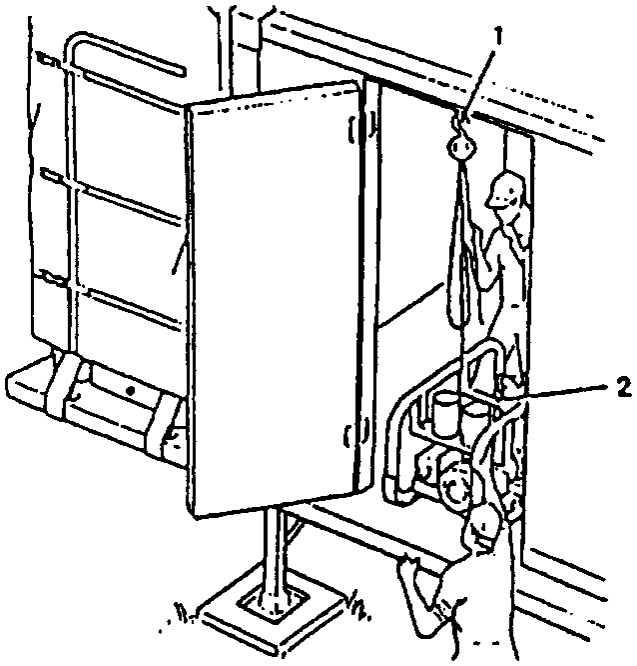


Figure 2-26. Unloading Distribution Pump

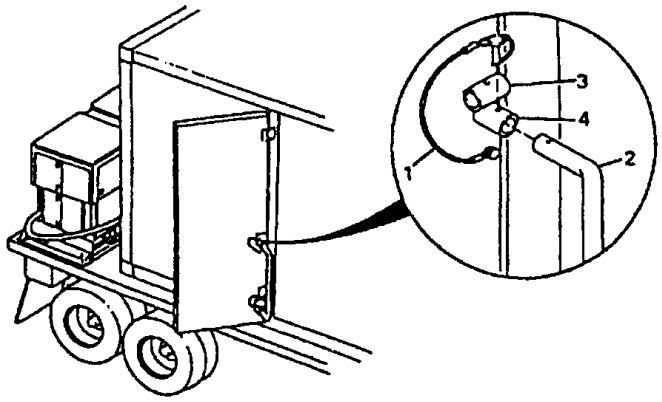


Figure 2-26.1. Handrail Installation

(25) Setup handrail on raw waterside ISO shelter door (Figure 2-26.1).

(a) Remove pins (1) and side handrail (2) out of brackets (3).

(b) Replace handrail (2) in bracket (4) so it is at a 90' angle to the door.

(c) Replace pins (1) on brackets (4).

(d) Deploy (Set-Up) Raw Water Intake System.

(1) Use the shoulder straps (Figure 2-25) to pull the raw water pump (1, Figure 2-27) into place. Make sum pump location is within limits shown on Figure 2-22 and upstream of cyclone separator if water source is a river or has prevailing flow.

CAUTION
Make note of tidal or river flood conditions and keep the pump located beyond the reach of the water.

NOTE

- **Keep the following in mind:**
- **Place intake in center of narrow rivers in deep water**
- **Place intake at least 50 ft (15 m) from shore in wide rivers.**
- **Place intake as far out as possible at ocean beaches.**
- **Place pump less than 30 ft (9 m) from waters edge.**
- **Flat tidal beaches may require moving the pump according to tide conditions.**

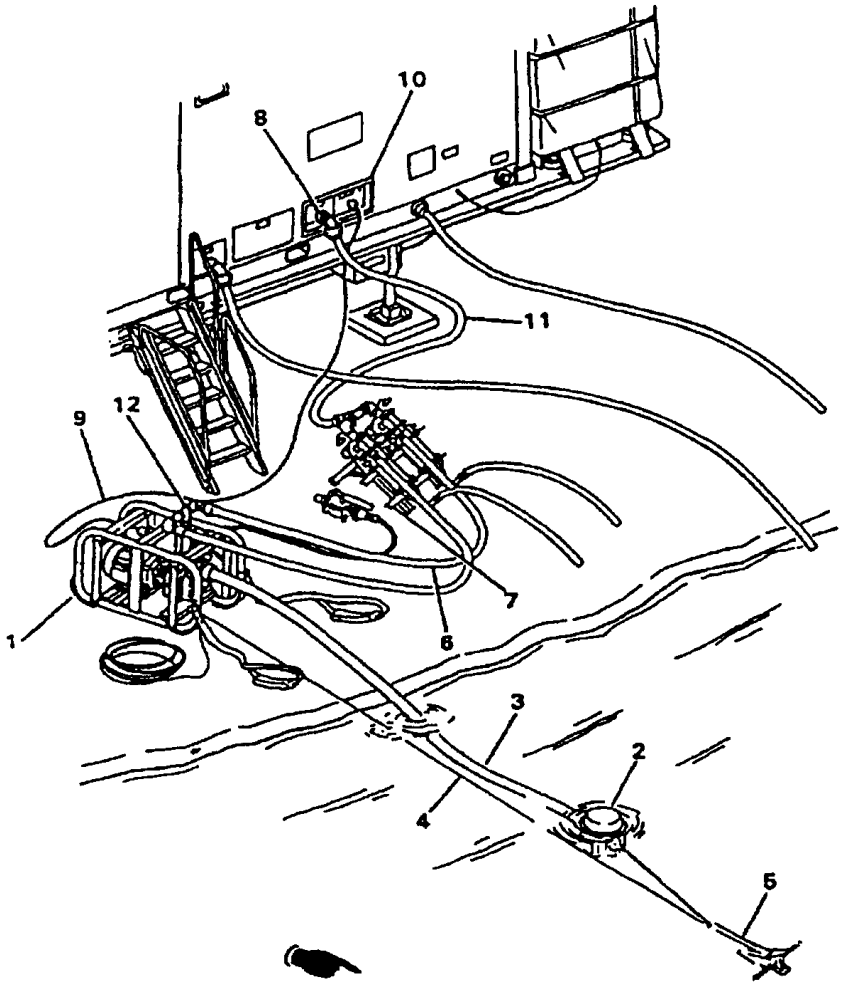


Figure 2-27. Deployed Raw Water Intake System (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

(2) Carry intake strainer (2, Figure 2-27), raw water suction hose sections (3), anchor tie down rope (4), and anchor (5), to raw water pump location.

WARNING

Never use potable water hoses to handle raw water or raw water hoses to handle potable water. Mixing hoses could cause contamination of water resulting in serious illness. Hoses are labeled.

NOTE

Two people will be required to deploy intake strainer. Work as near to the shore line as possible.

(3) Attach the snap (with the pulley) to the anchor eye and double back so rope length from anchor to free ends is at least 100 ft (30 m).

CAUTION

Remove protective caps from hoses only when ready to make connection. Keep hose connectors out of dirt and sand.

NOTE

Inspect hose ends and gaskets before connecting hose sections. Replace damaged gaskets.

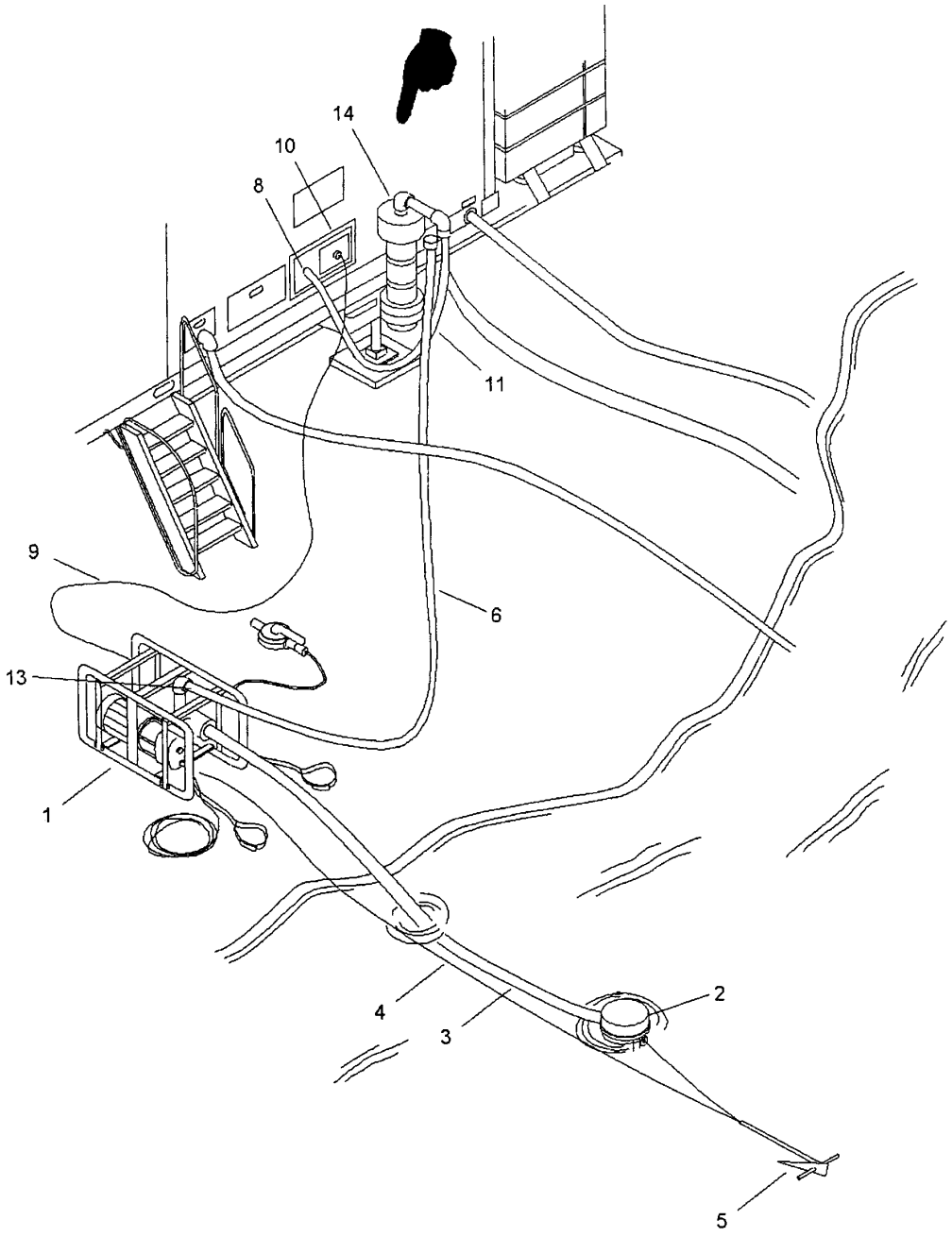


Figure 2-27. Deployed Raw Water Intake System (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

(4) Connect lengths of suction hose (3) required to reach intake point. Attach one end of hose to intake strainer. Keep sand and dirt out of connectors. Be sure gaskets are in place, and connectors are tight.

(5) Tightly cap raw water pump end of hose so air s trapped inside hose.

(6) Snap the end of the rope to the intake strainer eye and tie the free end to the suction hose.

(7) Carefully coil rope to prevent tangling when anchor is deployed.

WARNING
Other crew members must stand clear when anchor is being deployed.

(8) Deploy anchor (Figure 2-28).
   (a) Gain good footing near the waters edge.
   (b) Be sure rope is free to play out.
   (c) Throw anchor underhand into water source.
   (d) Pull slowly on the rope and feel for the anchor to grab. If t does not grab, repeat anchor deployment throwing it into an adjacent location.

Figure 2-28. Deploy Anchor

(9) Untie the free end of the rope from the suction hose. One crew member pulls free end of rope as another feeds out intake strainer and suction hose into water. When intake strainer is in desired position, uncap last hose. Hose will sink.

(10) Tie free end of anchor rope to raw water pump frame to secure the anchor (Figure 2-27).

(11) Connect or disconnect remaining suction hose sections (3) as required to obtain proper length. Connect raw water suction hose (3) to raw water pump (1).

(12) Install pipe section (12 for Model WTA-060 or 13 for Model ROWPU-1) to raw water pump (1) discharge.

(13) Connect raw water pump discharge hoses (6) to the pipe section (12 for Model WTA-060 or 13 for Model ROWPU-1) and lay out to location selected for the two separators (7) for Model WTA-060 or the single separator (14) installed on the trailer for Model ROWPU-1.

WARNING
Make sure the circuit breaker for the raw water pump is turned off. Failure to do so could result in electrocution.

CAUTION
Keep dirt and sand out of electrical connectors to prevent damage. Be sure connectors are locked tightly together.

CAUTION
Connect power cable first at pump motor, then at power outlet on ROWPU van.

(14) Uncoil and connect electrical cable sections (9) from raw water pump to raw water pump power outlet (10).

(15) Setup the cyclone separator as shown in Figure 2-29.

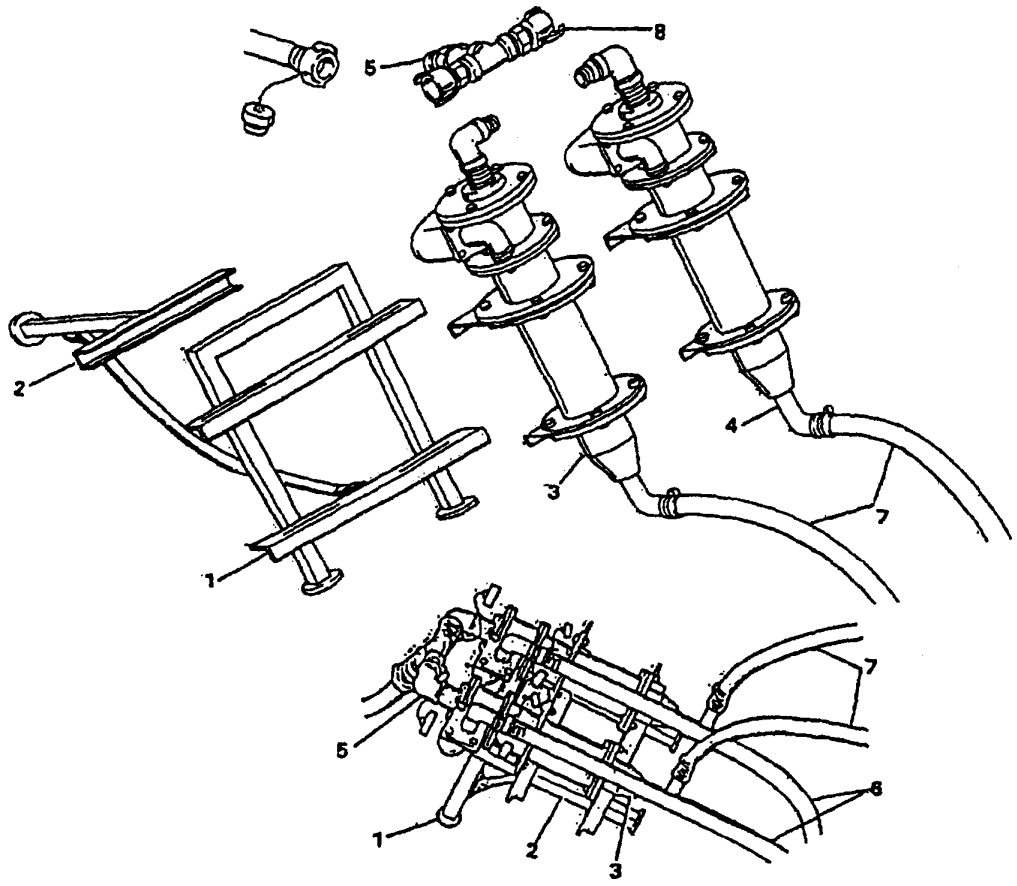


Figure 2-29. Set-Up Cyclone Separator (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

NOTE
Steps (a) through (j) apply to Model WTA-060 only.

NOTE
(MODEL WTA-060 ONLY)

When operating on well water with no convenient way to dispose of separator drain water it is allowable to disconnect the separator drain hose (7) from one separator and attach the hose from the second separator to the drain connection of the first. The separators will then act as a pressure drop device to keep the pressure in the ROWPU raw water system from getting too high.

(a) Position the frame on a fiat area of ground within easy reach of the raw water pump discharge hoses.

(b) Press the cross bar of frame member (1) into the open channel of frame member (2) to form the triangular frame. Pull out base until strap is tensioned.

(c) Set one separator (3 or 4) in place on the frame by inserting the upper and lower flange into the slots in the cross members. Place foot on frame to keep from tipping.

(d) Push the mounted separator to the outside edge of the slots and set the remaining separator in its place.

(e) Connect the separator discharge manifold (5) to one separator. Leave cam levers (8) open.

(f) Push both separators together until the manifold connection firmly mates with the second separator. Finish connection by closing hose cam levers (8).

(g) Connect the raw water pump discharge hoses (6) to the separators.

(h) Finish the installation by directing the separator drain hoses (7) away toward the water source.

(i) Install the 450 raw water inlet adapter (8, Figure 2-27) at the raw water inlet connection on the ROWPU van.

(j) Lay out and connect raw water hose sections (11, Figure 2-27) between the separator manifold (5, Figure 2-29) and the raw water inlet adapter. Use only the number of hoses sections needed. Avoid kinking.

NOTE
Steps (k) through (p) apply to Model ROWPU-1 only.

(k) Install the 90º raw water inlet adapter (8, Figure 2-27) at the raw water inlet connection on the ROWPU van.

NOTE
Do not set separator in front of booster access door.

(l) Install the cyclone separator (9, Figure 2-29)) into the stake pocket (10) on the trailer.

(m) Install pipe section (15) onto the cyclone separator (9).

(n) Connect the raw water discharge pump hose (12) to the cyclone separator (9).

(o) Connect the raw water inlet hose (11) to the raw water inlet (14) and to the pipe section (15).

(p) Direct the cyclone separator drain hose (13) toward the water source.

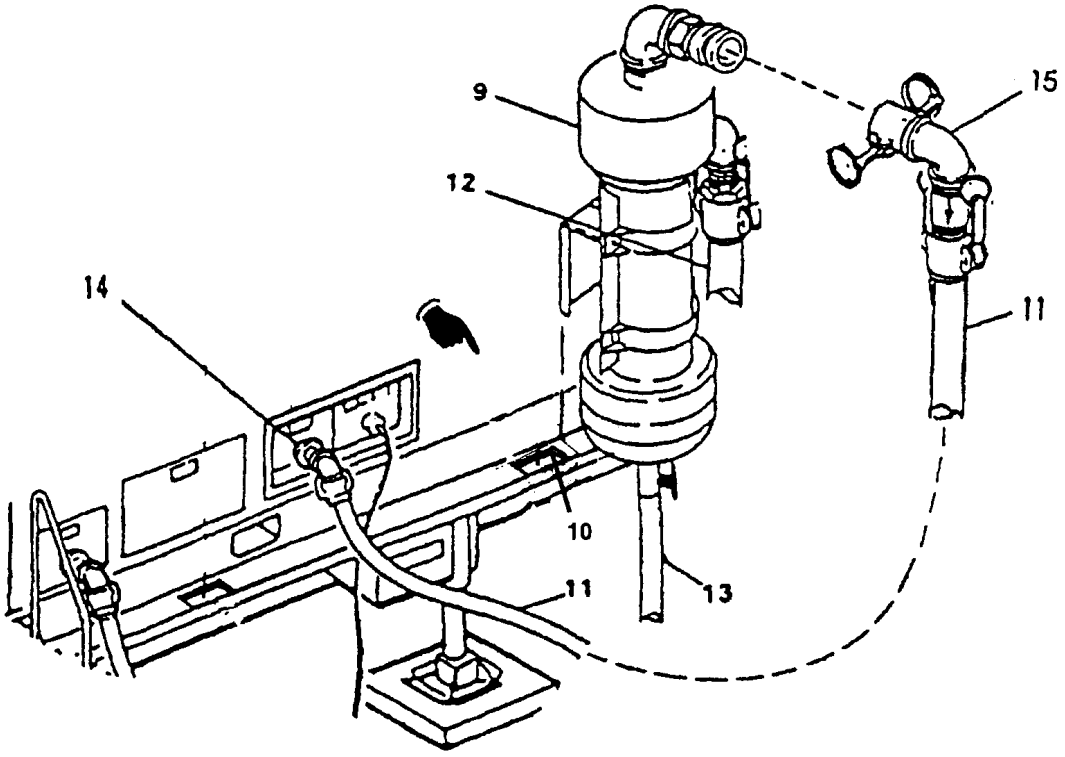


Figure 2-29. Set-Up Cyclone Separator (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

e. *Ready Diesel Generator (Figure 2-30, Sheet 1 of 2)*. (MODEL WTA-060 ONLY)

WARNING

A good ground is required to protect operators and equipment, and to provide lightning protection. Failure to properly ground the generator, ISO container and high pressure pump assembly could result in electrocution.

WARNING

Ground rod must be driven at least 8 ft (2.5 m) deep to be sure of a good ground. A poor electrical ground can lead to injury or death from electrical shock.

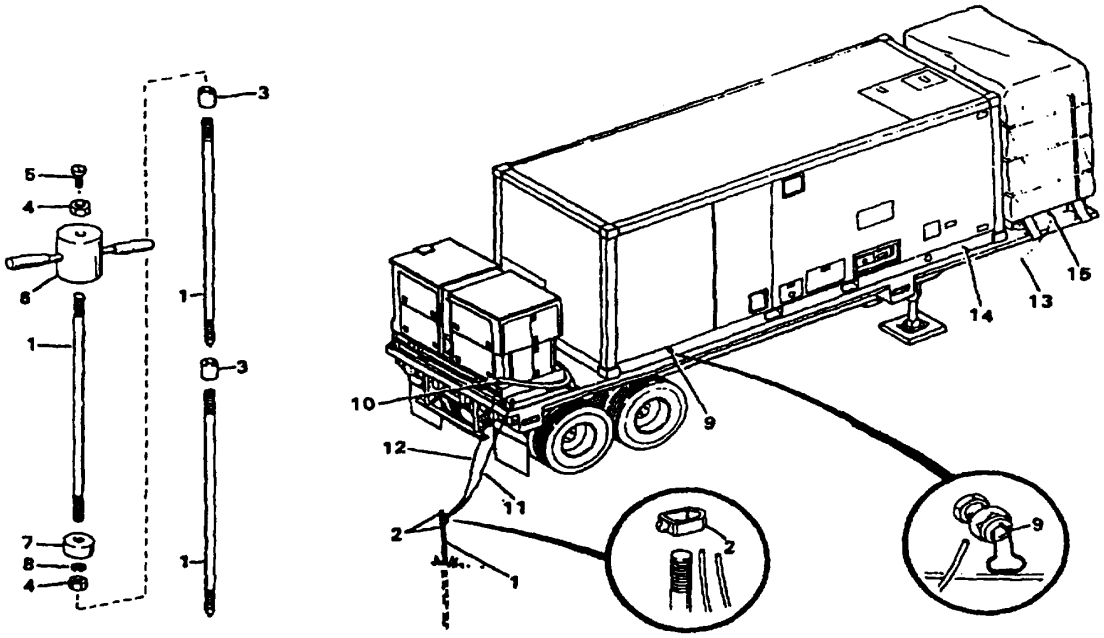


Figure 2-30. Ground Rod Installation (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

NOTE

Refer to TM 5-6115-545-12 or TM 9-6115-645-10 for generator operation.

NOTES

- **Ground rod assembly with special ROWPU cables are used to ground the generator and the ROWPU.**
- **Water area around grounding rod site to loosen ground before driving in rod.**

(1) Locate the two ground rod sections (1) with cable clamps (2) and collars (3) at a point where the assembled ground rods can be sunk into the earth at least 8 ft (2.5 m) and where the ground cables will not be ripped loose by vehicle travel or present a hazard to personnel movement.

(2) Remove collar (3) from end of one rod (1).

(3) Thread striker (7) completely onto one end of rod (1). Secure striker by installing lockwasher (8) and one nut (4).

(4) Slide hammer handle (6) onto the rod and thread remaining nut (4) onto end of rod to form slide hammer assembly.

(5) Thread the hammer assembly into the collar (3) of another rod. Using the hammer, drive the rod into the ground leaving approximately 3 in. exposed.

(a) Unthread the hammer assembly from the rod.

(b) Thread the remaining rod (1) and collar (3) into the rod in ground.

(c) Thread the hammer assembly into the collar (3) and drive the second rod into ground, leaving approximately 3 exposed.

(d) Unthread hammer assembly.

(6) Remove nuts (4), lockwasher (8), striker plate (7) and hammer (6) from rod (1).

(7) Thread remaining collar (3) onto rod (1). Insert striker bolt (5) into collar. Using hammer, drive rod into ground, leaving approximately 1 ft. exposed.

(8) Uncoil ground cables (11 and 12). Install one end of both cables to the rod using cable clamp (2). Unscrew the nuts from grounding lugs (9 and 10) to expose slots in lugs.

(a) Connect the shorter cable to the generator ground lug (10) and tighten lug nut.

(b) Connect the longer cable (11) to the ROWPU ground lug (9) and tighten lug nut.

(9) Place the front door fire extinguisher on the ground next to the ground rod.

(10) Check to make certain that grounding cable (13) is securely attached to grounding lugs (14) and (15). Cable should remain attached during transport and deployment but will be disconnected whenever the van or high pressure pump assembly are removed from the trailer.

e.1. *Ready Diesel Generator (Figure 2-30, Sheet 2 of 2).* (**MODEL ROWPU-1 ONLY**)

WARNING

A good ground is required to protect operators and equipment, and to provide lightning protection. Failure to properly ground the generator, ISO container and high pressure pump assembly could result in electrocution.

WARNING

Ground rod must be driven at least 8 (.5 m) deep to be sure of a good ground. A poor electrical ground can lead to injury or death from electrical shock.

NOTE

Refer to TM 5-6115-545-12 or TM 9-6115-645-10 for generator operation.

NOTES

- **Ground rod assembly with special ROWPU cables are used to ground the generator and the ROWPU.**
- **Water area around grounding rod site to loosen ground before driving in rod.**

(1) Locate the two ground rod sections (1) with cable clamps (2) and collars (3) at a point where the assembled ground rods can be sunk into the earth at least 8 ft (2.5 m) and where the ground cables will not be ripped loose by vehicle travel or present a hazard to personnel movement.

(2) Remove collar (3) from end of one rod (1).

(3) Thread striker (7) completely onto one end of rod (1). Secure striker by installing lockwasher (8) and one nut (4).

(4) Slide hammer handle (6) onto the rod and thread remaining nut (4) onto end of rod to form slide hammer assembly.

(5) Thread the hammer assembly into the collar (3) of another rod. Using the hammer, drive the rod into the ground leaving approximately 3 in exposed.

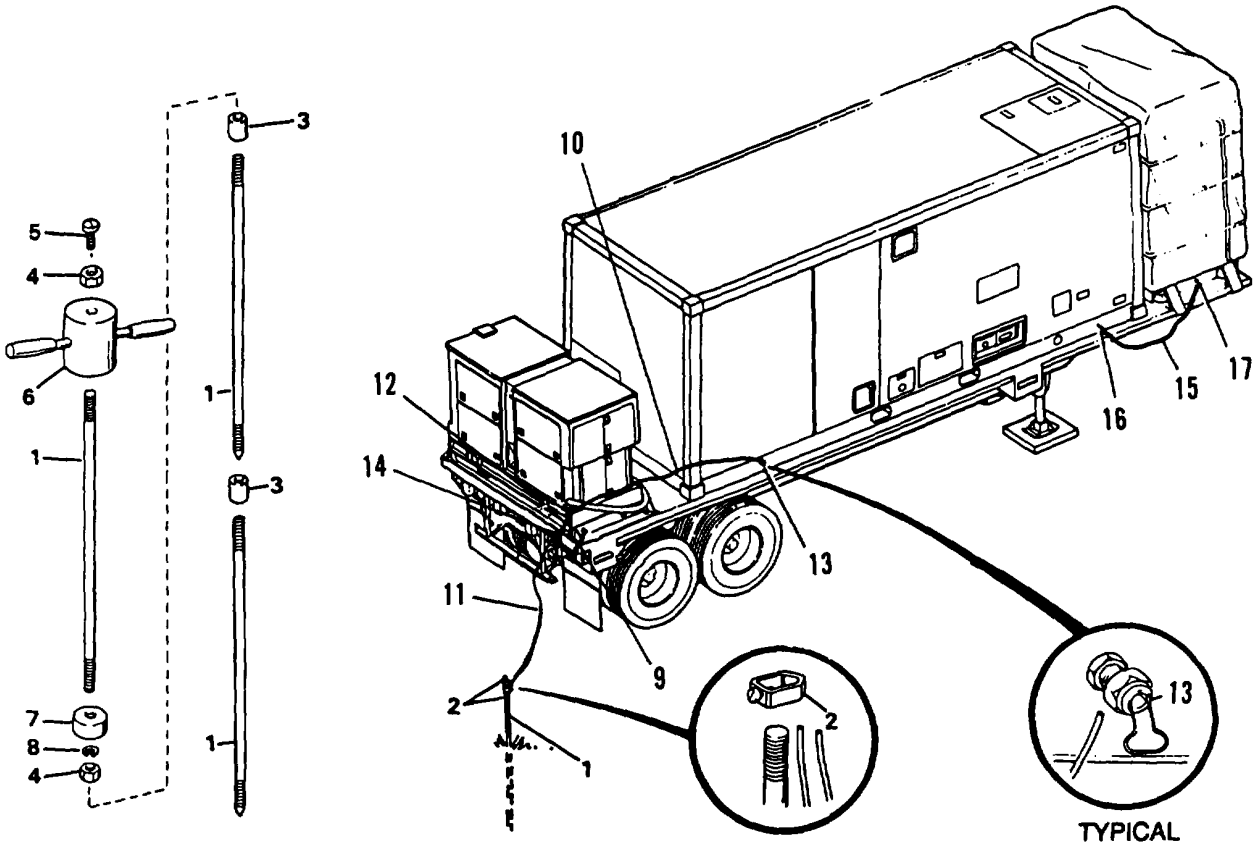


Figure 2-30. Ground Rod Installation (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

(6) Uncoil ground cables (9), (10), and (11).
(7) Unscrew the nuts from generator ground lug (12), ROWPU ground lug (13), and trailer ground lug (14) to expose slots in lugs.
(8) Connect one end of ground cable (9) to generator ground lug (12) and tighten lug nut.
(9) Connect one end of ground cable (10) to ROWPU ground lug (13) and tighten lug nut.
(10) Connect other ends of ground cables (9) and (10) and one end of ground cable (11) to trailer ground lug (14) and tighten lug nut.
(11) Install other end of ground cable (11) to grounding rod (1) using cable clamp (2).
(12) Place front door fire extinguisher on the ground next to ground rod (1).

WARNING

Check to make certain that grounding cable (15) is securely attached to grounding lugs (16 and 17). Cable (15) should remain attached during transport and deployment, but will be disconnected whenever the van or high pressure pump assembly are removed from the trailer.

f. *Waste Outlet and Sump Drain Hoses (Figure 2-31, Sheet1I of 2).* (MODEL WTA-060 ONLY)

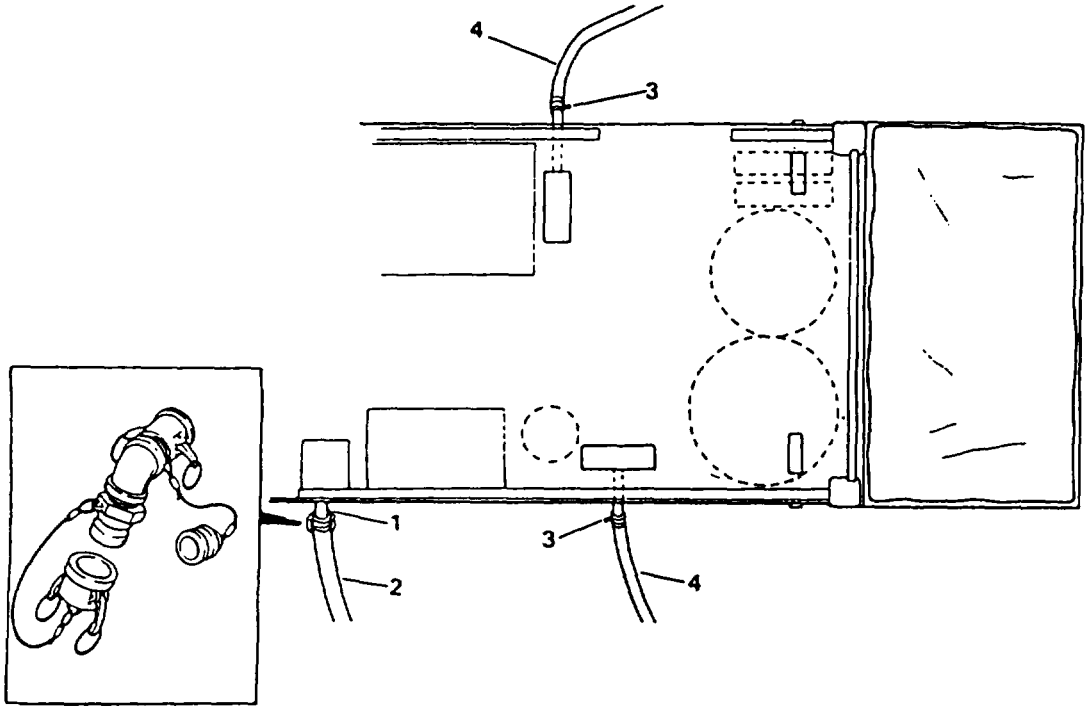


Figure 2-31. Waste Outlet and Front Sump Drain Connections (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

WARNING

Under some unusual conditions, air may be pushed out the waste hose (2) causing the end to whip. Stand clear of hose end by at least 20 ft (6 m) while ROWPU is operating.

NOTE

Be sure to remove caps from ends of waste out hose section

(1) Connect waste outlet 450 adapter (1) to waste-out connection. Connect waste hose (2) sections as needed to reach water. The open end is placed back in the water at least 50 ft(15 m) from intake (downstream in a river). Six 50 ft (15 m) coils of waste out hose are applied. Remove any sharp kinks or bends in hose.

(2) Connect 45° adapters (3) to drain-out connections. Connect sump drain hoses (4) to drain-out connections and place discharge ends downstream and away from work areas.

f.1. *Waste Outlet and Sump Drain Hoses (Figure 2-3 1, Sheet 2 of 2).* (MODEL ROWPU-1 ONLY)

WARNING

Under some unusual conditions, air may be pushed out the waste hose (2) causing the end to whip. Stand clear of hose end by at least 20 ft (6 m) while ROWPU is operating.

NOTE

Be sure to remove caps front ends of waste out hose section

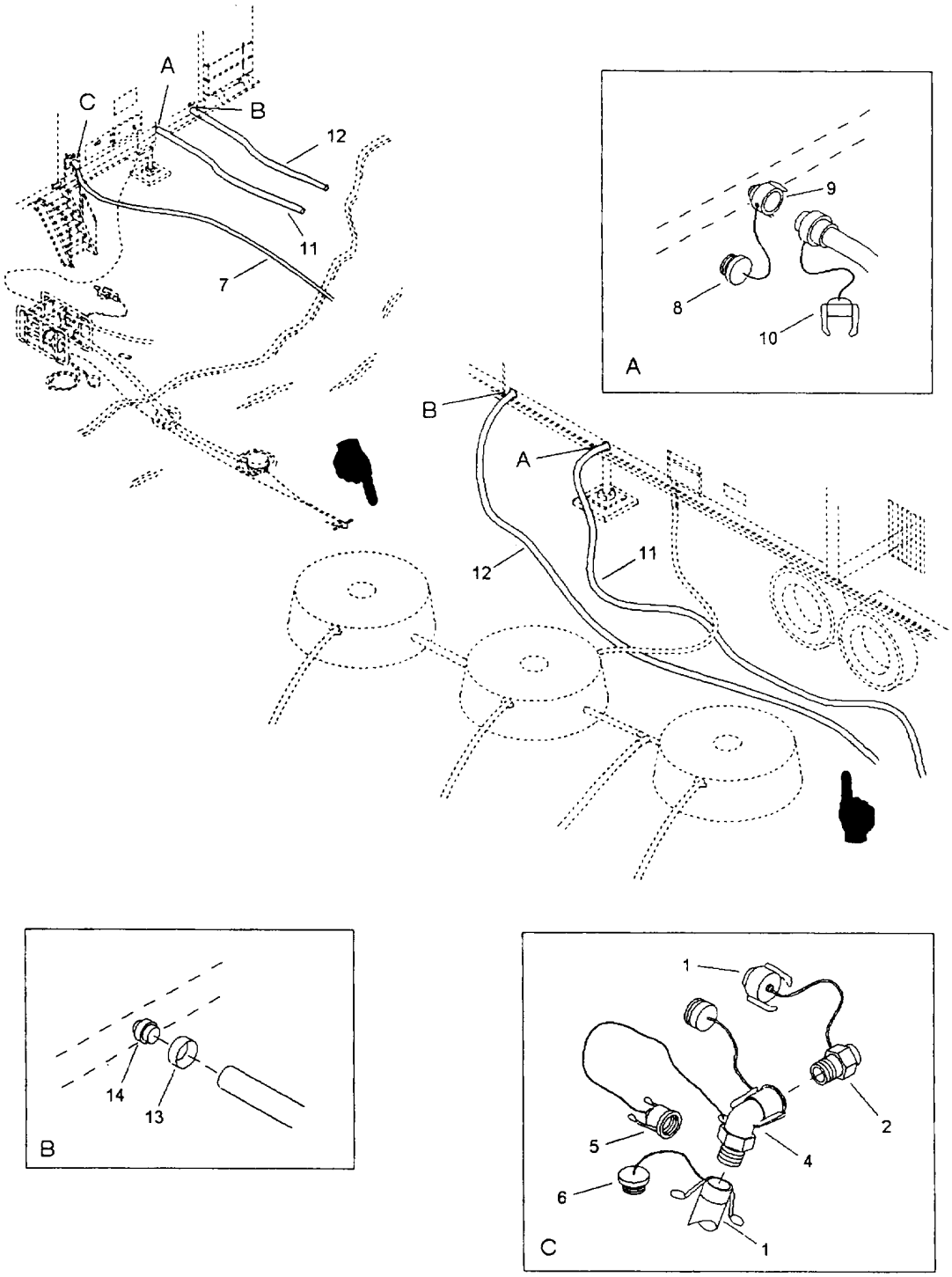


Figure 2-31. Waste Water and Front Sump Drain Connections (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

(1) Remove cap (1) from connector (2) of the waste water port of the ROWPU.

(2) Remove plug (3) from waste water 45º outlet adapter (4).

(3) Install waste water 45º outlet adapter (4) to connector (2).

(4) Remove cap (5) from waste water 45º outlet adapter (4).

(5) Remove plug (6) from waste water hose (7).

(6) Install waste water hose (7) onto waste water 45º outlet adapter (4).

(7) Connect other sections of waste hoses (7) as needed to reach water. The open end of the last section must be placed into the water at least 50 feet (15 meter) downstream from the ROWPU raw water intake. Six 50 foot (15 meters) long sections of waste hose are supplied.

(8) Remove two plugs (8) from two connectors (9) at the two piping drain ports of the ROWPU. One drain pod is located on each side of the ROWPU.

(9) Remove caps (10) from two drain-out hoses (11) and connect one drain-out hose to the drain-out ports on each side of the ROWPU. Place discharge ends of drain-out hoses downstream from raw water intake and away from work areas.

(10) Connect sump drain hose (12) and clamp (13) to connector (14) on ROWPU. Repeat for sump drain on other side of ROWPU. Place discharge ends of sump drain hoses downstream from raw water intake and away from work areas.

(11) Remove any sharp kinks or bends from all wastewater hoses to insure proper drainage in hoses during ROWPU operation.

g. Deploy (Set-Up) Water Distribution System (Figure 2-32).

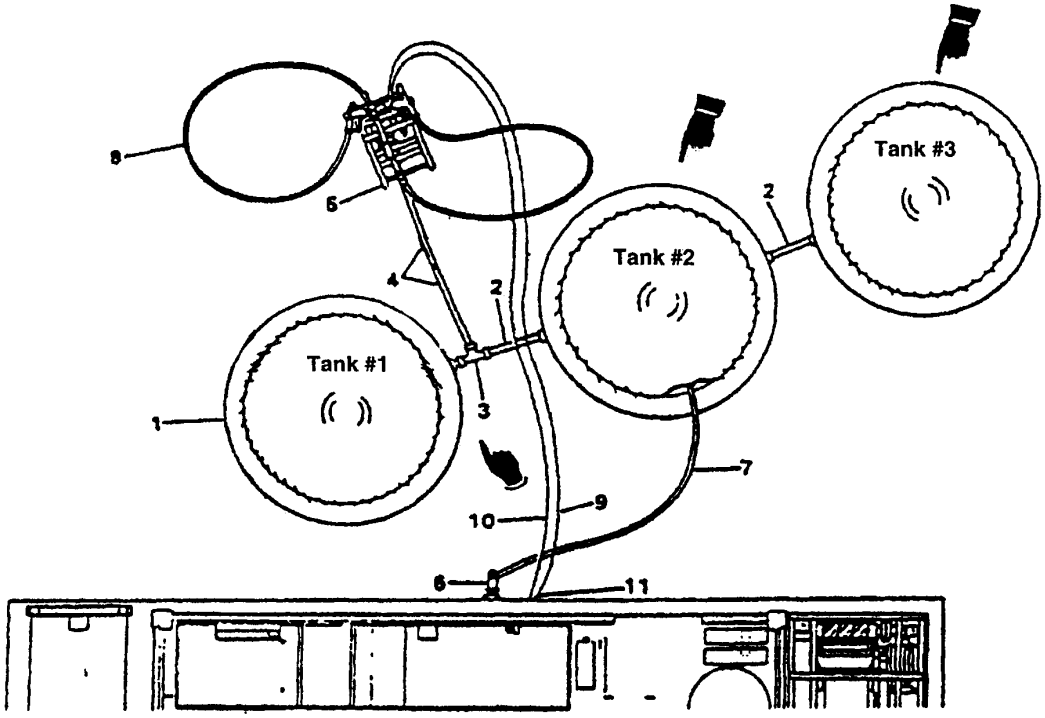


Figure 2-32. Water Distribution System Deployment

WARNING

Never use potable water hoses to handle raw water, or raw water hoses to handle potable water. Mixing hoses could cause contamination of potable water resulting in serious illness. Hoses are labeled.

NOTE

Remove protective caps from hoses only when ready to make connection. Do not allow sand or dirt to get into hoses or connectors. Inspect hose gaskets before making connections. Replace damaged gaskets.

NOTE

This set-up need not be finished until the ROWPU is started and water is being produced.

NOTE

Only 50 feet of potable water-to-storage hose is provided. Do not position storage tanks too far from ROWPU. Hose must reach center tank.

NOTE

Refer to TM 5-5430-225-12&P for set up and operation of storage tanks.

(1) Remove storage tanks, tank covers and ground cloths from protective covers.

(2) Spread out ground cloths where potable water storage tanks (1) will be located.

(3) Unfold tanks on ground cloths. Spread out to round shape and avoid ridges in the bottom.

(4) Pull out at tank connections to be sure they will be clear when tanks are filled.

(5) Remove caps and plugs from tank #1 connections and connect special tee (3) to tank #1 and connect distribution hose (2) to special tee (3). Connect other end of hose (2) to tank #2.

(6) Connect second distribution hose (2) to other side of tank #2 and connect other end of the hose (2) to tank #3.

NOTE

The storage to pump suction hose sections are the same size as raw water intake system hoses, except one has two female connectors and one has two male connectors to prevent accidental mix-up with raw water hoses.

(7) Connect storage to pump suction hose sections (4) together.

(8) Place distribution pump (5) into final position and connect suction hose (4) to pump (5) and other end of hose (4) to special tee (3).

(9) Connect product shutoff valve (6) to the product out connection.

(10) Connect product out water hose sections (7) to the product shutoff valves (6) and add sections as needed. Lay hose out on the ground with end directed away from the work area. Be sure to uncap the end.

(11) Connect distribution pump outlet piping to the distribution pump outlet.

(12) Connect both dispensing hoses (8) (with nozzles) to distribution pump outlet piping. Put dispensing nozzles in cups on pump frame. Do not leave them on ground.

(13) Connect the electrical power cable (9) from distribution pump to the Distribution Pump power outlet.

(14) Connect the electrical control cable (10) from the distribution pump to the distribution pump control outlet.

(15) Inflate storage tank colas using air pump. Install tank covers and support balls. (See TM 55-5430-225-12&P for storage tank instructions.)

2-15. INITIAL ADJUSTMENTS, CHECKS, AND SELF-TESTS. The following checks and tests must be made before starting the ROWPU. When these steps are completed the ROWPU will be ready to start.

a. After Movement and Assembly Adjustments and Checks. After setting up the ROWPU make sure:

NOTE

Use plastic covered checklist located in (MODEL WTA-060) ROWPU to assure that proper procedures have been followed.

(1) All hose couplings are tight.

WARNING

Make sure the circuit breaker for the raw water and distribution pump is turned off prior to proceeding. Failure to do so could result in electrocution.

(2) Electrical cable connectors am locked.

(3) Ground rod is driven in as described and illustrated in paragraph 2-14 and Figure 2-30.

(4) Ground cables are tight at both ends from the ground rod to trailer.

(5) Check raw water to determine if polyelectrolyte will be used. Use the portable turbidity meter (para. 2-6) to measure the raw water turbidity. If it is greater than 8.0, polyelectrolyte will be needed. Skip step (6) below. If it is less than 8.0. continue with step (6) below.

CAUTION

If polyelectrolyte is used when the color is greater than 10 and the turbidity is 8.0 or less, the elements will be plugged with a coating called tannic acid that can not be removed. This will require replacement of the elements.

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(6) Use the color test kit (para. 2-8) to measure the raw water color. If greater than 10 (and the turbidity is 8.0 or less), polyelectrolyte will not be needed. If 10 or less, polyelectrolyte will be used.

(7) Measure TDS of the raw water using portable TDS meter (para. 2-7).

(8) Check that cartridge filters are installed in cartridge filter vessel.

NOTE

If cartridge filers or RO elements are to be replaced, red tag as empty.

b. Before Start-up Adjustments and Checks

(1) See Figure 2-33 and establish electrical power as follows:

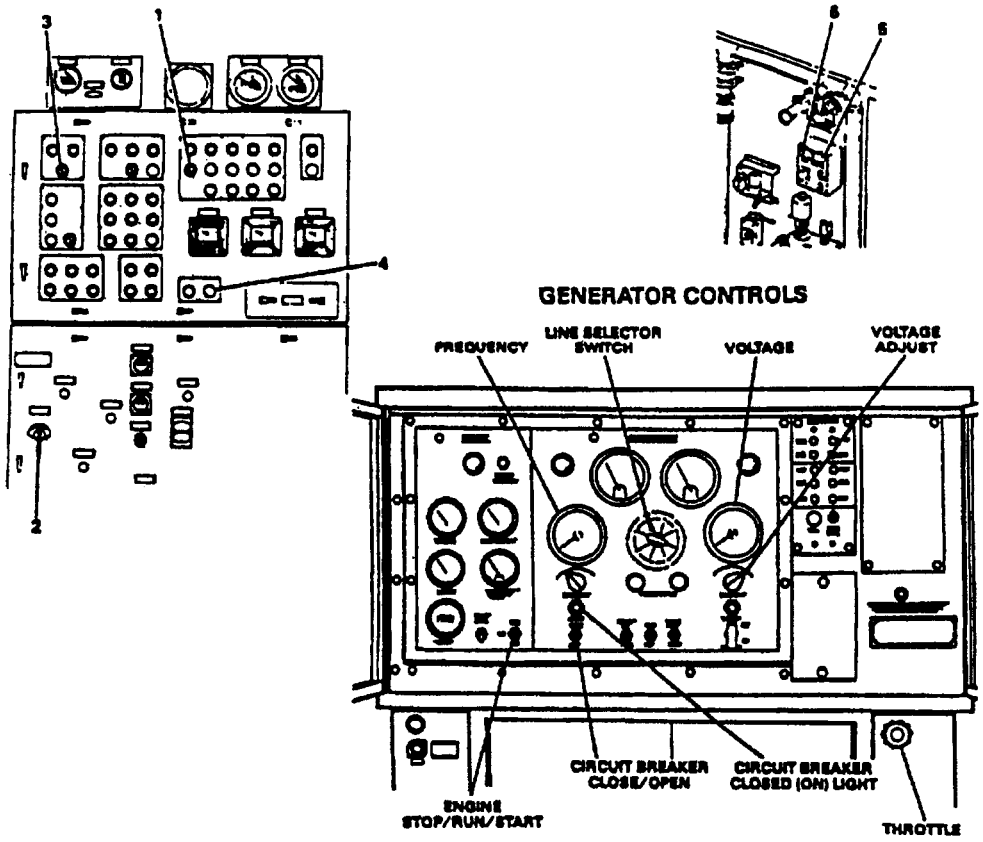


Figure 2-33. Establishing Electrical Power

(a) COMPRESSOR OFF/ON switch (1) OFF at main control panel.

(b) MAIN CIRCUIT BREAKER (2) OFF at main control panel.

(c) Check ground cables for tightness at both ends.

(d) Generator circuit breaker toggle switch in the OFF position.

(e) Start diesel generator as described in TM 5-6115-545-12 or TM 9-6115-645-10 and wait for diesel to settle out..

(f) Make sure generator line selector switch is set to L1-12 or L2-L3 or L3-L1.

NOTE

The diesel generator (MEP006A only) is a utility set. The frequency adjustment knob is not connected. Use the throttle for adjustment.

(g) Open throttle to obtain 60 Hz.

(h) Adjust voltage to 440 VAC.

(i) Turn generator circuit breaker toggle switch to ON.

(j) Check that main control panel SYSTEM MODE switch (3) is in SYSTEM ON.

(k) Turn main control panel MAIN CIRCUIT BREAKER (2) to ON. PANEL ENERGIZED light (28) must be lit, if not pull out EMERGENCY STOP (29) (Figure 2-34).

(l) Push SYSTEM RESET pushbutton (4) (Figure 2-33).

(m) Turn on lights with pushbutton (5).

(n) Open fan shutter and turn on vent fan with on/off switch (6).

(2) Prepare air system (Figure 2-34).

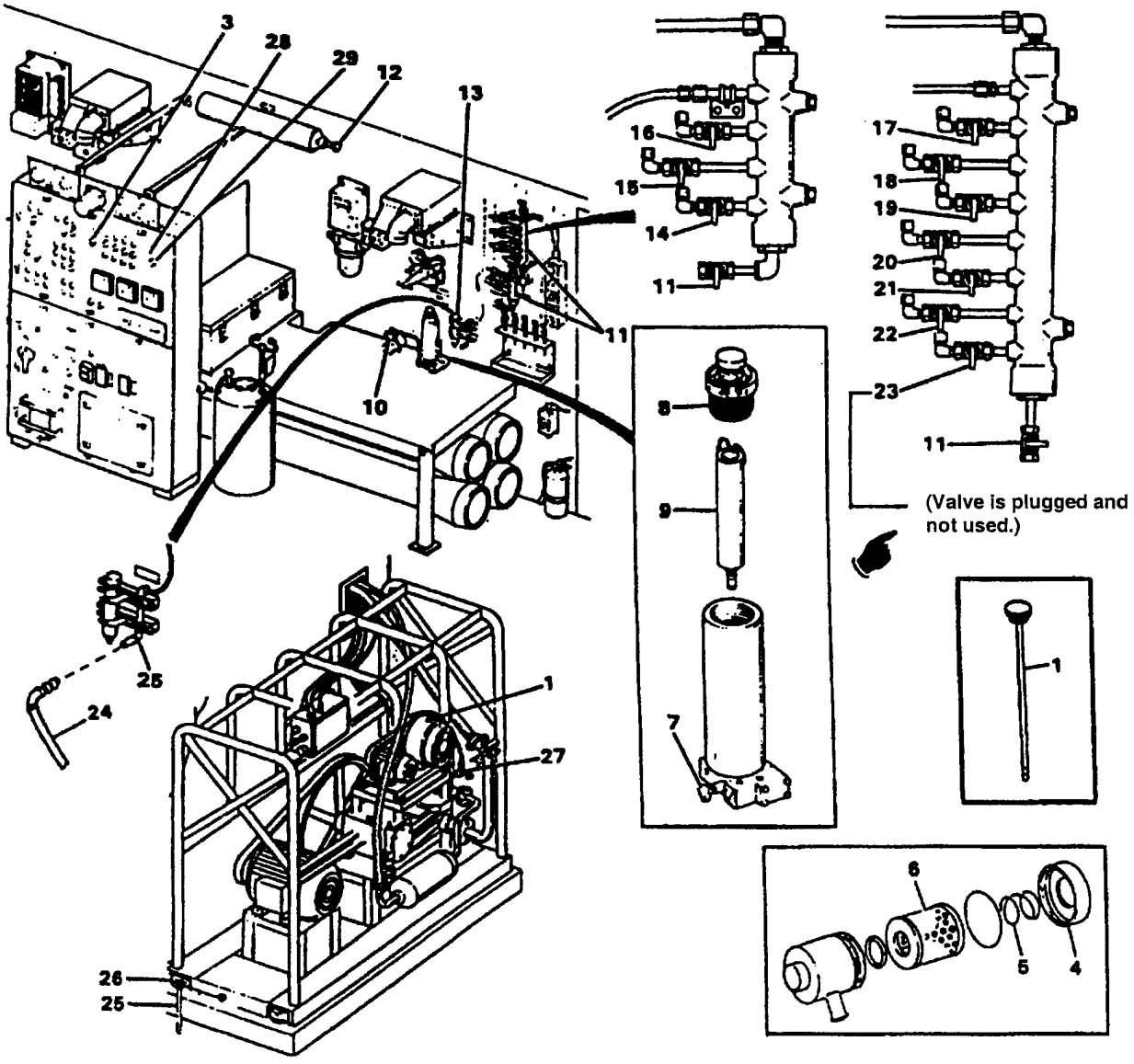


Figure 2-34. Ready Air System

(a) Check air compressor oil level dipstick (1). If oil level is below mark, add oil to top of mark.

(b) Close air compressor bleed valve (27).

(c) Check AIR COMPRESSOR hourmeter (2) and unit log for last filter replacement. Replacement intervals are shown in Table 2-14.

CAUTION

Clogged filters will reduce the operating efficiency of the ROWPU. If this is the first time that the ROWPU has been started or if the ROWPU has been in storage, replace the outlet filter before start up and after the air pressure bottle has been pressurized to 1800 psi. Thereafter, replace the outlet filter in accordance with the following table.

Table 2-14. Filter Replacement Intervals

Outlet Filter	Replace every 44 hours if below 85ºF (29ºC).
	Replace every 22 hours if above 85ºF (29ºC).
Inlet Filter	Replace every 250 hours.

(3) If the inlet filter requires replacement:

(a) Be certain COMPRESSOR OFF/ON switch (3) is OFF.

(b) Unscrew filter cover (4), spring (5), and filter (6).

(c) Install spring and new filter. Reinstall filter cover.

(4) If the outlet filter requires replacement:

WARNING

The air manual blowdown valve must be bled (opened) before removing the fitter cap. Failure to do so will result in the cap being blown off which could cause serious injury.

(a) Be certain COMPRESSOR OFF/ON switch (3) is OFF.

NOTE

Make certain air tank valve is closed.

(b) Open outlet filter housing drain cock (7) to release air pressure. Leave open.

NOTE

Do not turn vent knob on top of cap.

(c) Unscrew cap (8). Remove and throw away filter (9).

(d) If oil residue appears, remove filter housing and wipe down.

(e) Install new filter and reinstall cap (8).

(f) Close outlet filter housing drain cock (7). Make certain high pressure air auto blowdown block valve (10) is open.

(g) Air manifold bleed valves (11) closed.

(h) Air storage valve (12) open.

(i) Air dryer valve (13) closed.

(j) Media filter air purge block valve (14) closed.

(k) Air block valves (15 thru 23 for Model WTA-060, 15 thru 22 for Model ROWPU-1) open.

(l) Turn COMPRESSOR OFF/ON switch (3) ON. Notify unit maintenance if compressor malfunctions.

(4.1) Make sure air storage valve is open.

(5) Make sure all vent, drain, and sample valves listed in Table 2-15 are closed.

(6) Make sure manual valves are positioned as listed in Table 2-16.

NOTE

After air pressure has reached 85 psi (586 kPa), proceed with step 7 below.

(7) Remove utility air hose (24) from storage box 2 (43, Figure 2-24) and connect utility air hose to utility air connection (25, Figure 2-34) to stabilizers (26). Use utility air hose and fill stabilizers 26 to 30 psi (207 kPa) and use tire pressure gage to check pressure.

Table 2-15. Closed Vent, Drain, and Sample Valves (Item numbers are keyed to Figure 2-35)

Item	Description	Valve No.
1	Raw Water Pump Drain	V1
2	Clean/Flush Tank Drain	V4
3	Media Filter Vent	V19
4	Media Filter Upper Drain	V25
5	Media Filter Lower Drain	V24
6	Media Filter Outlet Sample	V33
7	Media Filter Outlet Piping Drain	V73
8	Deleted	
9	Cart. Filter Outlet Piping Drain	V40
10	Booster Pump Drain	V9
11	Cartridge Filter Drain	V39
12	Cartridge Filter Vent	V38
13	Raw Water Sample/Vent	V12
14	Distribution Pump Drain	V66
15	Cartridge Filter Outlet Sample	V41

Item	Description	Valve No
17	Product Drain	V48
18	Product Water Sample	V54-V59
19	High Pres. Pump Suction Vent	V76
20	High Pressure Pump Discharge Vent	
21	Product Vent	V100
22	Pulse Dampener Drain	V74
23	Air Compressor Bleed Valve	V70
24	Air Blanket Level Indicator Drain Valve	
25	Chemical Drain Valves	V26, V36-V37
26	High Pressure Drain Valves	V7
27	Pressure Gage Drain Valves	--

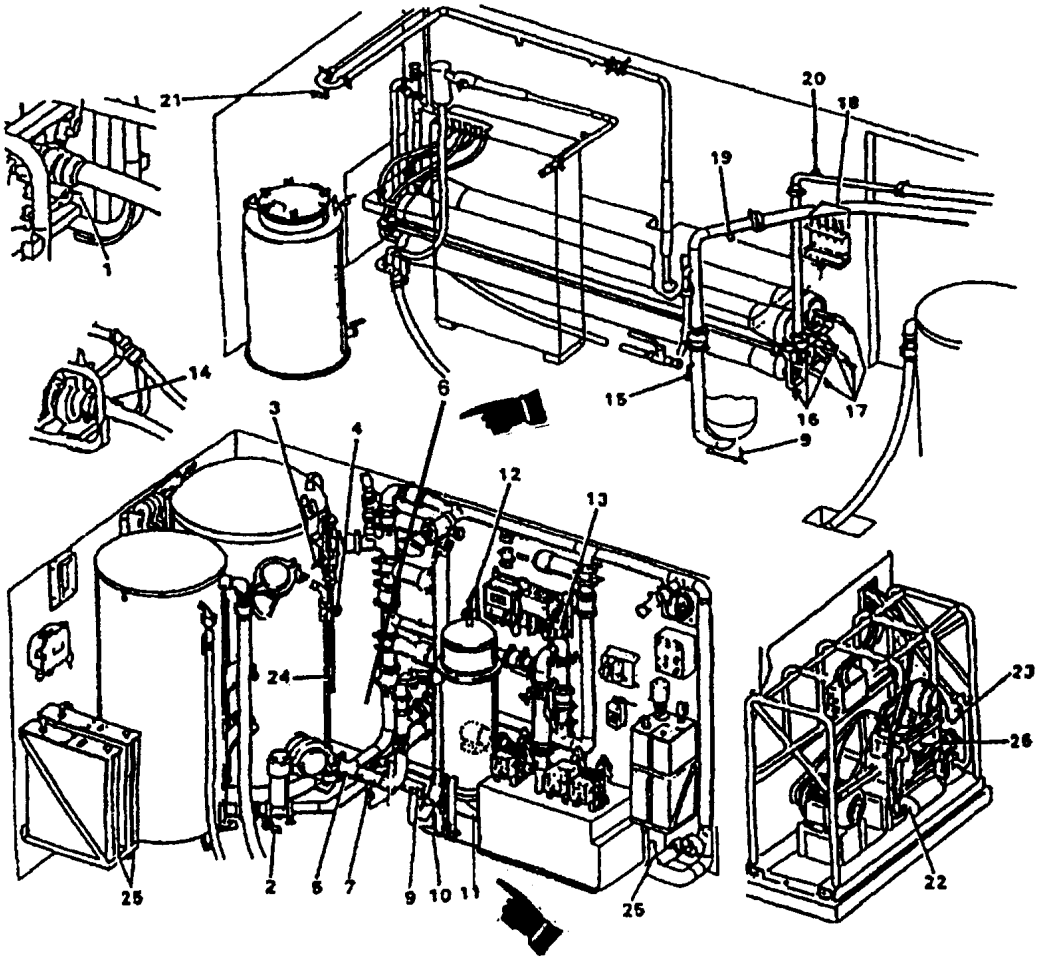


Figure 2-35. Vent, Drain, and Sample Valves (Sheet 1 of 2)

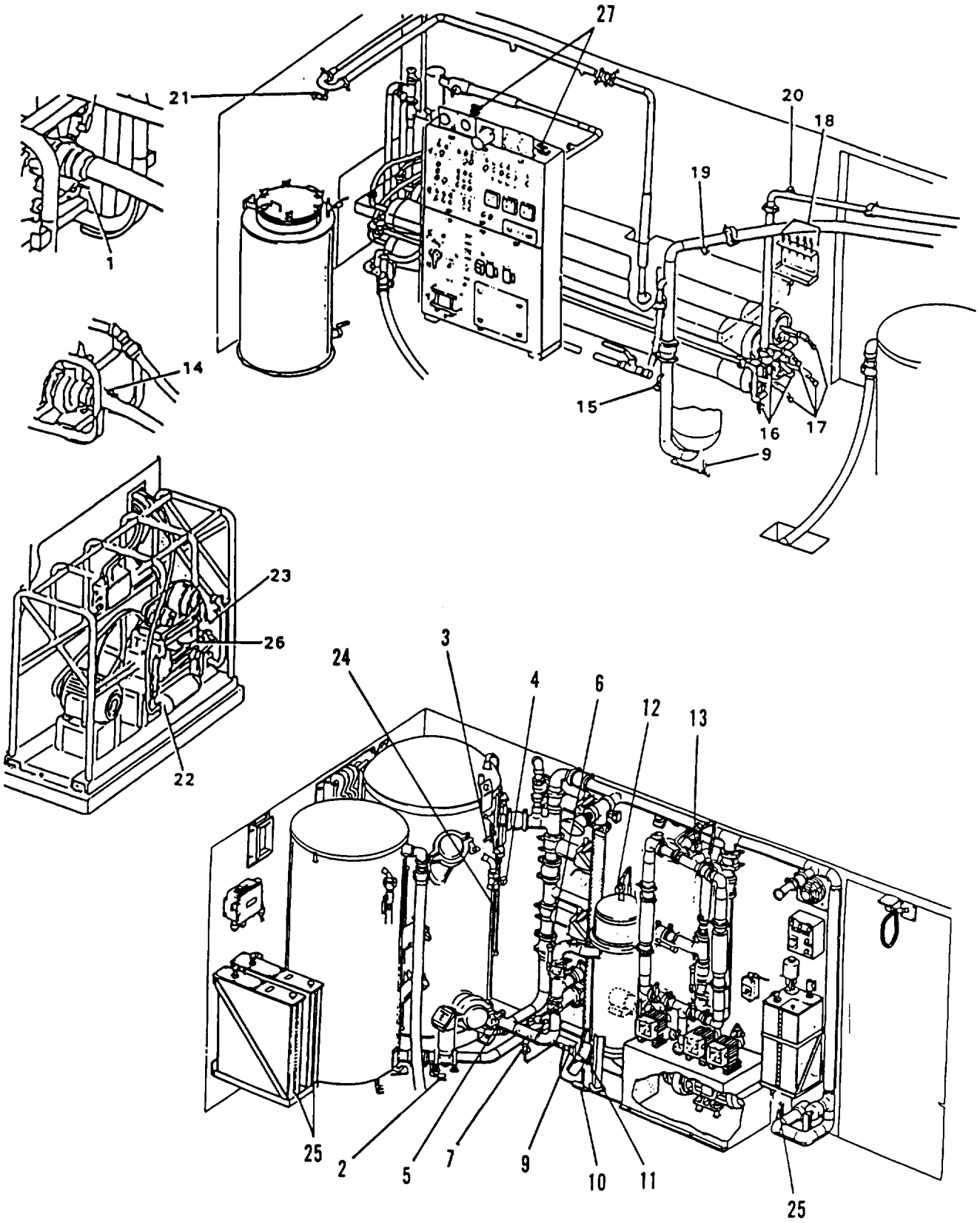


Figure 2-35. Vent, Drain, and Sample Valves (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

Table 2-16. Manual Valve Positions Prior to Star-Up (Item numbers are keyed to Figure 2-36)

Item	Description	Valve No.	Position	Item	Description	Valve No.	Position
1	Cartridge Filter Block	V37	Closed	5	Clean Return	V50	Closed
2	Feed	V14	Open	6	Clean/Flush Tank Fill	V52	Closed
3	Cleaning Bypass	V13	Closed	7	Product Utility Hose	V10	Closed
4	Product Shut-Off	V64	Open	8	System Control Valve	V51	Closed

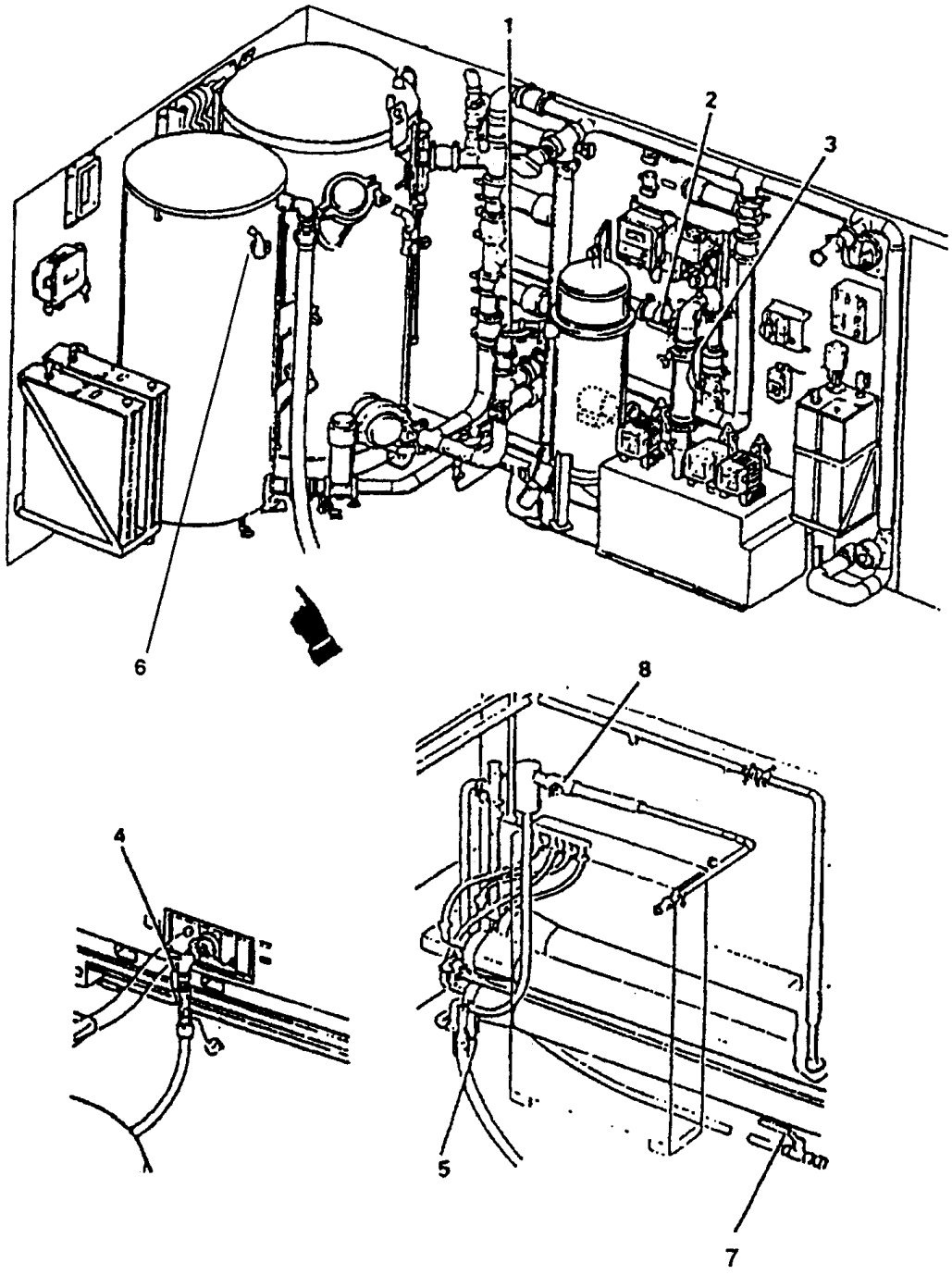


Figure 2-36. Manual Valve Pre-Star Positions (Sheet 1 of 2)
(Model WTA-060 Only)

Table 2-16. Manual Valve Positions Prior to Start-Up (Item numbers are keyed to Figure 2-36)

Item	Description	Valve No.	Position
1	Cartridge Filter Block	V37	Closed
2	Feed	V14	Open
3	Cleaning Bypass	V13	Closed
4	Product Shut-Off	V64	Open
5	Clean Return	V50	Closed
6	Clean/Flush Tank Fill	V52	Closed
7	Product Utility Hose	V10	Closed
8	System Control Valve	V51	Closed
9	Strainer Selection Valve	--	*
10	Strainer Selection Valve	--	*

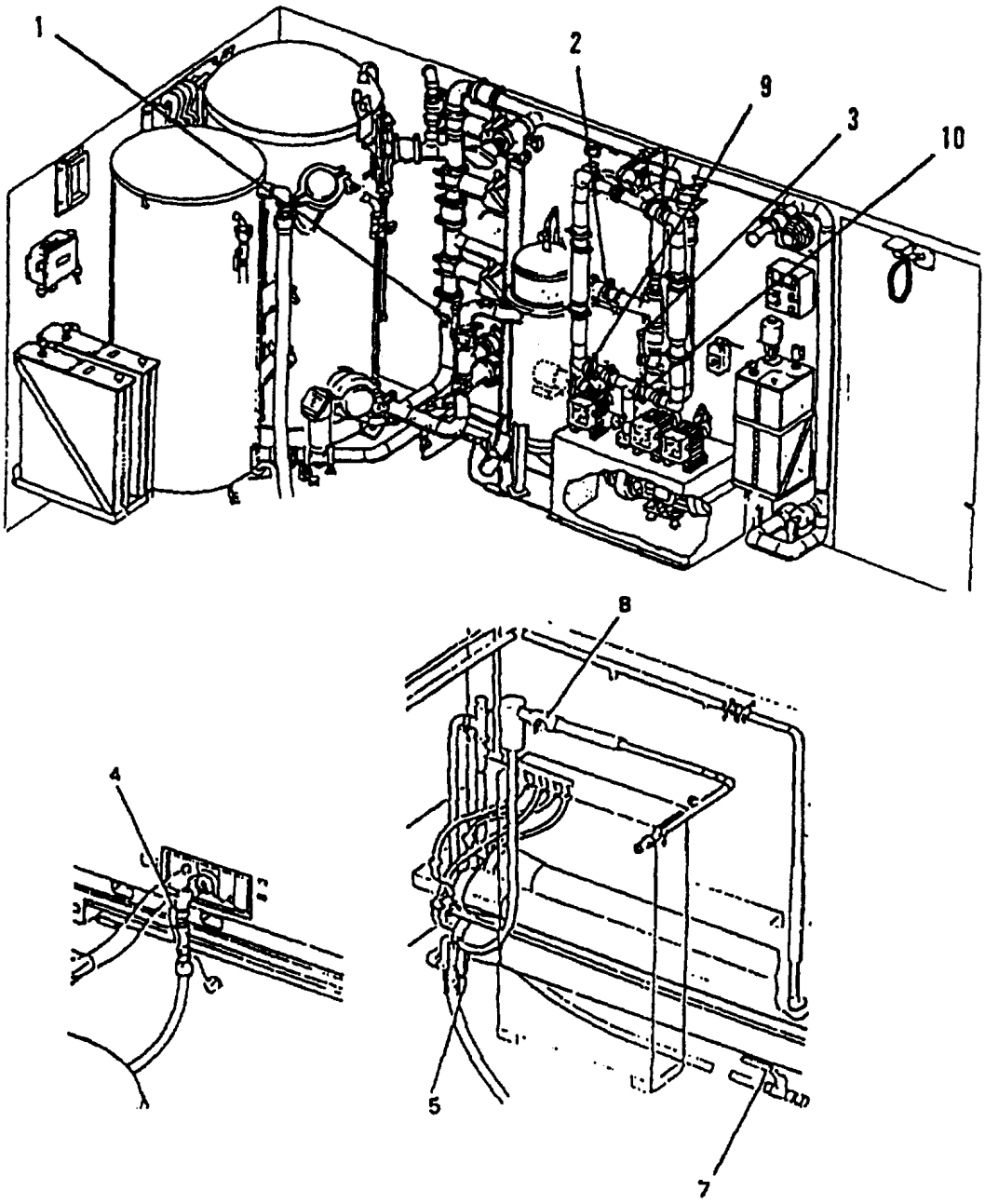


Figure 2-36. Manual Valve Pre-Start Positions (Sheet 2 of 2)
(Model ROWPU-1 Only)

(8) Main control panel (Figure 2-37).

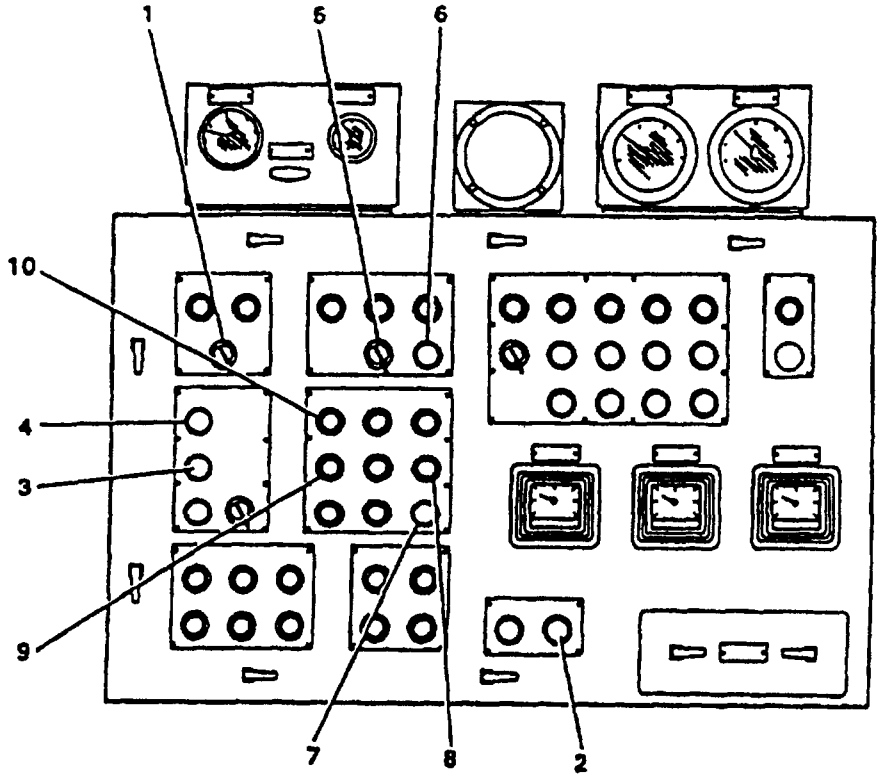


Figure 2-37. Main Control Panel Checks

NOTE
SYSTEM MODE switch (1) must be in ON position and SYSTEM RESET (2) must be pushed.

(a) Push LIGHT TEST (3). All panel plot lights and the distribution pump power light on switch panel 1 should come on. If not, replace bulbs (b) Push ALARM TEST (4). Notify unit maintenance either horn is not working.

(c) Turn OPERATION MODE selector switch (5) to FILTER NORMAL.

(d) Push INITIATE (6).

(e) Push MEDIA FILTER FORWARD FLUSH (7) to open valve. A blue indicator (8) should light up.

CAUTION
If the system pressure control valve is not closed, raw water will back up into the elements which may cause damage.

(e 1) Close system pressure control valve (Valve V-51) (ref. item 8, Figure 2-36).

NOTE

A minimum air pressure of 85 psig (586 kPa) is required to assure proper functioning of automatic valves. When the air pressure gage shows at least 85 psig the blue indicator lights should be on.

If valve indicator lights are not as stated below, troubleshoot valves. DO NOT start ROWPU. Refer to para. 2-33a. for manual override procedures until Organizational Maintenance can fix problems.

(f) Check valve indicator (blue) lights.

MEDIA FILTER INLET VALVE (10) -ON
MEDIA FILTER OUTLET VALVE (9) -ON
MEDIA FILTER FLUSH VALVE (8) -ON
All other blue lights : OFF

(9) Check level of carbon monoxide in the van (Table 2-9).

(10) Check level of oil in high pressure pump (Figure 2-38).

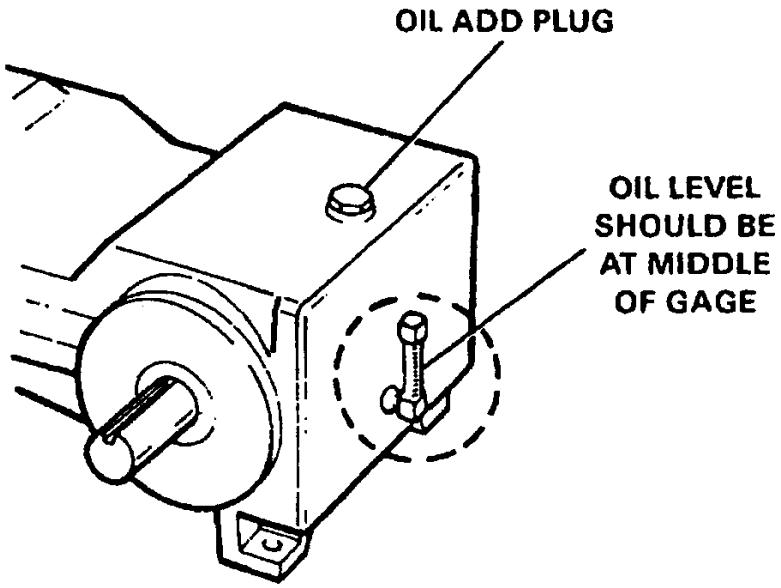


Figure 2-38. High Pressure Pump Oil Level

2-16. EMERGENCY STOP (Figure 2-39).

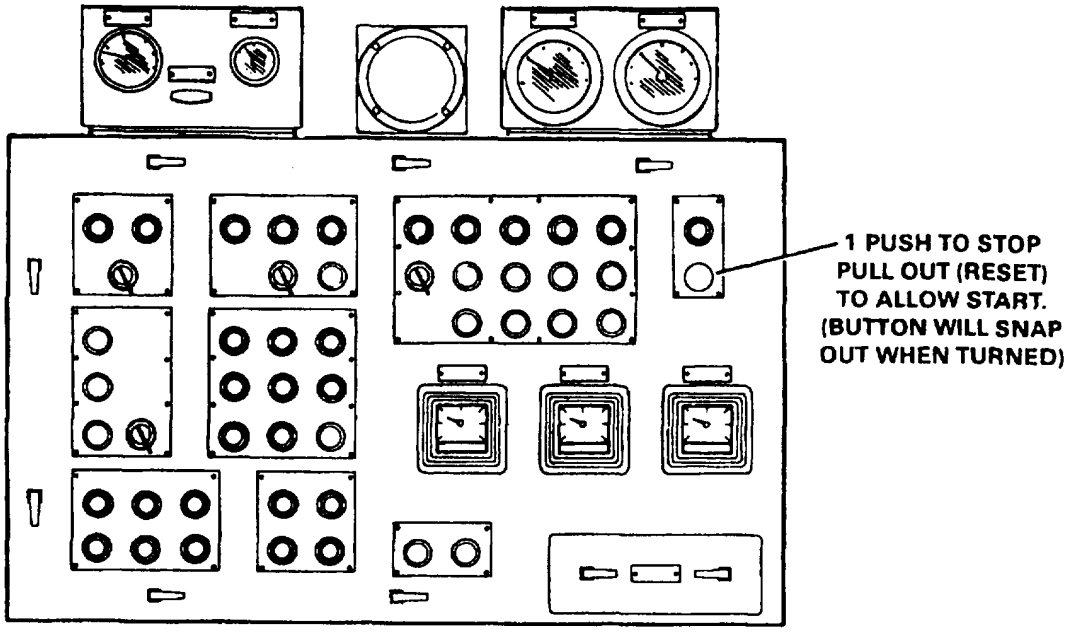


Figure 2-39. Emergency Stop

CAUTION

The emergency stop button should be pushed only when equipment failure or another problem demands immediate shutdown. Do not use the emergency stop button for routine shutdown.

Push the EMERGENCY STOP button (1) to immediately stop all motors within the ROWPU.

NOTE

See paragraph 2-20 for start up after emergency stop.

2-17. FIRST START-UP OR START-UP FROM SECURED OR DRAINED CONDITION. Follow this procedure when starting the ROWPU for the first time after movement, when the ROWPU is started from the drained condition, or when it is started from secured shutdown condition.

NOTE

For start-up from Temporary Shutdown (para. 2-22) or Long Term Shutdown (para. 2-23) complete the procedures of para. 2-15 before continuing.

WARNING

Use caution when using chemicals (polyelectrolyte, sequestrant, citric acid, NTP-A, detergent, calcium hypochlorite, sodium bisulfite). Failure to do so could result in severe burns, especially to eyes. Always wear chemical protective gloves and a face shield. If a chemical comes in contact with skin or clothes, wash off immediately. If a chemical comes in contact with eyes, wash eyes immediately for 15 minutes from the eyewash station.

a. *Initial Polyectrolyte Set-Up (Figure 2-40).*

CAUTION

Stroke control knobs on all chemical injection pumps turn only when pumps are running. To avoid damaging knobs, do not attempt to turn knobs when pumps are off.

NOTE

Make sure the speed controls on all thee chemical injection pumps am in the OFF position (speed controls for all three pumps are the same as item 3, Figure 2-40).

NOTE

Polyelectrolyte is not used in low turbidity which contains moderate to high color.

Refer to para. 2-15a (5) to determine water color and para. 2-6 to determine turbidity.

NOTE

The polyelectrolyte tank and chemical bottles are identified by a triangle symbol.

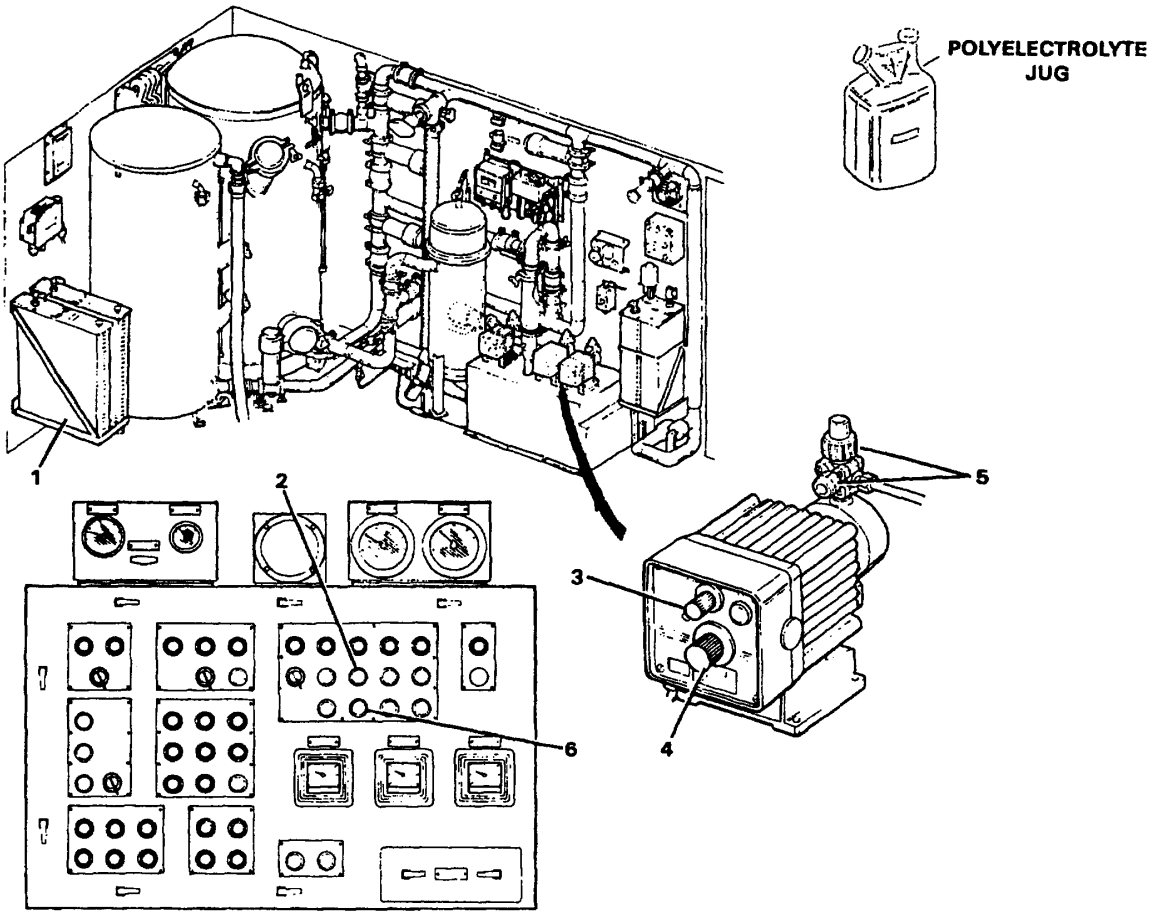


Figure 2-40. Initial Polyelectrolyte Set-Up

(1) For fresh waters with a turbidity of less than 8 NTU and color greater than 10, polyetectrolyte is not required. Proceed to para. 2-17b, "Establishing Water Flow".

(2) Empty the five gallon can of water into the polyelectrolyte tank.

CAUTION
Make certain hypochlorite and sequestrant pumps are OFF.

NOTE
This action removes air from chemical system and allows polyelectrolyte to be pumped.

(3) Push CHEMICAL PUMP START (2).

(4) Set speed control knob (3) to 80 and record.

(5) Set stroke control knob (4) to 100 and record.

(6) Pull out and hold priming knobs (5) until solution is being pumped out though discharge tubing to drain.

(7) Tip the polyelectrolyte jug to fill measuring chamber to 8 oz. (236 ml). Empty measuring chamber into the polyelectrolyte tank.

(8) Repeat to add one more 8 oz. (236 ml) measure and then a final 4 oz. (118 ml) measure for a total of 20 oz. (591 ml).

NOTE
For mission start-up use 20 oz in 5 gallons water (4 oz. in one gallon).

(9) Vigorously mix with mixing paddle for 2 minutes. By visual observation, make sure all polyelectrolyte is in solution. Use caution while mixing to avoid hitting the fittings or switches in the bottom of the tank.

(10) Reset the speed (3) and stroke control knobs (4) and record. See Table 2-17.

NOTE
The settings provide an initial adjustment only. Further adjustment of polyelectrolyte injection will be required after the sequestrant and hypochlorite systems are set-up and pumping.

Table 2-17. Polyelectrolyte Pump Settings

	Pump Settings	
Water Source/Conditions	Stroke	Speed
Seawater	10	32.5
Slow to moderate flowing rivers under 8 NTU turbidity, color less than 10.	10	65
Slow to moderate flowing rivers over 8 NTU turbidity	20	65
Fast flowing rivers	10	65
Lakes	10	16
Backwaters	20	65
Wells	10	16
All fresh waters with turbidity less than 8 NTU and color greater than 10.	-	off

(11) Push CHEMICAL PUMP STOP (6).

b. Establishing Water Flow.

(1) Prime the raw water pump (Figure 2-41).

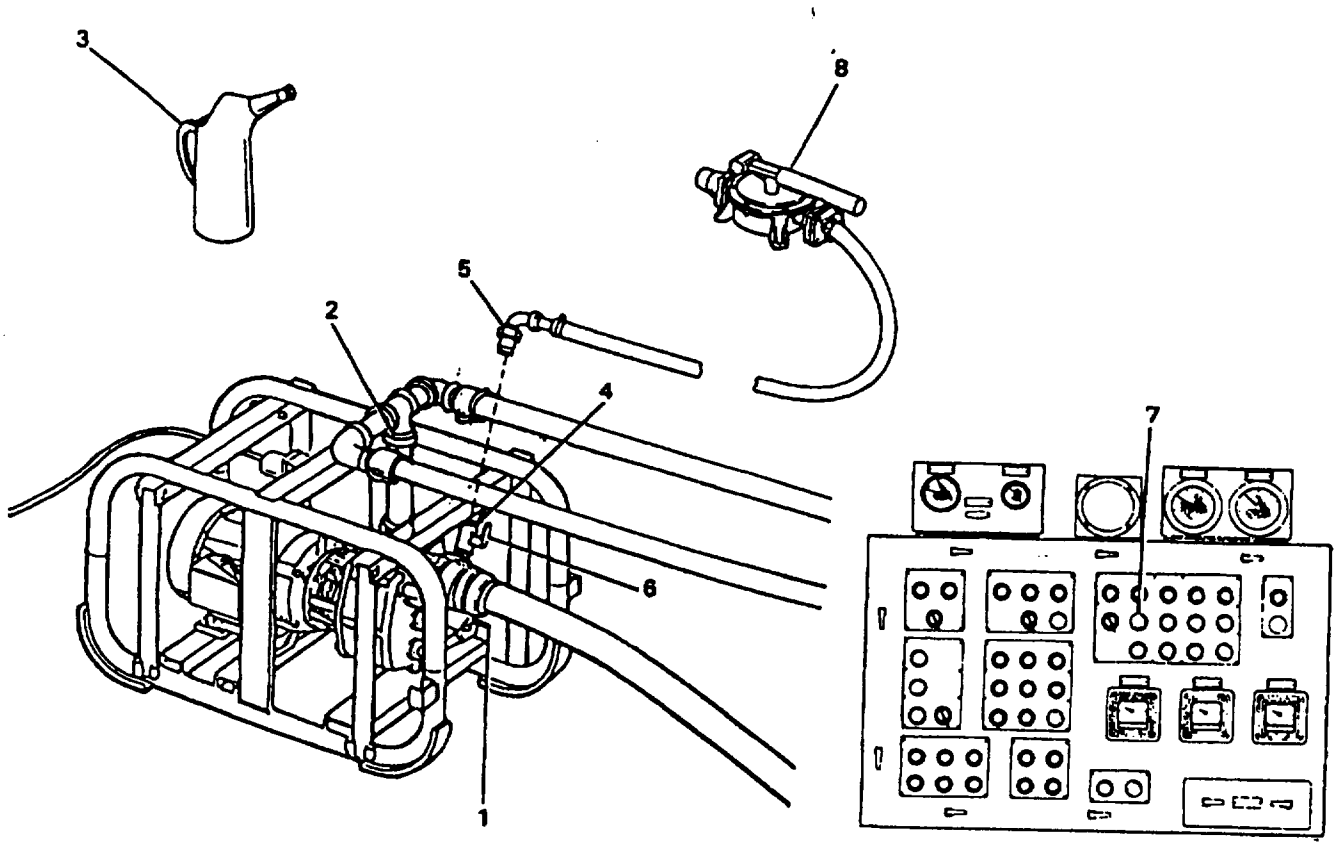


Figure 2-41. Priming the Raw Water Pump (Sheet 1 of 2)
(MODEL WTA-060 ONLY)

(a) Be sure drain valve (1) is closed.

(b) Disconnect the piping section (2) from fitting on pump and pour water from priming pitcher (3) into fitting until pump is full and then replace pipe section.

(c) Remove plug (4) from prime assist port.

(d) Attach the prime assist coupler (5) to the prime assist port. Make sure no gravel or stones are on the pump diaphragm. They will cause damage to the prime assist pump.

(e) Open prime assist valve (6).

CAUTION

Operation of raw water pump when not properly primed will result in damage to raw water pump. If pressure or flow is not noted on any restart of the raw water pump after any shutdown, reprime in accordance with para. 2-17b (1).

(f) At the main control panel, push RAW WATER PUMP START (7).

(g) Manually operate the prime assist handle (8) to assis t in puling the air out of the suction hoses.

CAUTION

Do not allow the raw water pump to run continuously for more than 3 or 4 minutes or damage to the pump can occur. Stop pump and refill pump housing before restarting.

(h) When the air is removed, the cyclone discharge hose will get hard and underflow will come out of the cyclone drain hoses.

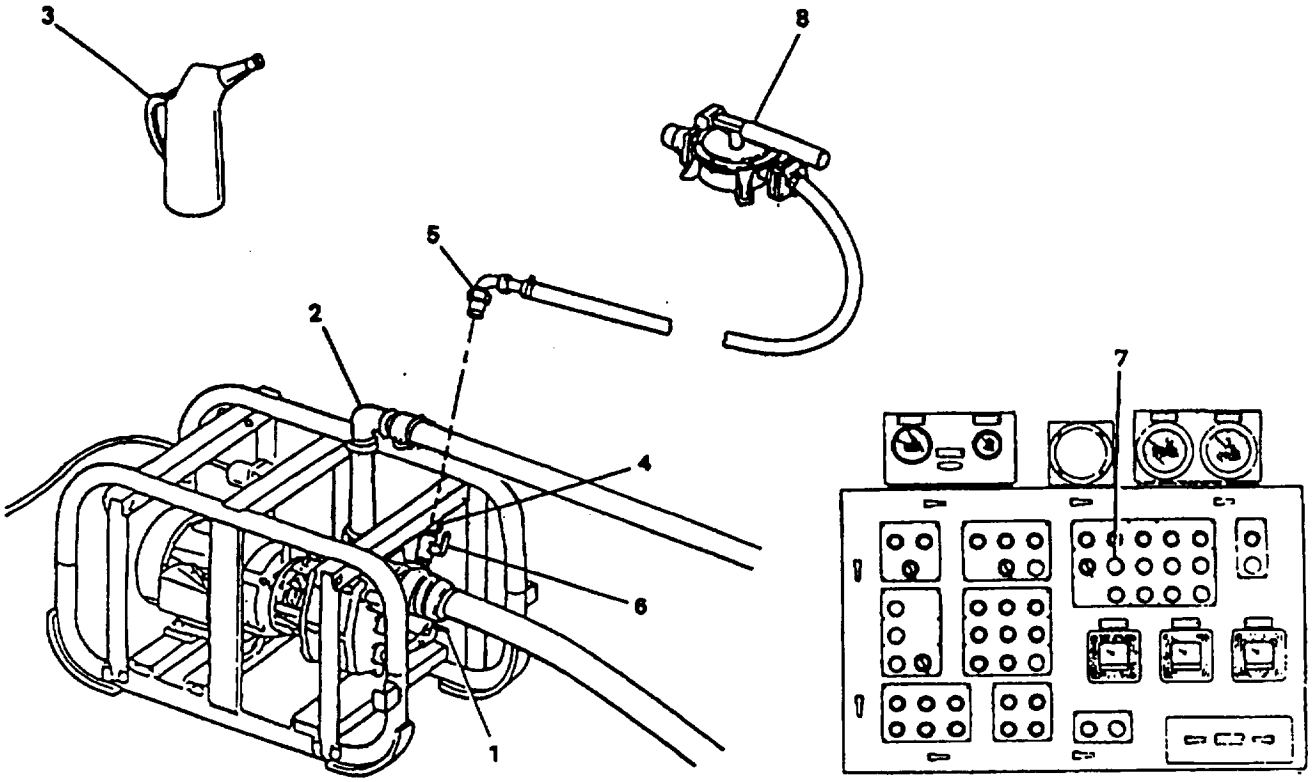


Figure 2-41. Priming the Raw Water Pump (Sheet 2 of 2)
(MODEL ROWPU-1 ONLY)

(i) Close the prime assist valve (6).

(j) Remove the prime assist and replace the plug (4).

(k) Clean any sand and debris from the prime assist and place the prime assist inside the ROWPU van.

NOTE

Priming will take several minutes, depending on the length of suction hoses used. Check the following conditions to ensure a good prime:

- **Check the elevation of the pump above the water level (para. 2-13, Fig. 2-22).**
- **Check to see that the strainer is floating properly and not being held out of water.**
- **Check each hose connection between the pump and water's edge.**
- **Check for gaskets, gasket damage, and complete closure of the connector levers.**
- **Check for flapper movement to ensure it will open. See Raw Water Pump Troubleshooting. Notify organizational maintenance if pressure cannot be established.**

(2) Start-up procedures (Figure 2-42).

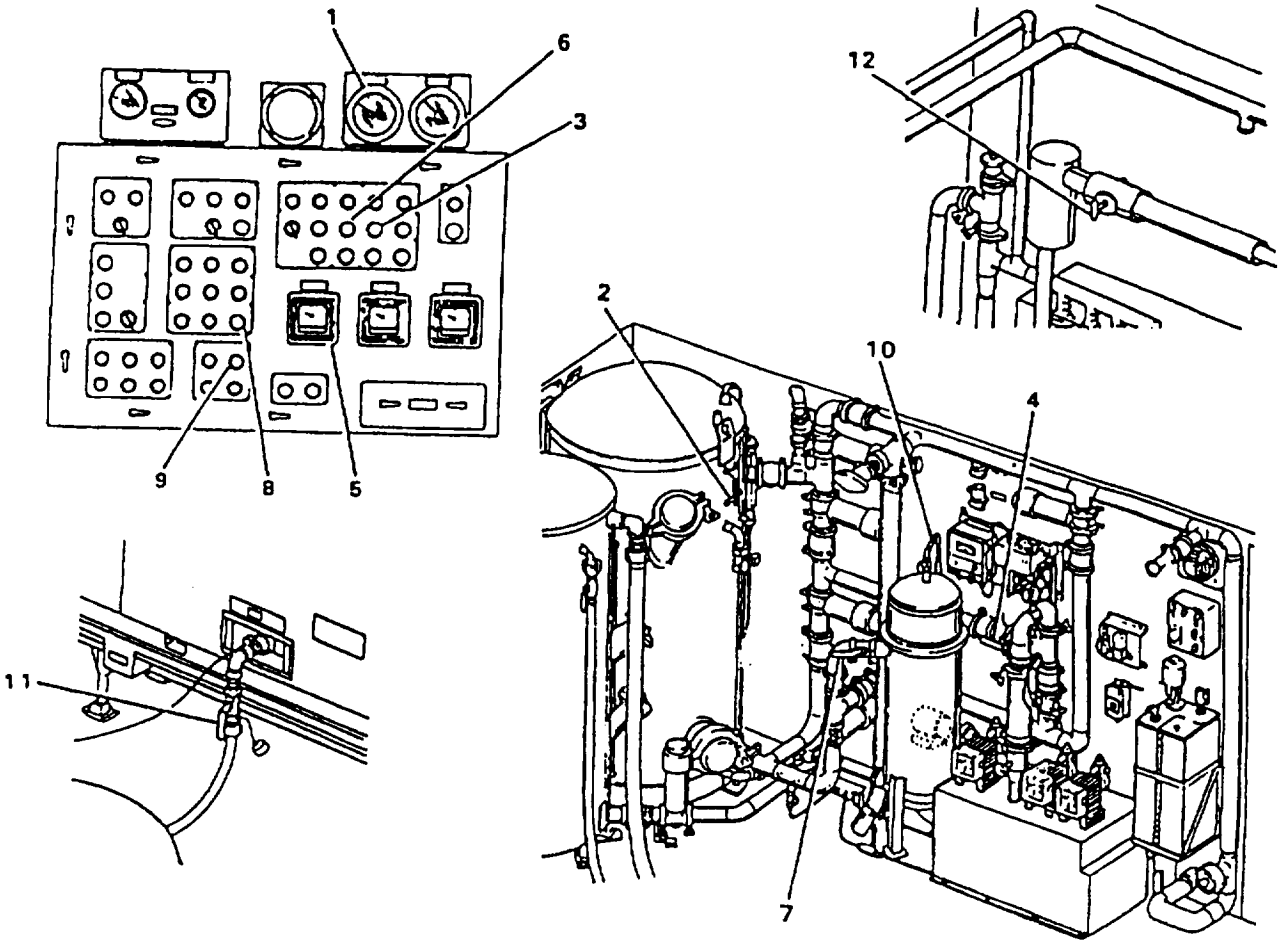


Figure 2-42. Start-Up Procedures

(a) With the raw water pump primed, the discharge hose will quickly fill and harden with pressure. Check the hose and the media inlet/outlet pressure gage (1) to assure pressure has been established.

NOTE

If pressure is not observed check the raw water hose for kinks, sharp bends, or leaks. Check that control panel and valves are set up properly.

(b) Push CHEMICAL PUMP START (6).

(c) When media inlet/outlet pressure gage (1) reading steadies, push BOOSTER PUMP START (3), and slowly close feed valve (4) until feed flowmeter (5) reads 100 gpm.

NOTE

If 100 gpm cannot be obtained check as follows:

- **Check discharge hose for kinks restricting the water flow.**
- **Check valves for proper position.**
- **Check suction hose connections to assure tightness.**
- **Refer to Troubleshooting.**

(d) Open media filter vent valve (2), close, when a steady stream of water is seen.

(e) Hold steady condition (no control operations) for 10 minutes.

(f) Fully open cartridge filter block valve (7) and feed valve (4).

(g) Fully open system pressure control valve (12) by turning handle counterclockwise until it stops turning.

(h) Push MEDIA FILTER FORWARD FLUSH (8) to close this valve. The FEED PRESSURE low light (9) should come on and the booster pump will shut off.

(i) Open cartridge filter vent valve (10); close when water is seen.

CAUTION

Product shut-off valve should be in the open position.

(j) Check product shut-off valve (11). It must be open.

NOTE

If the RO vessels am empty or there is not enough pressure in the vessels, the FEED PRESSURE low light will come on, and the booster pump will shut off.

(k) When the media inlet/outlet pressure gage (1) reads between 35 and 40 psig (241 and 276 kPa), the FEED PRESSURE low light (9) will go off. When the light goes off, push BOOSTER PUMP START (3).

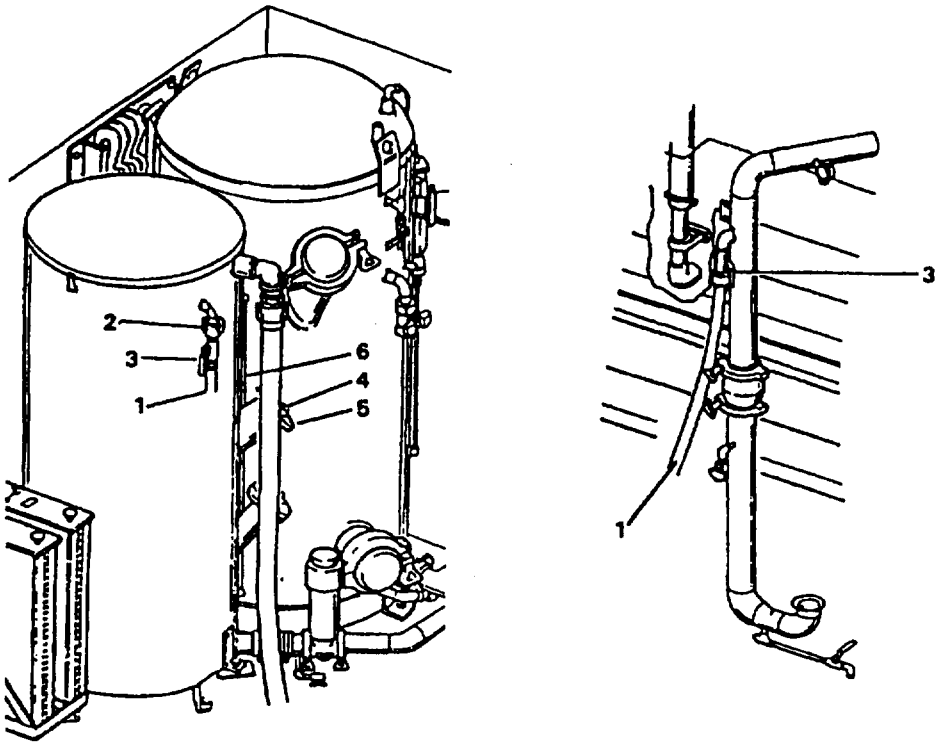


Figure 2-43. Clean/Flush Tank Set-Up

(3) High Pressure Pump Start-Up (Figure 2-44).

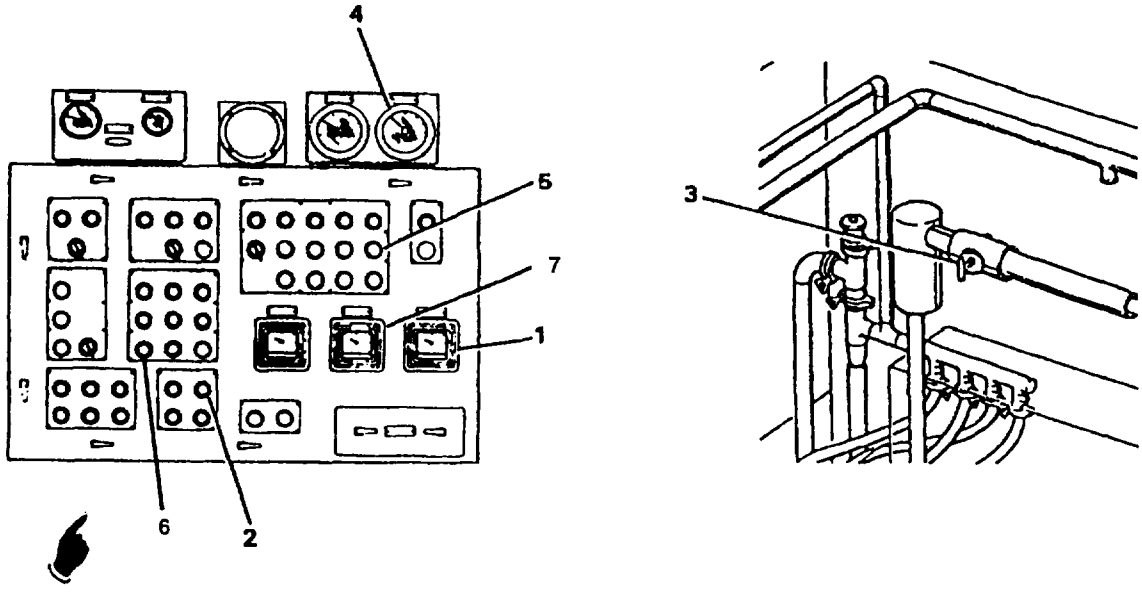


Figure 2-44. High Pressure Pump Readiness

(a) Water is flowing through the waste outlet hose.

NOTE

If water is not flowing through the hose, check that pressure control valve is open and waste hose is not capped.

(b) FEED PRESSURE LOW light (2) is off.

(c) System pressure control valve (3) is open.

(d) Cartridge inlet/outlet pressure gage (4) shows at least 50 psig (345 kPa). All flags on media level gage should be orange before continuing.

NOTE

If water level in media filter is low when the high pressure pump is started, the low level switch (P37) will not activate the air blanket solenoid (V20).

(e) Push HIGH PRESSURE PUMP START (5). Check that AIR BLANKET V20 blue light (6) is on.

CAUTION

Stop pump and refer to Troubleshooting, Table 3-1 if pump vibrates excessively, or the piping pulses severely.

CAUTION

DO NOT exceed 900 psig (6210 kPa).

(f) When the system pressure gage stops rising, turn system pressure control valve (3) slowly clockwise until product flowmeter (7) shows mission normal water flow. Refer to Tables 2-18 and 2-20. Do not exceed 900 psig. Refer to troubleshooting, Table 3-1, if mission normal flow cannot be obtained.

(g) Check generator as follows:

- Adjust throttle to provide 60 Hz.
- Adjust voltage to provide 440 VAC.

CAUTION

Stabilizers must be "'fine tuned"' to eliminate noise and excess vibration which will cause damage to the ROWPU.

(h) Check high pressure pump assembly for noise and excessive vibration. Slowly decrease air pressure in the stabilizers until noise and vibration diminish. If the noise and vibration do not diminish and all the air is out of the stabilizers, then slowly and equally put air into the stabilizers until noise and vibration diminish.

CAUTION

Operating at push limit may damage RO elements and require more frequent leaning.

(4) The average mission normal water flow for the ROWPU is related to the type of water and its temperature as listed by Tables 2-18 and 2-20. Higher water flows up to listed limits may be set under "push" conditions to meet unusual mission demands. Do not push beyond the flow listed for 75°F (24°C) when operating on well water sources

Table 2-18. Average Mission Normal Water Flow for Fresh/Brackish Water Sources Up to 1000 ppm TDS

Temp. °F (C)	Flow gpm (l/m)	Daily Gallons (ltrs)
32 (0)	26 (98)	29,000 (110,000)
35 (2)	27 (102)	31,000 (117,000)
40 (4)	29 (110)	33,000 (125,000)
45 (7)	32 (121)	36,000 (136,000)
50 (10)	34 (129)	39,000 (148,000)
55 (13)	37 (140)	42,000 (159,000)
60 (16)	40 (151)	45,000 (170,000)
65 (18)	44 (167)	50,000 (189,000)
70 (21)	48 (182)	54,000 (204,000)
75 (24)	53 (201)	60,000 (227,000)
Over 75 (24)	53 (201)	60,000 (227,000)
Push Limit	70 (265)	79,000 (299,000)

Table 2-19. Deleted

NOTE

For sea water sources over 37000 ppm the mission normal water flow may not be obtainable.

Table 2-20. Average Mission Normal Water Flow for Sea Water Source Up to 37000 ppm (Maximum Limit)

Temp. °F (C)	Flow gpm (l/m)	Daily Gallons (ltrs)
32 (0)	17 (64)	19,000 (72,000)
35 (2)	18 (68)	20,000 (76,000)
40 (4)	19 (72)	21,000 (79,000)
45 (7)	21 (79)	24,000 (91,000)
50 (10)	22 (83)	25,000 (95,000)
55 (13)	24 (91)	27,000 (102,000)
60 (16)	26 (98)	29,000 (110,000)
65 (18)	28 (106)	32,000 (121,000)
70 (21)	31 (117)	35,000 (132,000)
75 (24)	34 (129)	40,000 (151,000)
Over 75 (24)	34 (129)	40,000 (151,000)
Push Limit	40 (151)	45,000 (170,000)

(4.1) Clean/Flush Tank Set-Up (Figure 2-43).

(a) Connect cartridge filter water hose (1) to clean/flush tank inlet (2).

(b) Open valve (3).

NOTE

Do not fill tank above 100 gallon mark to avoid water overflow through port before removing cover from port.

(c) Loosen wing nut (4) and access cover (5). Open one 2 ounce packet of bisulfite and empty into the clean/flush tank. Install cover on access port. Wash off any chemical that lays in port before closing up.

(d) Watch level gage (6) and close valve (3) when water reaches the 200 gallon mark.

NOTE

Clean/flush tank is now ready for fir backwash. All red warning light should be off.

c. Chemical System Final Set-Up.

NOTE

If the product shut-off valve is closed too far, the ROWPU will automatically shut down.

(1) Final polyelectrolyte set-up.

(a) If polyelectrolyte is not being used (see para. 2-17a), fill polyelectrolyte tank half full with product water. Proceed to (2), "Sequestrant Set-Up", below.

(b) Add an additional 28 oz (828 ml) of polyelectrolyte to the polyelectrolyte tank (1, Figure 2-40).

NOTE

The normal fill 48 oz (419 ml) in a full tank of 12 gallons of water (4 oz. per gallon of water).

(c) Partially close the product shut-off valve to provide back pressure no greater than 20 psig. Open fully when done filling chemical tanks.

(d) Use the product utility hose to fill the polyelectrolyte tank with 12 gallons of product water.

(e) Vigorously mix with mixing paddle for two minutes. Visually make sure all polyelectrolyte is in solution. Use caution to avoid hitting fittings in tank.

(2) Sequestrant Set-Up (Figure 2-45).

NOTE

Sequestrant containers and chemical bottles are identified by a square symbol.

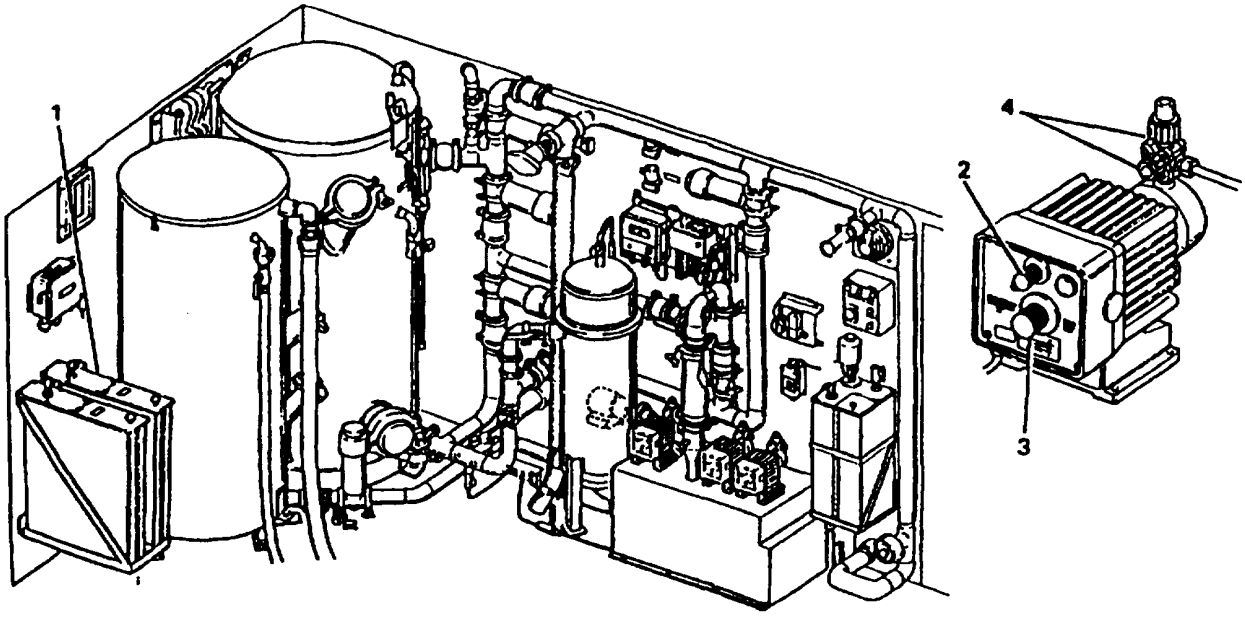


Figure 2-45. Sequestrant Set-Up

(a) Fill sequestrant tank (1) half full with product water, using product utility hose. Turn sequestrant pump on.

(b) Set speed control knob (2) to 80 and record.

(c) Set stroke control knob (3) to 100 and record.

(d) Pull out and hold priming knobs (4) until water is being pumped out through discharge tubing to drain.

(e) Measure sequestrant into tank. The quantity to be transferred depends on water source. See Table 2-21.

NOTE

Sequestrant alone causes an increase in the growth rate of bacteria on the RO membranes. Bisulfite is added to counteract this growth.

(f) If sequestrant is added, also add one large 2 lb (.9 kg) bag of bisulfite.

(g) Fill tank to full level (number 12 on scale) with product water and vigorously mix with mixing paddle for two minutes. By visual observation, make sure all sequestrant is in solution. Use caution when mixing to avoid hitting fittings and switches in tank.

(h) Reset stroke control knob (3) to 40 and record.

Table 2-21. Sequestrant Concentration

Water Source/Condition	Amount of Sequestrant to be Used
Fresh surface water with under 500 ppm TDS	None*
Surface waters with over 500 ppm TDS	18 oz (1-1/2 oz per gal.)
Sea water	18 oz (1-1/2 oz per gal.)
Persian Gulf and Red Sea	36 oz (3 oz per gal.)
Well waters:	
Europe or North America	None*
All others	36 oz (3 oz per gal.)

*For water sources that do not require sequestrant, fill tank with product water to just above level switch so that yellow light on control panel goes off. Make sure pump speed switch is off.

(3) Initial Hypochlorite Set-Up (Figure 2-46).

WARNING

Wear protective face shield and chemical gloves when handling calcium hypochlorite. Hypochlorite will give off chlorine vapor which will burn your nose, throat and lungs if inhaled directly. Keep head away from the top of the tank while filling it. See a medic if fumes are inhaled. Make certain vent fan is running.

NOTE

Hypochlorite chemical packets and containers are identified by a circle symbol.

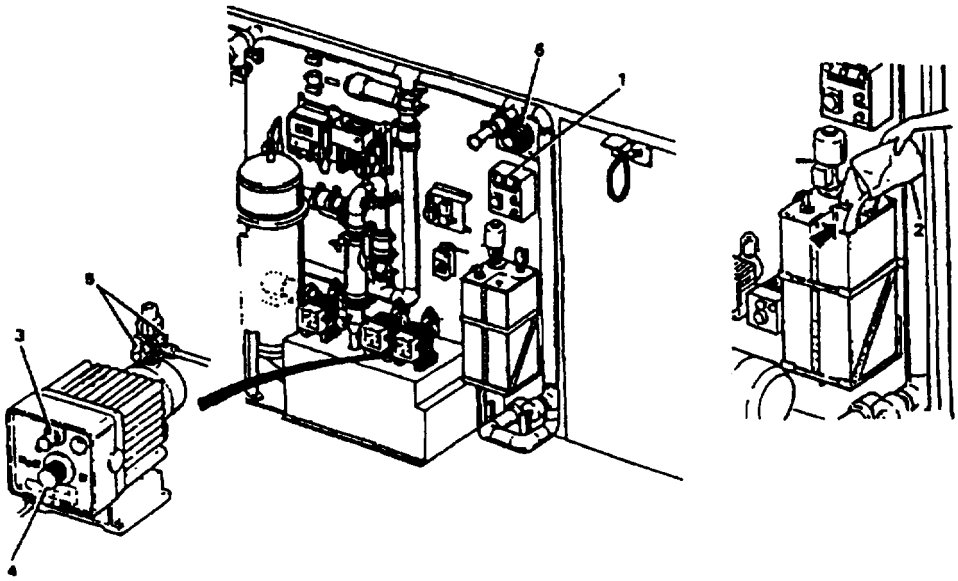


Figure 2-46. Initial Hypochlorite Set-Up

CAUTION

Damage will occur to the hypochlorite backwash pump if the suction strainer is clogged.

(a) Check the suction trainer located inside of tank to make sure it is not clogged. Fill tank with product water, using the product utility hose.

(b) Set speed control knob (3) to 80 and record.

(c) Set stroke control knob (4) to 100 and record.

(d) Pull out and hold priming knobs (5) only until water is seen in discharge tubing to drain.

(e) Turn MIXER switch (1) on.

CAUTION

Pouring the contents of the hypochlorite packet all at once into the tank can cause powder to clump together and clog the suction strainer.

NOTES

- **Add one packet of hypochlorite for each 6 gallons of water.**
- **Leave mixer on during operation with hypochlorite.**

(f) In a marked pail filled with product water, add three packets of hypochlorite powder and mix for 3 minutes. Slowly pour mixed solution into hypochlorite tank, leaving behind the undissolved crystals. This will prevent clogging the suction strainer.

(g) Reset stroke and speed controls on the hypochlorite pump according to operating conditions as shown on Table 2-22 and record. These settings will provide chlorination to the Surgeon General's requirements.

- Winter 2 ppm
- Summer 2 ppm

NOTE
After hypochlorite setup is complete, all red and yellow lights will be off

WARNINGS

- **Do not proceed until hypochlorite pump has been adjusted as described in step (g) above. Otherwise water that is unfit to drink will be delivered to storage tanks.**
- **To avoid contaminating product water hose prior to use, ensure product water hose is out of product water tank until water meets all requirements for safe usage.**

Table 2-22. Initial Hypochlorite Pump Adjustment

Condition Product Flow gpm (l/m)	Pump Adjustment	
	Stroke	Speed
50 (190)	35	60
45 (170)	32.5	60
40 (151)	27.5	60
33 (125)	22.5	60
25 (95)	17.5	60

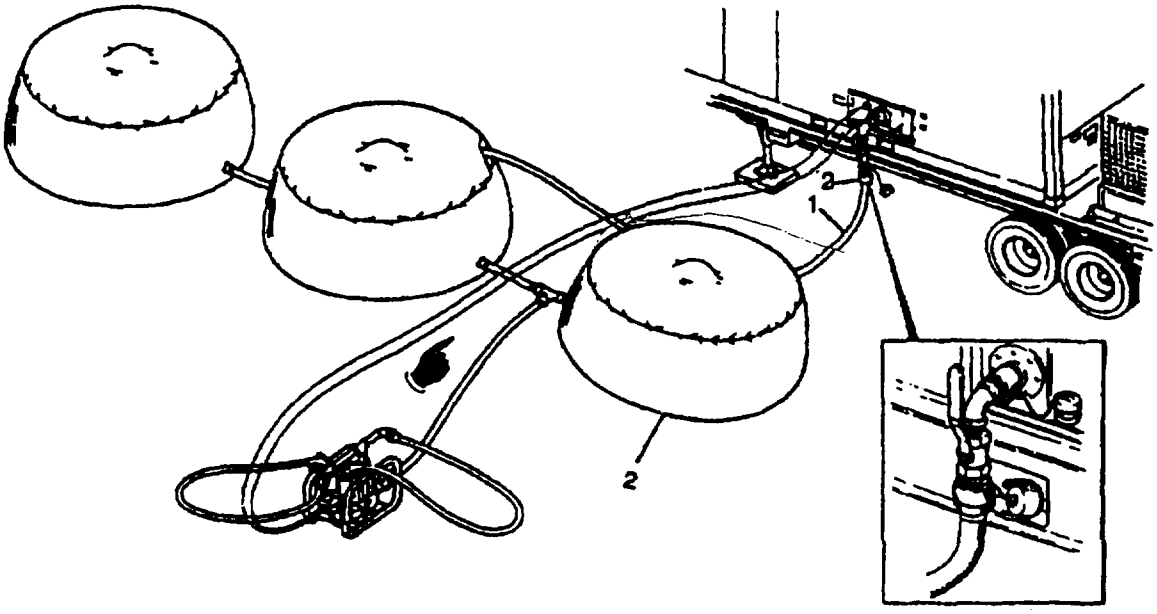


Figure 2-47. Potable Water to Storage Connections

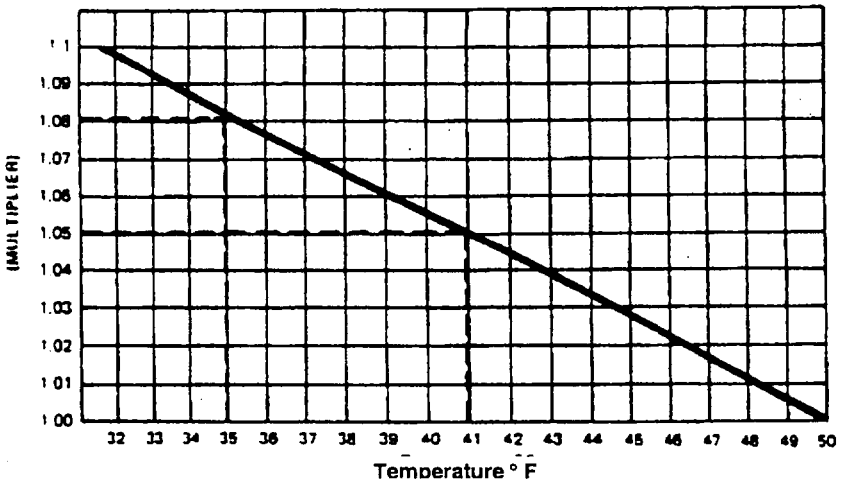
d. Direct Potable Water to Storage (Figure 2-47).

NOTE

During first start-up with new RO elements, continue to direct the product water to waste for at least 30 minutes to flush out preservative.

(1) The TDS meter is designed for use with water temperatures of 50°F (10°C) and above. If water being tested is below 50°F, then reading obtained must be adjusted. Use water temperature along base of graph (Table 2-22.1) to obtain the multiplier on the left side of the graph. Multiply reading by the multiplier obtained to correct the reading for temperature. (Example: 35°F = 1.08 multiplier, 41°F = 1.05 multiplier.)

Table 2-22.1. TDS Temperature Graph



(2) Use the portable TDS meter to measure the TDS from the concentrated sample valve (Item 20, Figure 2-6).

(3) Table 2-23 presents the maximum product water TDS as a percentage of the water source TDS. Use the portable TDS meter to measure the water source TDS.

(4) Calculate the maximum product water TDS as shown in the examples.

CAUTION

Before placing the product hose end into a tank, be sure mud and dirt have been washed off.

NOTES

- **If after 20 minutes the product water TDS has not dropped below the calculate maximum, refer to RO elements troubleshooting, Table 3-1. The product water may only be directed to storage if released by the medical team.**
- **When product water is acceptable for storage, fill the 5 gallon plastic jug for use in net start-up. Set the 5 gallon jug filled with product water in corner of the van.**
- **Water will fill all potable water storage tanks simultaneously once the outlet level of the first tank is reached**

(5) Compare the actual measured product water TDS with the maximum TDS. If the measured sample is less, and the water is released by the medical team, proceed and direct the product water into the storage tanks by inserting the product water hose in the middle tank and strapping it down.

Table 2-23. Maximum Product TDS as % of Water Source TDS

FRESH WATER			BRACKISH WATER			SEA WATER		
Temperature	Up to 1000 ppm		Temperature 1000 is 10,000 ppm			Temperature	Over 10,000 gpm	
32-34 F	1.25	(0.0125)	32-35 F	1.5	(0.015)	32-35 F	2.0	(0.010)
35-37 F	1.3	(0.013)	36-39 F	1.55	(0.0155)	36-39 F	2.1	(0.011)
38-40 F	1.35	(0.0135)	40-43 F	1.6	(0.016)	40-43 F	2.2	(0.012)
41-43 F	1.4	(0.014)	44-47 F	1.65	(0.0165)	44-47 F	2.3	(0.013)
44-46 F	1.45	(0.0145)	48-51 F	1.7	(0.017)	48-51 F	2.4	(0.014)
47-49 F	1.5	(0.015)	52-55 F	1.75	(0.0175)	52-55 F	2.5	(0.025)
50-52 F	1.55	(0.0155)						
53-55 F	1.6	(0.016)						
56-61 F	1.7	(0.017)	56-63 F	1.8	(0.018)	56-59 F	2.6	(0.026)
62-66 F	1.8	(0.018)	64-70 F	1.9	(0.019)	60-64 F	2.7	(0.017)
67-72 F	1.9	(0.019)	71-77 F	2.0	(0.020)	65-68 F	2.8	(0.028)
73-77 F	2.0	(0.020)				69-73 F	2.9	(0.029)
						74-77 F	3.0	(0.030)
78-81 F	2.1	(0.021)	78-81 F	2.1	(0.021)			
82-84 F	2.2	(0.022)	82-84 F	2.2	(0.022)	78-81 F	3.1	(0.031)
85-88 F	2.3	(0.023)	85-88 F	2.3	(0.023)	82-84 F	3.2	(0.032)
89-91 F	2.4	(0.024)	89-91 F	2.4	(0.024)	85-88 F	3.3	(0.033)
92-95 F	2.5	(0.025)	92-95 F	2.5	(0.025)	89-91 F	3.4	(0.034)
						92-95 F	3.5	(0.035)

Examples

Fresh water 75 ppm at 38°F
Adjust for temperature - 1.07 x 75 ppm = 80.25 or 80 ppm
Maximum TDS - 1.35% or 0.0135
0.0135 x 80 = 1.08 ppm or 1 ppm
1 ppm is maximum product water TDS, for this condition.

Brackish water 3500 ppm at 63°F
Maximum TDS - 1.8% or 0.018
0.018 x 3500 = 63 ppm
63 ppm is maximum product water TDS for this condition.

Sea water 47,000 ppm at 95°F
Maximum TDS - 3.5% or 0.035
0.035 x 47,000 = 1645 ppm
1645 ppm is not consumable under Army Regulations.
Repurify as brackish water
Brackish water 1645 ppm at 95°F
Maximum TDS - 2.5% or 0.0250.025 x 1645 = 41.12 or 41 ppm
41 ppm is maximum water TDS for this condition.

Paragraph e. DELETED

WARNING

The operator must check the product water regularly and change the pump settings as needed to maintain the recommended residual. If the correct residual is not maintained serious illness or death may occur.

f. Hypochlorite Pump Adjustment. When storage tanks have at least 1 ft (0.3 m) of water, check chlorine level in product water as follows:

(1) Use available chlorine color comparator test kit (para. 2-9). Take water sample from dispensing nozzle. Allow water to flow for 30 seconds before collecting sample.

(2) Unless otherwise directed by the medical team or Surgeon General directive, the pump must be adjusted to provide chlorination to the following standard:

- Warm weather with water over 50°F (10°C): 2 ppm free chlorine.
- Cold weather with water at or below 50°F (10°C): 2 ppm free chlorine.

Use the chlorine test result to calculate the proper pump setting as follows:

Test Results ..... 6 ppm
Required ..... 2 ppm
Current Pump Stroke 60
New Stroke Setting 2 ÷ 6 = 0.33333 x 60 = 19.99999 or 20

g. Polyelectrolyte Optimization. After the first hour of operation, if polyelectrolyte is being used, adjust polyelectrolyte, as soon as other set-up tasks are complete.

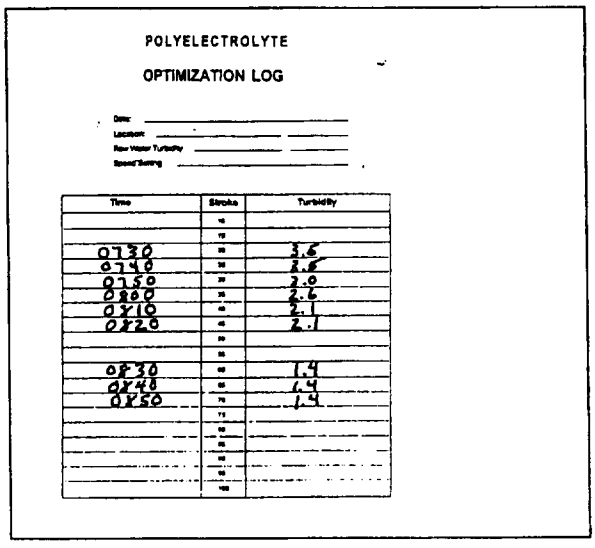
CAUTION

It is essential that the amount of polyelectrolyte be optimized to provide the lowest turbidity with the least amount of polyelectrolyte. Failure to carry out this procedure will result in insufficient filtration and rapid accumulation of dirt on the RO elements. This dirt (fouling) will decrease the amount of product water produced or will lead to early failure of the RO elements, and failure to complete the assigned mission.

(1) Set up and calibrate the portable turbidity meter.

Table 2-24. Polyelectrolyte Optimization Log Sample

Example: Polyelectrolyte Optimization: Initial setting 20 stroke 65 speed. Initial turbidity 3.5 at start of optimization. Final turbidity 1.4 after optimization. Best stroke setting in 65.



POLYELECTROLYTE

OPTIMIZATION LOG

Date: _____

Location: _____ _____

Raw Water Turbidity _____ _____

Speed Setting _____

Time	Stroke	Turbidity
0730		3.6
0740		2.8
0750		2.0
0800		2.6
0810		2.1
0820		2.1
0830		1.4
0840		1.4
0850		1.4

(3) Increase stroke setting in increments of 5, wait ten minutes and record new turbidity reading.

(4) Continue to increase stroke setting by 5, waiting ten minutes and then recording new turbidity reading.

NOTE
As the stroke is increased, the turbidity should decrease and then level out at the optimum setting.

NOTE
Never run at less than initial setting as determined by water type, see Table 2-17.

(5) The optimum setting can be determined by any one of the following situations: (see Table 2-24)

(a) Situation 1 - If the turbidity decreases with increased stroke setting, but then stops changing for 3 successive stroke increases, set the stroke at 5 less than the last setting. If the turbidity increases after a stroke change, set the stroke back to the setting which first resulted in the lowest turbidity.

(b) Situation 2 - If the speed is at a setting of 16 or 32.5 and the stroke reaches 100 with the turbidity still decreasing with each stroke increase, set the stroke back to 50 and double the speed. Continue optimization by increasing stroke from 50.

(c) Situation 3 - If the speed is at 65 and the stroke reaches 100 with the turbidity still decreasing with each stroke increase, leave the stroke at 100 for the final setting.

(d) Situation 4 - If increased stroke settings from the initial setting do not result in decreasing turbidity and the speed is 32.5 or 65, decrease the speed by 1/2 and repeat.

(e) Situation 5 - If increased stroke settings from the initial setting do not result in decreasing turbidity and the speed is 16, set the stroke at 10 for the final setting.

NOTE
If not enough or too much polyelectrolyte is pumped to the system, the formation of floc particles will not be controlled; a mid-range concentration (optimization) of polyelectrolyte is required for operation.

h. Enter Data Log information for start-up (see Appendix H).

CAUTION
One yellow light will cancel out all other alarms.

i. Once polylectrolyte in feed water and chlorine level in product water are correctly set the ROWPU is fully operational. It will keep on working with very little attention. Only routine tasks, and special jobs indicated by warning lights and the alarm horn, will need to be done.

NOTE
During a typical filter run (i.e. time between backwashes) the turbidity will usually continue to decrease with time. On occasion it will increase after some time, indicating that the filter is so loaded with dirt that it can no longer remove dirt efficiently and it requires backwashing.

j. If allowed by mission demands, backwash media filter after optimization (para. 2-21).

k. Pressure switch operational set points. Operate the ROWPU and proceed as follows:

NOTE
Perform operational set points/pressure switch test at first start up and weekly.

(1) Slowly close the product block valve while watching the product water pressure gage. The ROWPU should shutdown at 35-45 psig. Another method is to open product utility hose and close product shut-off valve to shut down ROWPU. Perform this test weekly using product utility hose.

CAUTION

Watch the product water flowmeter during the next test. If the product flow starts to exceed 75 gpm, stop the test and open the system pressure control valve. The ROWPU is making too much water to finish testing of the high pressure switch. Bypass test until next scheduled PMCS.

NOTE

Step (2) applies only when operating on salt water. If operating on brackish or fresh water, proceed to step (3).

(2) Slowly close the system pressure control valve while watching the Reverse Osmosis pressure gage. The ROWPU should shutdown at 930-960 psig.

(3) Slowly close the cartridge filter block valve while watching the cartridge filter differential pressure gage. The cartridge filter plugged light and alarm should come on when the difference between the two needles is 13-18 psig.

(4) Slowly close the feed control valve while watching the media filter differential gage. The media filter plugged light and alarm should come on when the difference between the two needles is 22-28 psig.

(5) Slowly close the cartridge filter block valve while watching the red needle on the cartridge filter inlet/outlet pressure gage. The booster pump and high pressure pump should shutdown at 4-8 psig.

2-18. ROUTINE SHUTDOWN TO STAND-BY. Use this procedure when the ROWPU is to be shut down for 3 hours or less (Figure 2-48).

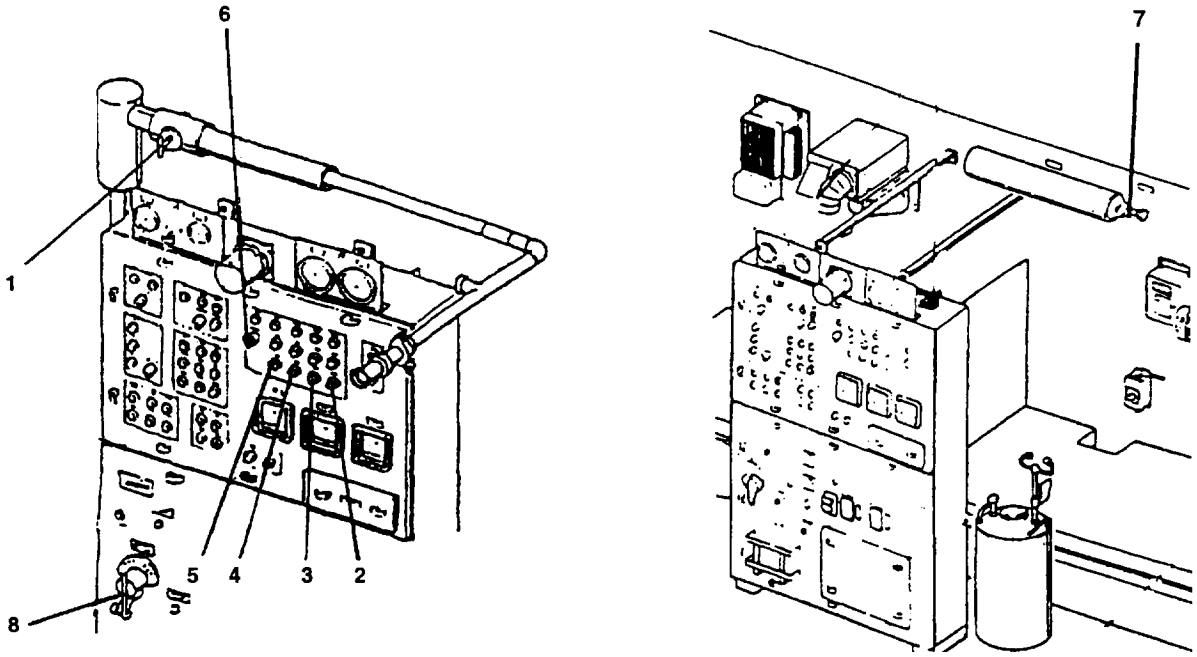


Figure 2-48. Routine Shutdown to Stand-By

a. Fully open system pressure control valve (1).

b. Push HIGH PRESSURE PUMP STOP (2).

c. After the feed flow drops below 60 gpm, push BOOSTER PUMP STOP (3).

d. Push CHEMICAL PUMP STOP (4).

e. Push RAW WATER PUMP STOP (5).

f. Turn COMPRESSOR OFF/ON switch (6) to OFF position.

g. Close air storage valve V72 (7).

CAUTIONS

- **If ROWPU is kept in stand-by more than 3 hours, the RO elements may lose performance and require cleaning. Use temporary secured shutdown procedures (para. 2-22) when a longer shutdown is anticipated.**

- **When operating in brackish or seawater and ROWPU is kept in stand-by for 3 hours or more, severe corrosion of piping and equipment will occur if brackish or seawater is not flushed from system. Perform temporary secured shutdown procedures (para. 2-22)**

NOTE

Allow media filter to drop in pressure to less than 5 psi (34 kpa) before opening main circuit breaker or shutting down generator.

h. Turn MAIN CIRCUIT BREAKER (8) to OFF.

i. Shut down generator.

2-19. ROUTINE START-UP FROM STAND-BY SHUTDOWN. Use this procedure to restart the ROWPU after it has been shut down in the stand-by condition (Figure 2-49).

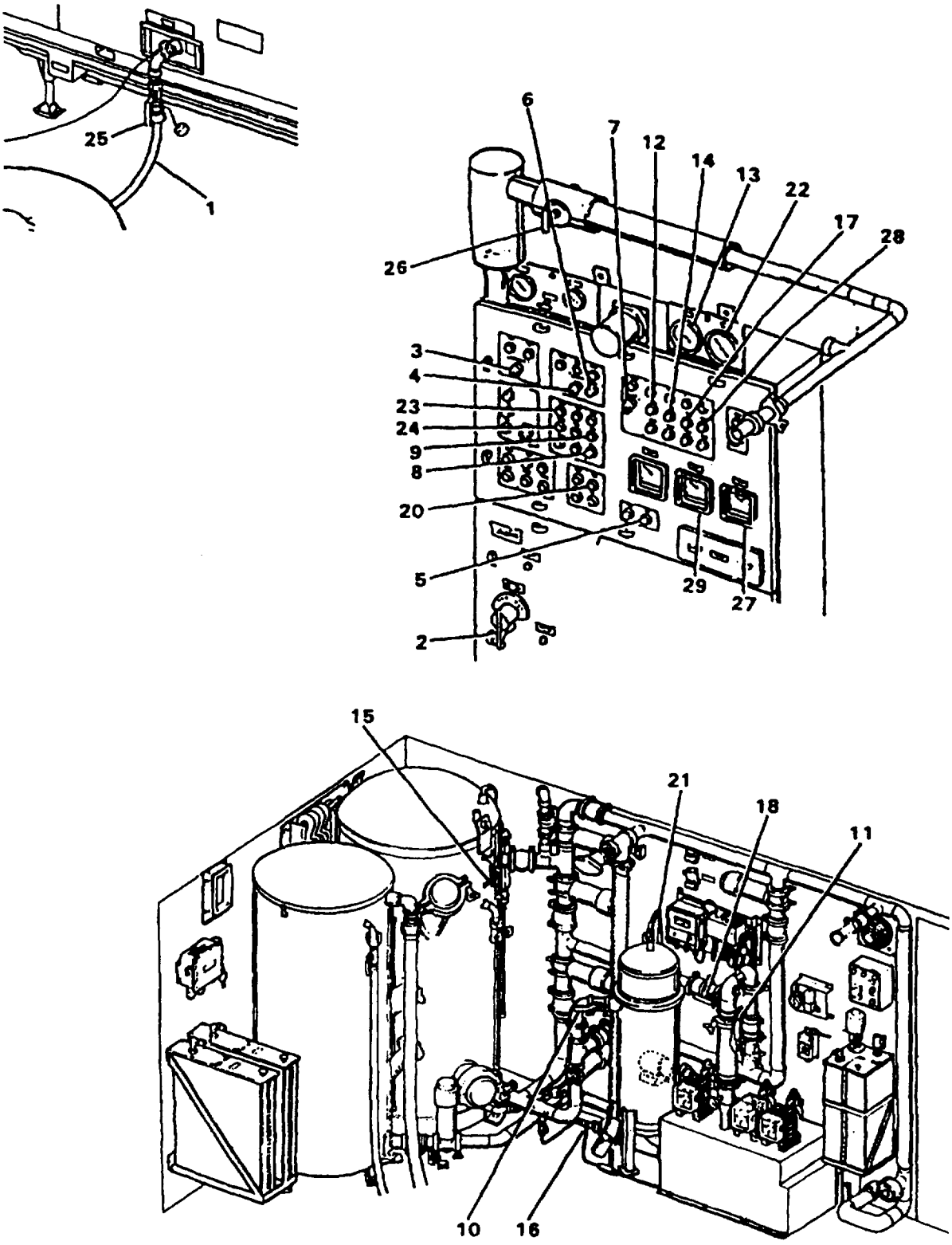


Figure 2-49. Routine Start-Up From Stand-By Shutdown

CAUTION

To avoid contaminating storage tanks, make certain the product hose (1) is out of the storage tank and directed away from the work area.

NOTE

Start generator and establish power to ROWPU (para. 2-15) if generator has been secured.

a. Check that MAIN circuit breaker (2) is in ON position and the SYSTEM MODE switch (3) is in the SYSTEM ON position.

b. Check that OPERATION MODE switch (4) is in FILTER NORMAL position.

c. Push SYSTEM RESET (5).

d. Push INITIATE (6).

e. Make sure COMPRESSOR ON/OFF switch (7) is ON.

NOTE

Be certain air system pressure is 85 psig (586 kPa) before stating pumps.

f. Push MEDIA FILTER FORWARD FLUSH pushbutton (8) to open valve. The blue indicator light (9) should light up.

g. Fully close the cartridge filter block valve (10). Check that cleaning bypass valve (11) is closed.

CAUTION

If the system pressure control valve is not closed, raw water will back up into the elements which may cause damage

g.1. Close system pressure control valve (26).

h. If feed pressure low alarm sounds, push SYSTEM RESET (5).

i. Push RAW WATER PUMP START (12).

j. With the raw water pump primed, the discharge hose will quickly fill and harden with pressure. Check the hose and the MEDIA INLET/OUTLET PRESSURE gage (13) to assure pressure has been established.

NOTE

If pressure is not observed within 3 minutes, reprime raw water pump. Refer to Raw Water Pump Troubleshooting.

k. Push CHEMICAL PUMP START (14).

l. When he MEDIA INLET/OUTLET PRESSURE gage (13) reading is steady, push BOOSTER PUMPSTART (17) and slowly close feed valve (18) until FEED FLOW meter (19) reads 100 gpm.

NOTE

If 100 gpm cannot be obtained check as follows:

- **Check raw water hose for kinks restricting water flow.**
- **Check valves for proper position. Media filter inlet - on.**
  Media filter outlet - on.
  Forward flush valve - on. All other blue - off.
- **Refer to troubleshooting,**

m. Open media filter vent valve (15). When a solid stream of water is seen at drain (16), close vent valve.

n. Hold steady for 3 minutes.

o. Open cartridge filter block valve (10).

p. Fully open feed valve (18).

p.1. Open system pressure control valve (26).

q. Push MEDIA FILTER FORWARD FLUSH (8). This closes the automatic media filter flush valve. The FEED PRESSURE LOW light (20) will go off when the MEDIA/CARTRIDGE INLET/OUTLET PRESSURE gages (13, 22) read 35-40 psig (241-276 kPa).

NOTE

If the FEED PRESSURE LOW light stays on, the alarm horn sounds and the booster pump stops, push SYSTEM RESET and then push BOOSTER PUMP START again.

r. Open cartridge filter vent valve (21). Close when water is seen.

s. Observe CARTRIDGE INLET/OUTLET PRESSURE gage (22). Minimum reading is 50 psig (345 kPa) on the red needle.

NOTE

If pressure is low, check as follows:

- **Check blue lights.**
  - **MEDIA FILTER INLET light (23) must be on.**
  - **MEDIA FILTER OUTLET light (24) must be on.**
  - **If they are not, refer to troubleshooting. Refer to manual operation of automatic valves (para. 2-33a).**
- **Feed valve (18) must be open.**
- **Cartridge filter block valve (10) must be open.**
- **Check raw water canvas hoses to be sure raw water pump is providing water. Hose should be firm with water pressure. If not, stop pump and recheck the prime (para. 2-17b).**
- **Refer to troubleshooting.**

s.1. Make sure the product shut-off valve (25) is open. If it is closed, the ROWPU will shutdown on a PRODUCT PRESSURE HIGH (red light).

t. DELETED.

NOTE

High pressure pump is ready to start if:

- **Water is flowing through the waste out hose.**
- **FEED PRESSURE LOW light (20) is off.**
- **SYSTEM PRESSURE CONTROL valve (26) is open.**
- **CARTRIDGE INLET/OUTLET PRESSURE gage (22) reads 50 psig (345 kPa) or more (red needle) and is steady, and all flags on the media filter level should be orange.**

u. Push HIGH PRESSURE PUMP START (28).

CAUTION

Stop pump and refer to Troubleshooting, Table 3-1 if pump vibrates excessively, or if the piping pulses severely.

CAUTION

DO NOT exceed 900 psig (6210 kPa).

v. Slowly turn system pressure control valve (26) clockwise until product flowmeter (29) shows mission normal flow (refer to Tables 2-18 and 2-20) or selected push condition water flow.

w. Check generator and adjust throttle to provide 60 Hz. Adjust voltage to provide 440 VAC.

x. Direct potable water to storage.

CAUTION

Before placing the product hose end into the tank, be sure mud and dirt have been washed off.

(1) Check the product water TDS. When it falls below the previously determined maximum (para. 2-17d), direct the product water into the storage tank. Extend the free end of the hose well into the tank.

(2) Fill the clean/flush tank if empty with product water from the product utility hose (para. 2-17b).

2-20. START-UP AFTER EMERGENCY SHUTDOWN. Use this procedure to restart the ROWPU after an emergency shutdown (Figure 2-50).

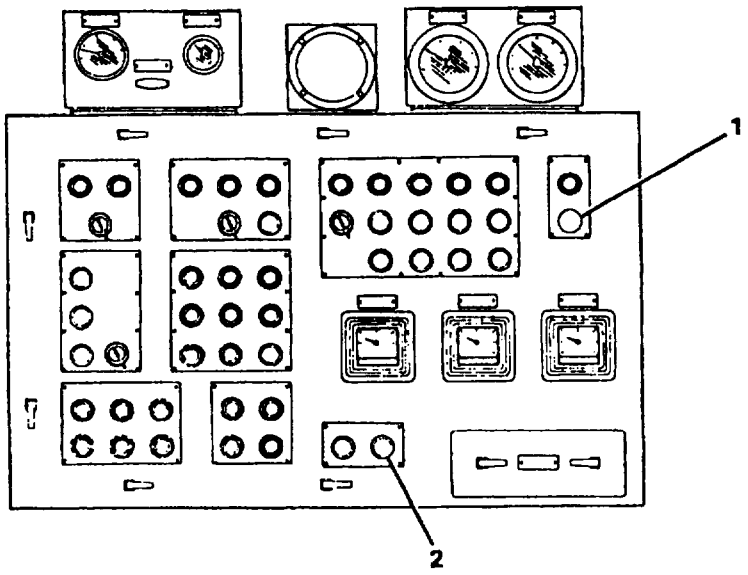


Figure 2-50. Start-Up After Emergency Shutdown

a. Pull out EMERGENCY STOP button (1).

b. Push SYSTEM RESET button (2).

c. Restart the ROWPU using the procedure for ROUTINE START-UP FROM STAND-BY SHUTDOWN, para. 2-19

2-21. MEDIA FILTER BACKWASH (Figure 2-51).

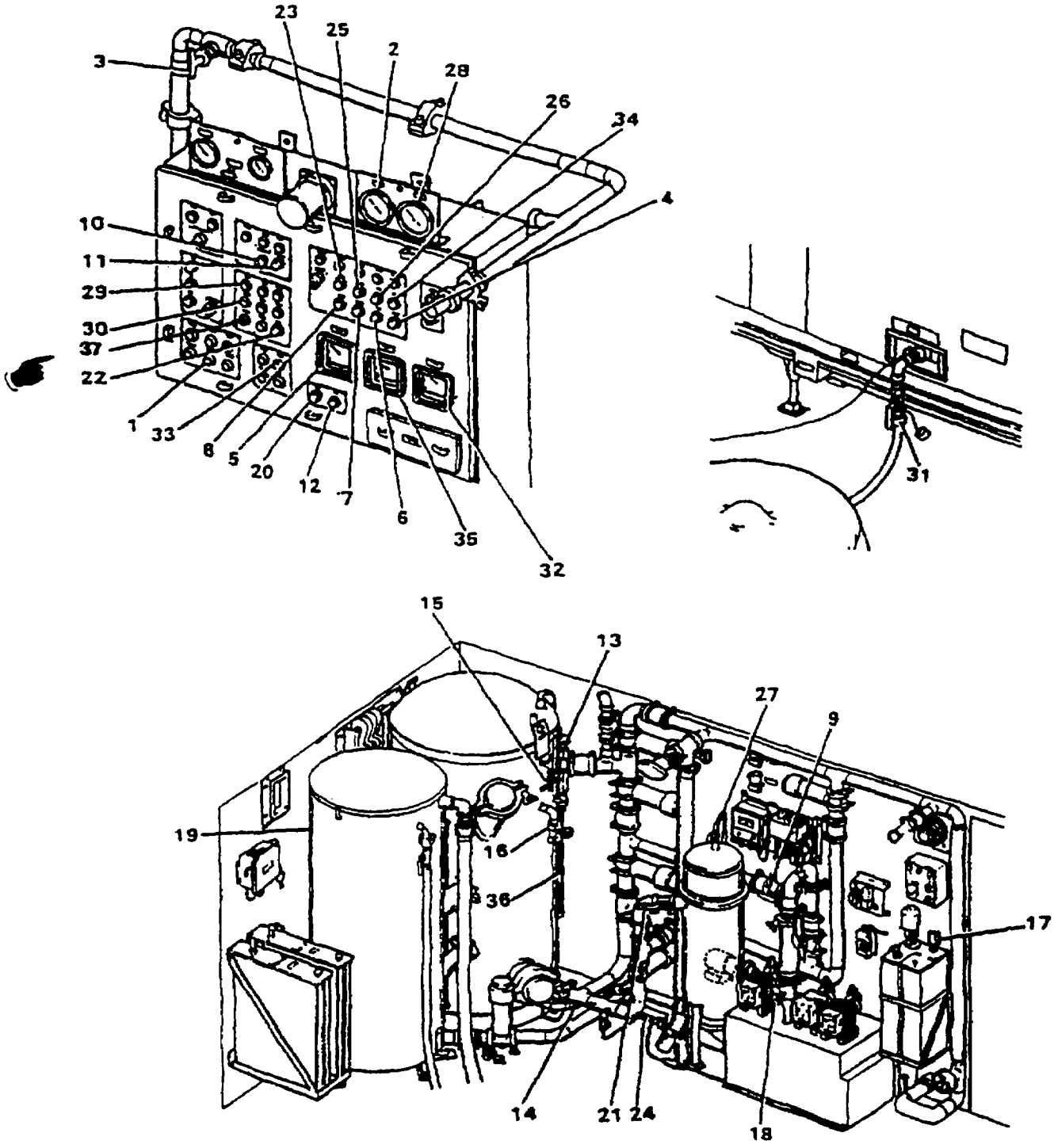


Figure 2-51. Media Filter Backwash

a. General. Suspended solids filtered from feed water will accumulate in the media filter and must be removed in accordance with the following circumstances.

- At least once each day.
- Every six hours on rivers and lakes with a lot of organic matter, where turbidity is over 15 NTU and water temperature is over 70°F (21°C).
- Whenever media filter outlet turbidity increases by more than 0.5 NTU over lowest reading since last backwash.
- Whenever the MEDIA FILTER PLUGGED yellow light (1) and horn go on and the media inlet/outlet pressure gage (2) reading is over 25 psi (172 kPa) differential, (Warning horn should come on).
- As specified in shutdown procedures.

b. Preparation. Prepare for backwashing the media filter as follows:

CAUTION

Pouring the contents of the hypochlorite packet all at once into the tank can cause the powder to clump together and clog the suction strainer.

(1) Check hypochlorite tank level. If less than nine gallons, add six gallons of product water from the product utility hose and one packet of hypochlorite and turn on mixer.

(2) Check to be sure that clean/flush tank has 200 gallons (757 l) and one 2-ounce packet of sodium bisulfate was mixed in (para. 2-17b).

(3) Check that air tank air pressure at gage (Item 4, Figure 2-8) is 900 psig (6.2 MPa) or more. If less, wait until pressure builds to 900 psig (6.2 MPa). If pressure is less than 900 psig (6.2 MPa) and air compressor is not running, troubleshoot air compressor.

(4) AIR BLANKET blue light (37) must be OFF and media filter level should be below level switch P36.

c. Backwash Procedure.

NOTE

Refer to Figure 1-11 for illustrations of backwash cycle. Refer to para. 2-34, page 2-156, for manual backwash instructions if automatic operation fails to function.

(1) Fully open system pressure control valve (Item 3, Figure 2-51).

(2) Push HIGH PRESSURE PUMP STOP (4) and wait for the feed control to drop below 60 gpm (227 lpm)

(3) Wait for the feed flow meter (5) reading to stop dropping and then push in sequence. CHEMICAL PUMP (7) and RAW WATER PUMP (8) STOP pushbuttons

(4) Close feed valve (9) almost completely.

CAUTION

If the system pressure control valve is not closed, raw water will back up into the elements which may cause damage.

(5) Close system pressure control valve (3).

(6) Set OPERATION MODE switch (10) to FILTER BACKWASH.

(7) Push INITIATE (11).

(8) If the feed pressure low alarm sounds, push SYSTEM RESET (12).

NOTE

The flow rate of 30 gpm (114pm) must be obtained to loosen the packed media beds. Higher flow rates will result in a loss of media out of the waste hose.

(9) When 2/3 of the flags turn white, the media filter pressure drops below 3 psig (21 kPa), and the raw water pump should come ON. Adjust the feed valve (9) to obtain a flow rate of 30 gpm (114 lpm) at flowmeter (5).

NOTE

As the media filter level drains down, the level indicator (13) flags flip from orange to white until 2/3 of the flags are white. (Red indicates water level.) If the drain down is not observed or stops, check the media filter pressure gauge and manually assist the drain down as follows:

- **If the pressure is over 5 psig (34 kPa), open the upper drain valve (16). Close when the raw water pump starts.**
- **If the pressure is near zero (or falls to near zero) open the lower drain valve (14) and the vent valve (15). The upper drain valve (16) should be closed. The flags should now flip showing the drain down. If not, also open the level indicator drain valve (36). Close drain and vent valves immediately when the raw water pump starts.**
- **Refer to troubleshooting if the raw water pump still does not start.**

CAUTION
If the hypochlorite pump is allowed to run without liquid, damage will occur to the pump.

(10) Open hypochlorite backwash pump priming valve (17) until hypochlorite is seen. Then close valve. Make sure hypochlorite level drops about 1/2 gallon per minute during backwash.

(11) Wait about one minute and 36 seconds until the feed water booster pump comes on. Adjust feed valve (9) to obtain a flow rate at flowmeter (5) according to water temperature gage (18) as shown on Table 2-25. If media filter outlet pressure is more than 30 psig, decrease flow rate slightly until it is not over 30.

(12) Wait about ten minutes. When the final backwash step begins to take water from the clean/flush tank (19) (one minute and 30 seconds), refer to Table 2-25 and readjust feed valve as necessary.

(13) When the horn sounds, indicating backwash is complete, return to normal operation as described below.

(a) Set OPERATION MODE switch (10) to FILTER NORMAL.

Table 2-25. Backwash Flow Rate

Water Temperature	Feed Flowmeter
32 to 40°F (0-70°C)	70 gpm (265 l/min)
40 to 45°F (4-70°C)	75 gpm (284 l/min)
45 to 50°F (7-10°C)	80 gpm (303 l/min)
50 to 55°F (10-13°C)	90 gpm (341 l/min)
55 to 60°F (13-16°C)	100 gpm (379 l/min)
60 to 65°F (16-18°C)	105 gpm (398 l/min)
65 to 70°F (18-21°C)	110 gpm (417 l/min)
70 to 75°F (21-24°C)	115 gpm (436 l/min)
over 75°F (24°C)	120 gpm (455 l/min)

(b) Push INITIATE (11).

(c) Push SYSTEM RESET (12).

NOTE
ALARM SILENCE pushbutton (20) is not operative at this time.

d. Return to Normal Operation/Stage 5 Backwash.

(1) Close cartridge filter block valve (21).

(2) Partially open feed valve (9).

(3) Push MEDIA FILTER FORWARD FLUSH pushbutton (22).

(4) Push RAW WATER PUMP START (23).

(5) Push CHEMICAL PUMP START (25).

(6) When the MEDIA INLET/OUTLET PRESSURE gage (2) reads steady, push BOOSTER PUMP START (26) and slowly close feed valve (9) until flowmeter (5) reads 100 gpm.

(7) Open media filter vent valve (15). Close when water is seen at drain (24).

(8) Hold steady for 10 minutes to repack the media bed.

(9) Open cartridge filter block valve (21).

(10) Fully open feed valve (9).

(10.1) Open system pressure control valve (3).

(11) Push MEDIA FILTER FORWARD FLUSH pushbutton (22).

(12) Open cartridge filter vent (27). Close when water is seen.

(13) Observe CARTRIDGE INLET/OUTLET PRESSURE gage (28). Reading should come up to 50 psig (345 kPa) minimum on the red needle and all flags on media level gage are orange.

NOTE

If pressure is low, check as follows:

- **Check blue lights.**
  - **MEDIA FILTER INLET light (29) must be on.**
  - **MEDIA FILTER OUTLET light (30) must be on.**
  - **If they are not, troubleshoot automatic valves.**
- **Feed valve (9) must be open.**
- **Cartridge filter block valve (21) must be open.**
- **Check raw water canvas hoses to be sure pump is providing water. Hose should be firm with water pressure. If not, stop pump and recheck the prime (para. 2-17b).**
- **Refer to troubleshooting.**

NOTE

High pressure pump is ready to star it

- **Water is flowing through the waste out hose.**
- **FEED PRESSURE LOW light (33) is OFF.**
- **System pressure control valve (3) is open.**
- **CARTRIDGE INLET/OUTLET PRESSURE gage (28) reads 50 psig (345 kPa) or more (red needle) and is steady.**

(14) Push HIGH PRESSURE PUMP START (34).

CAUTION

Stop pump and refer to Troubleshooting, Table 3-1 if pump vibrates excessively, or if the piping pulses severely.

CAUTION

DO NOT exceed 900 psig (6210 kPa).

(15) Slowly turn system pressure control valve (3) clockwise until product flowmeter (35) shows mission normal (refer to Tables 2-18 and 2-20) or selected push condition water flow.

(16) Check generator and adjust throttle to provide 60 Hz. Adjust voltage to provide 440 VAC.

CAUTION

Make sure the product shut-off valve (31) is open.

(17) Fill clean/flush tank (19) with product utility hose and add one 2 ounce packet of bisulfite (para. 2-17 b(2.1)).

(18) Direct product water to storage tanks (para. 2-17d).

(19) Refill hypochlorite tank if required (para. 2-17b).

e. Backwash Check.

(1) Read and record the media filter differential pressure at MEDIA INLET/OUTLET PRESSURE gage (2) if pressure differential is more than 15 psig (103 kPa), continue with the next step. If the differential is less than 15 psig (103 kPa), the backwash procedure is complete.

(2) Continue operation until the compressor builds up an air tank pressure of at least 900 psig (6204 kPa), and repeat backwash steps.

NOTE

If two backwashings do not restore acceptable pressure differential, refer to troubleshooting.

2-22. SHUTDOWN TO TEMPORARY SECURED STATUS - UP TO 3 DAYS. Use this shutdown procedure when the ROWPU will be shut down for 3 hours to 3 days.

NOTE

525 gallons of potable water will be used in this procedure. Be sure water is available. Before shutdown, be sure that the 5 gallon can is filled with product water to use in the polyelectrolyte tank during next start-up.

CAUTION

This backwash is critical when operating in brackish or seawater. Failure to backwash system will result in piping/equipment corrosion and failure.

a. *Backwash Media Filter.* Backwash media filter with product water in the clean/flush tank.

(1) Fill clean/flush tank with potable water.

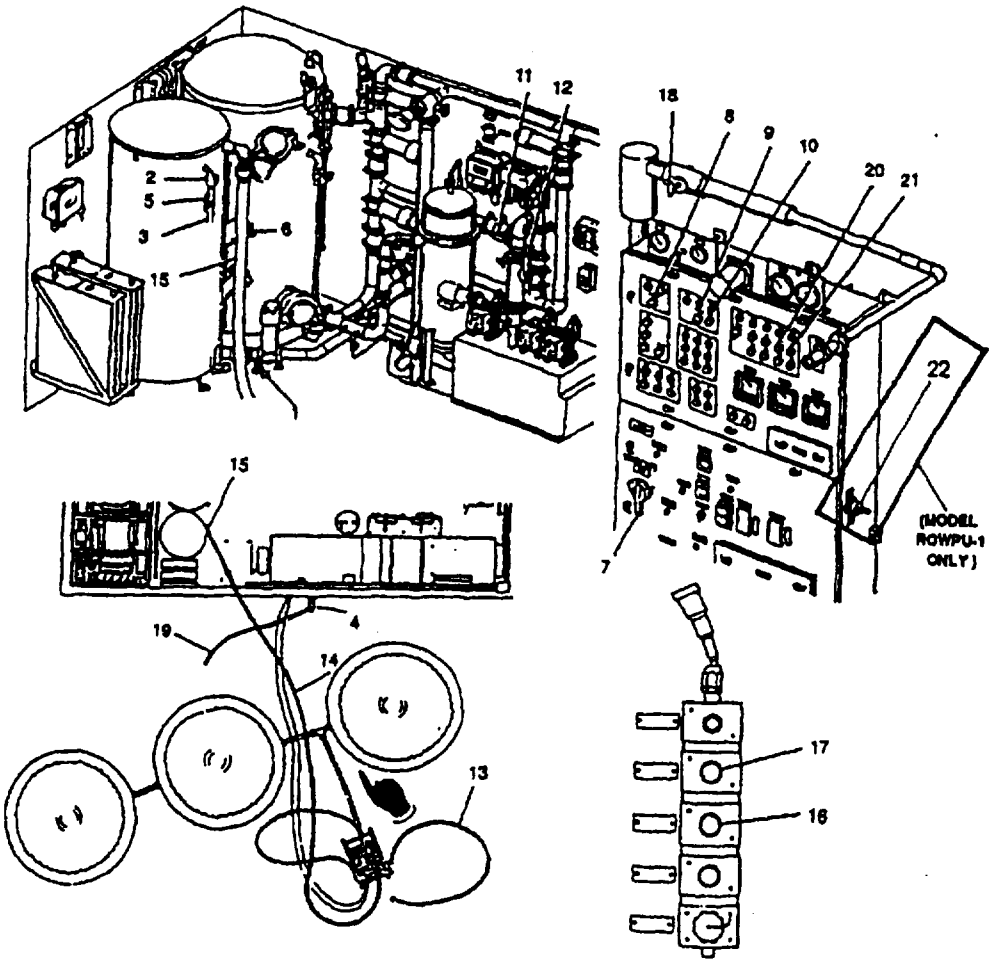


Figure 2-52. System Flush

(a) Open clean/flush tank drain valve (1, Figure 2-52).

(b) Remove cartridge filter water utility hose from the clean flush tank inlet (2). Connect product utility hose (3) to the clean/flush tank inlet (2).

(c) When the tank is empty close the drain valve (1).

NOTE

Fill clean/flush tank to just below 100 gallons to prevent overflow when chemical port is opened.

(d) Partially close the potable water shut-off valve (4) to provide back pressure.

NOTE

If the potable water shut-off valve is closed too far, the pressure will increase over 35 psig and the ROWPU will automatically shutdown.

(e) Open product utility hose valve (5) and fill to 100 gallons, close valve.

(f) Open the chemical port cover (6) and pour in one 2 ounce packet of bisulfite. Clean off any chemical that lays in port opening.

(g) Close cover (6).

(h) Open the product utility hose valve (5).

(i) When the level reaches the 200 gallon (757 l) level, close the utility hose valve (5) and open the product shut-off valve (4).

(2) Backwash as described in para 2-21 b-c Do not forward flush the media filter

b. *System Flush* (Figure 2-52). Flush with potable water as follows.

CAUTION

This system flush is critical when operating in brackish or sea water. Failure to flush system will result in piping/equipment corrosion and failure.

(1) Make sure MAIN circuit breaker (7) is ON and SYSTEM MODE switch (8) is in SYSTEM ON position.

(2) Set OPERATION MODE switch (9) to SYSTEM CLEAN.

(3) PUSH INITIATE (10).

(4) Close feed valve (11).

(5) Open cleaning bypass valve (12).

(5.1) Close potable water shut-off valve (4).

(5.2) Open product utility hose valve (5).

(6) Fill clean/flush tank with potable water.

(a) Disconnect one dispensing hose (13, Figure 2-52) from distribution pump.

(b) Connect auxiliary hose (14) to pump.

(c) Pass auxiliary hose through doorway and connect to clean/flush tank overflow hose (15).

NOTE

Selector switch on distribution pump must be in ON position in order to control the pump from the switch panel inside the door

(d) Press DISTRIBUTION PUMP ON pushbutton (17).

(e) Fill clean/flush tank to 50 gallon level. Press DISTRIBUTION PUMP OFF pushbutton (16).

(f) Remove chemical port cover (6) and pour in one 2 ounce bag of bisulfite. Clean off any chemical that lays in port opening.

(g) Replace chemical port cover (6).

(h) Press DISTRIBUTION PUMP ON pushbutton (17) and fill clean/flush tank to 200 gallons (757 l).

(i) Press DISTRIBUTION PUMP OFF pushbutton (16) when tank is full.

(7) Flush.

(a) Fully open system pressure control valve (18).

(b) Divert product hose (19) to waste.

(c) Push BOOSTER PUMP START (20).

(d) After flow is established, push HIGH PRESSURE PUMP START (21).

NOTE

Water will flush from clean/flush tank through system by-passing the media filter until high pressure pump and booster pump stop.

CAUTION

If tank is empty and pumps do not shut off, push HIGH PRESSURE PUMP STOP and BOOSTER PUMP STOP. Operation can continue by manually starting and stopping pumps. Notify Unit Maintenance. Troubleshoot the clean tank level switch (para. 3-3).

(8) Bisulfite sanitizing cleaning.

NOTE

Bisulfite sanitizing cleaning is required as part of shod term and long term shutdown to secured status to prevent bacterial growth within the RO elements. Refer to para. 2-26.

NOTE

This procedure leaves the RO vessels full of the sodium bisulfite sanitizing solution. Drain only if the ROWPU will be subject to freezing (para. 2-31).

c. *Hypochlorite Flush* (Figure 2-53). When shutdown periods exceed 2 days, clean hypochlorite tank and pump as follows:

CAUTION

Failure to flush system will result in damage to equipment.

NOTE

Control panel must be set up in FILTER NORMAL operation for following flush (para. 2-19 b thru d).

(1) Water flush.

(a) Open hypochlorite tank drain valve (1).

(b) Wait until level drops below MIXER on tank level gage (2) and turn MIXER switch (3) to OFF.

(c) Disconnect one dispensing hose (4) from distribution pump (5) and connect auxiliary fill hose (6).

(d) Pass auxiliary hose (6) through doorway and connect water flush adaptor (7) to hose end.

(e) Connect air/water utility "flush/purge" hose (8) to water flush adapter (7). Insert into hypochlorite tank quick-disconnect and slowly open the "flush/purge" hose valve to prevent blowing the lines.

NOTE

Push DISTRIBUTION PUMP OFF pushbutton and turn selector switch on pump to ON.

(f) Push DISTRIBUTION PUMP ON (9) and flush out hypochlorite tank. Close drain and partially fill tank. Then push DISTRIBUTION PUMP OFF (10).

(g) Push CHEMICAL PUMP START (11). Note speed (12) and stroke (13) settings and reset speed to 80 and stroke to 100.

(h) Flush for two to five minutes. Remove flush/purge hose and reset pump speed and stroke controls to original settings. Press CHEMICAL PUMP STOP (14). Open tank drain.

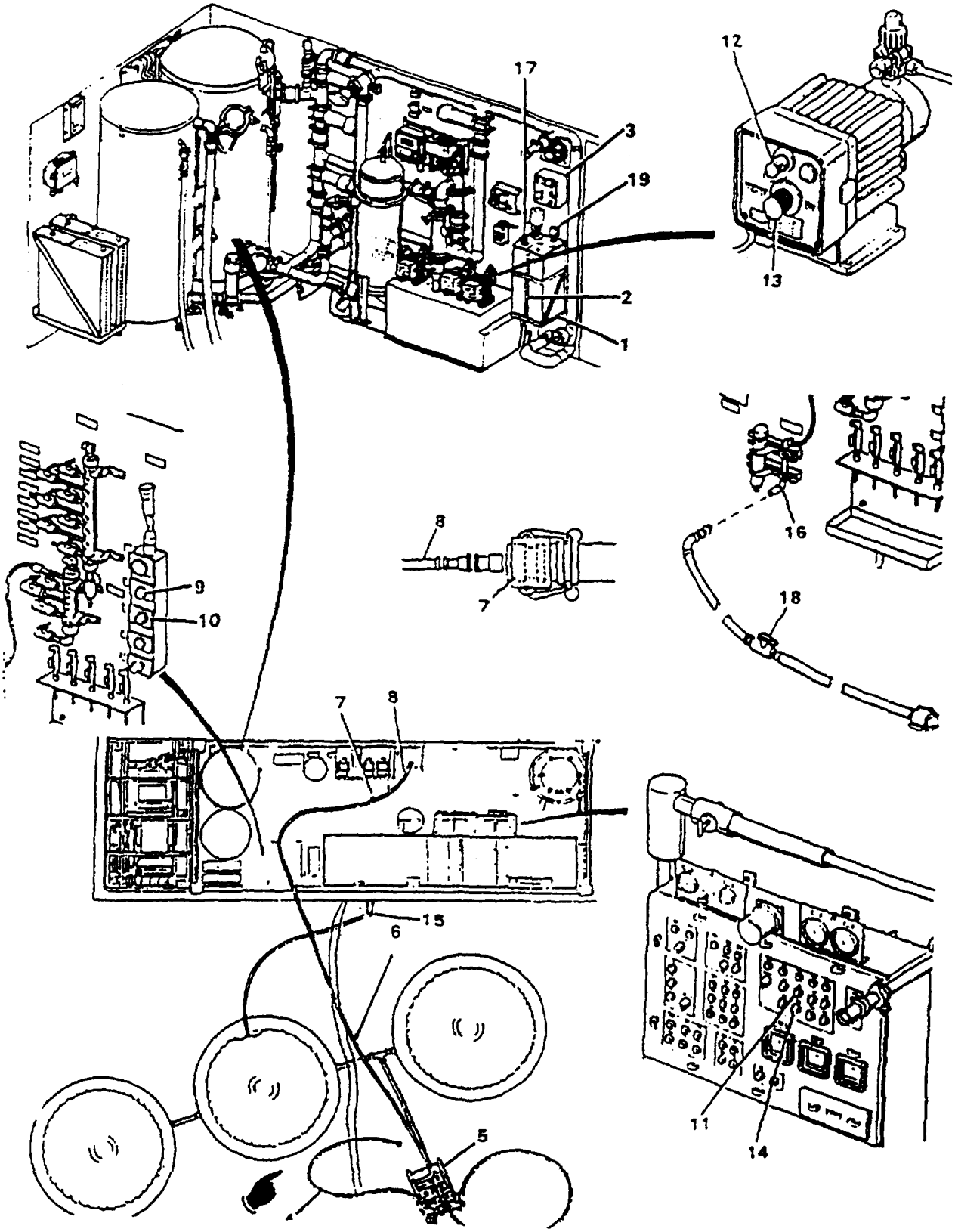


Figure 2-53. Hypochlorite Flush

NOTE

The polyelectrolyte and sequestrant systems do not need to be flushed. However, these tanks should be drained prior to moving the ROWPU, or if the shutdown will exceed 24 hours.

(2) Air purge.

(a) Open product shut-off valve (15).

(b) Disconnect the flush/purge hose (8) from water flush adapter (7).

(c) Connect flush/purge hose to the utility air connection (16).

(d) Connect flush/purge hose to hypochlorite quick-disconnect (17).

(e) Partially open hose valve (18) and dry out chemical tubing for 2 minutes, then close hose valve. Disconnect flush/purge hose. During the two minutes, crack open the Backwash Hypochlorite Pump Vent valve (19) until all the water is out.

(f) Close product shut-off valve (15).

d. *Secure Equipment*

(1) Open all drain valves, Table 2-15, EXCEPT THOSE AT THE RO VESSELS. Turn MAIN circuit breaker (7, Figure 2-52) to OFF and secure generator. Drain distribution system when appropriate.

CAUTION

DO NOT hold jog switch in the ON position for more than 10 seconds or severe damage to equipment will occur. (MODEL ROWPU-1 ONLY)

(2) Open all high pressure pump drain valves. (Model ROWPU-1 Only).

(3) Drain any remaining water from the HIGH PRESSURE PUMP by pushing in the jog switch (22) toggle up for not more than 10 seconds (Model ROWPU-1 Only).

CAUTION

When operating near or below 32° F (0° C) follow instructions in para. 2-31.

(4) If moving, follow instructions in para. 2-28.

NOTE

The generator should not be used for prolonged periods to provide power to the utility and lighting circuits during secured shutdown. Use a separate power source if power is needed. The generator may be used to power the distribution pump as needed.

2-23. SHUTDOWN TO LONG-TERM SECURED STATUS. Use this procedure when the ROWPU will be shutdown for more than 3 days.

NOTE
1400 gallons of potable water must be available.

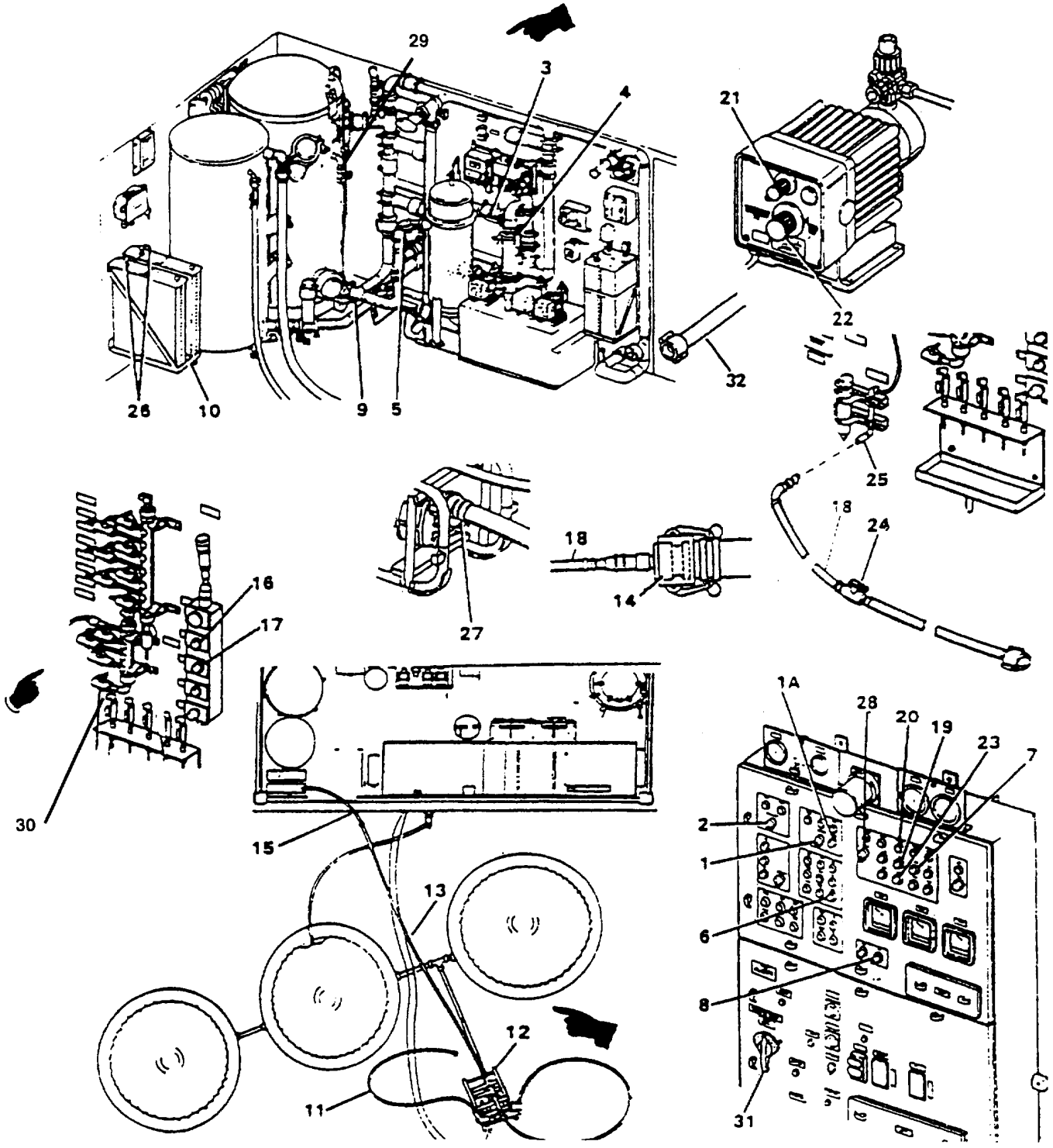


Figure 2-54. Flushing of Polyelectrolyte and Sequestrant Tanks

a. Clean-up.

(1) Use product utility hose to wash down the ROWPU floor with product water while still producing water.

(2) Clean-up inside ROWPU as time permits during following period.

b. Backwash media filter (para. 2-21). Do not forward flush media filter.

c. Water flush hypochlorite system (para. 2-22c(1)).

NOTE
When water flush is complete, add water as needed to leave 9 gallons in the tank.

CAUTION
Failure to flush system will result in damage to equipment.

d. Backwash media filter again with potable water in the clean/flush tank

CAUTION
This backwash is critical when operating on brackish or sea water. Failure to flush will result in piping/equipment corrosion and failure.

(1) Fill clean/flush tank with potable water (Figure 2-52).

(a) Disconnect one dispensing hose (13, Figure 2-52) from distribution pump.

(b) Connect auxiliary fill hose (14) to pump.

(c) Pass auxiliary fill hose through doorway and connect to clean/flush tank overflow hose (15). Push DISTRIBUTION PUMP OFF pushbutton (17) and turn selector switch on distribution pump to ON.

NOTE
Selector switch on distribution pump must be in ON position in order to control the pump from switch panel no. 1 inside the van.

(d) Press DISTRIBUTION PUMP ON pushbutton (16).

(e) Fill clean/flush tank to 50 gallon level. Press DISTRIBUTION PUMP OFF pushbutton (17).

(f) Remove chemical port cover (6) and pour in one 2 ounce bag of bisulfite. Clean off any chemical that remains in port opening.

(g) Replace chemical port cover (6).

(h) Fill the clean/flush tank to 200 gallons (757 l) and stop the distribution pump.

CAUTION
Do not forward flush.

(2) Backwash media filter (para. 2-21). Do not forward flush after backwash.

e. Flush piping (seawater and brackish or water operation only).

CAUTION
This flush is critical when operating on brackish or sea water. Failure to flush will result in piping/equipment corrosion and failure.

(1) Fill clean/flush tank with potable water (para. 2-23d (1))

(2) Set SYSTEM MODE switch (2) to SYSTEM ON.

(3) Set OPERATION MODE switch (1, Figure 2-54) to SYSTEM Clean; Push INITIATE pushbutton (1A).

(4) Open feed valve (3). Close cleaning bypass valve (4).

(5) Open cartridge filter block valve (5).

(6) Push MEDIA FILTER FORWARD FLUSH pushbutton (6) to open valve.

(7) Push BOOSTER PUMP START (7). Hold pushbutton in until pressure rises above 10 psig.

(8) When clean/flush tank empties and pump stops, push SYSTEM RESET(8) if alarm sounds.

(9) Repeat steps (1) through (8) for a second flush.

(10) While flushing, partially open the media filter lower drain valve (9).

(11) Check the TDS of the flushwater.

(a) Remove the waste out hose (32) from the ROWPU Van waste out connection.

(b) Sample the water draining from the waste out connection on the ROWPU Van.

(c) Measure the TDS of the flushwater using the Portable TDS meter (para. 2-7).

(d) Reconnect the waste out hose (32).

(e) If the TDS is 1000 ppm or less, continue with step (12). If the TDS is above 1000 ppm, repeat steps (1) through (11). ■

NOTE

This procedure assures all seawater/brackish water has been flushed from the media filter and piping system.

(12) Open the cartridge filter block valve (5) and the cleaning bypass valve (4).

f. RO element cleaning.

(1) Clean according to procedures of Table 2-28 or 2-29.

(2) Continue with bisulfite sanitizing cleaning (para. 2-26).

g. Flush chemical tanks (see Figure 2-54).

(1) Open drain valves (10) at both tanks.

(2) Disconnect one dispensing hose (11) from distribution pump (12); connect auxiliary fill hose (13) to pump.

(3) Pass hose through doorway and connect water flush adapter (14).

(4) Connect flush/purge hose (15) to water flush adapter (14). Push DISTRIBUTION PUMP OFF (17) pushbutton and turn distribution pump selector switch to ON. Slowly open valve on "flush/purge" hose to prevent blowing the lines.

NOTE

Selector switch on distribution pump must be in ON position in order to control the pump from the start/stop station inside the secondary access door.

(5) Push DISTRIBUTION PUMP ON (16) and use hose to flush out both tanks and to partially fill, then push DISTRIBUTION PUMP OFF (17).

(6) Disconnect flush/purge hose (18) from water flush adapter (14). ■

(7) Press CHEMICAL PUMP START (19).

(8) CHEMICAL PUMP START light (20) on panel should glow green.

(9) Set polyelectrolyte pump speed control (21) to 80 and stroke control (22) to 100.

(10) Flush for two to five minutes and press CHEMICAL PUMP STOP (23). Light (20) should go off.

(11) Repeat procedures (1 thru 10) for sequestrant pump, using sequestrant pump speed control (21) and stroke control (22) when adjusting speed and stroke.

(12) Be sure hose valve (24) is closed on flush/purge hose (15).

h. Purge air.

(1) Connect flush/purge hose (15) to the utility air connection (25).

(2) Connect flush/purge hose to the quick-disconnect (26) on the tank.

(3) Open hose valve (24) and dry out chemical tubing for 2 minutes. Close valve.

(4) Repeat steps 2 and 3 for sequestrant tank.

(5) Repeat steps 2 and 3 for hypochlorite tank.

(6) Disconnect flush/purge hose and store in storage box #3.

i. Secure equipment (Figure 2-54).

(1) Open all drain valves, vent valves, and manual valves, Table 2-15, EXCEPT THOSE AT THE RO VESSELS.

NOTE

This leaves the RO vessels full of sodium bisulfite sanitizing solution. Drain only if subject to freezing (para. 2-31).

CAUTION

DO NOT hold jog switch in the ON position for more than 10 seconds or severe damage to equipment will occur (MODEL ROWPU-1 ONLY).

(2) Open all high pressure pump drain valves. (Model ROWPU-1 Only).

(3) Drain any remaining water from the HIGH PRESSURE PUMP by pushing in the jog switch (22) toggle up for not more than 10 seconds. (Model ROWPU-1 Only).

(4) Remove raw water suction hose at pump and open drain valve (27) on raw water pump.

(5) Disconnect and coil raw water discharge and waste hoses.

(6) Turn COMPRESSOR OFF/ON switch (28) to OFF.

(7) Close media filter vent valve (29) and open the air purge media filter block (30) and allow remaining air in air storage bottle to dry media bed.

(8) Turn off MAIN circuit breaker (31).

(9) Secure diesel generator (see TM 5-6115-545-12 or TM 9-6115-645-10).

NOTE

If distribution system is to be drained make certain the 5 gallon plastic jug (18, Figure 2-24) is filled with product water prior to draining. This water will be used for initial polyelectrolyte set up (para. 2-17a) during next start-up.

(10) Drain distribution system (pump, tanks, hoses) when appropriate.

NOTE

If moving, follow instructions in para. 2-28.

2-24. ROUTINE OPERATION.

a. *Production Rate.* Operate the ROWPU to keep the storage tanks full without overflowing as follows:

(1) Set the operating pressure to obtain the mission normal water flow as described in para. 2-17b(4). The mission normal water flow (shown in gpm on Tables 2-18 and 2–20) will average the daily gallons of production as listed over a 10 day mission. The 10 day mission profile provides 200 hours of water production and 40 hours as follows:

Set-up/tear down and transportation	5 hours
Off-line generator PMCS	2 hours
Maintenance allowance	6 hours
Filter backwash, cartridge filter element changes and strainer changes	19 hours
RO element cleaning	8 hours
	40 hours

CAUTION

Operating at push limit may damage RO elements and require more frequent cleaning.

NOTE

To achieve the daily average production, the ROWPU is operated continuously at mission normal flow rate (Tables 2–18 and 2–20) and only shut down as needed for routine services and scheduled maintenance. If needed to meet mission demands, higher water flows may be obtained under push conditions.

(2) Operate under push conditions by increasing the pressure to provide any required water flow up to the limiting flow to meet mission demands. Operating at push conditions for up to 10 hours between routine cleanings does not require repeated procedures. Operating at push conditions for extended periods may cause fouling and scaling which will require extended cleaning. (See para. 2-25 and 2-26,) After a 24 hour maximum push to meet an emergency, a routine hot detergent cleaning should be carried out, if mission demands allow.

(3) The ROWPU maybe shut down to stand-by when the tanks are full.

(4) The flow of product water from the ROWPU can be decreased by decreasing system operating pressure. Decrease system operating pressure by further opening the pressure control valve. This is preferred over constantly stopping and starting the ROWPU when water demand is low. Constant starting and stopping stresses the equipment and may cause damage to the motor starters.

b. *Routine Operational Services.* Perform the following services as indicated by t he number of operating hours, or by the warning horn and yellow warning lights. Table 2-27 provides a summary.

NOTE

There are two horns which will come on when certain conditions occur. The warning horn has a pulsing sound; the alert horn has a steady sound. The warning horn will sound when chemical levels are low and when there is high differential pressure in the basket strainer or filters. The alarm horn will sound when the clean/flush tank level is low, feed pressure is low, product pressure is high, or high pressure pump pressure is too high. Yellow warning lights go on with the warning horn. Red alarm lights go on with the alert horn and the ROWPU shuts down, except for the clean/flush tank low alarm. It causes a shutdown only in clean mode.

(1) Backwash media filter. See para. 2-21 for instructions.

- At least once each day.
- Every six hours on rivers and lakes with a lot of organics, where turbidity is over 15 NTU and temperature is over 70°F (21°C).
- Whenever media filter outlet turbidity increases by more than 0.5 NTU over lowest reading since last backwash.
- Whenever the MEDIA FILTER PLUGGED light and warning horn go on.
- Whenever the pressure drop reading is over 25 psi (172 kPa). (Warning light and horn should come on.)

(2) Check filter performance and keep optimized if polyelectrolyte is being used.

(a) Record the media filter outlet turbidity at 1 hour intervals and note the time and polyelectrolyte pump settings on the Media Filter Log as shown on Figure 2-55 (Media Filter Log forms to be reproduced locally are contained in Appendix H). Also note the time of each backwash. This log provides information essential to the best operation of the ROWPU.

NOTE

If the turbidity recorded is more than 0.5 NTU higher than the lowest recorded turbidity since the last backwash, the filter is no longer efficiently removing suspended solids and must be backwashes as described in para. 2-21.

NOTE

When increased turbidity is noted, recalibrate turbidity meter and check turbidity again to be sure noted turbidity is correct. If in doubt, check turbidity with the portable meter.

(b) If the lowest turbidity recorded for a filter run between backwashes is more than 0.2 NTU higher than that recorded for other filter runs during the mission, the pump setting needs to be changed. If the raw water turbidity is higher than when the lowest turbidity was recorded, increase the pump stroke at increments of 5 after the next backwash until two successive increases show no decrease in turbidity. The correct setting is then 5 less than the final setting.

Media Filter Log (Sample)

Date / Time	Turbidities		Backwash Note	Pump Settings	
	Raw	Filter		Stroke	Speed
5/8 0800	32	1.6	Start-Up	65	65
0900	35	1.2		65	65
1000	33	1.0		65	65
1100	33	0.9		65	65
1200	33	0.9		65	65
1300	34	0.9		65	65
1310			Backwash	65	65
1330	34	2.0		65	65
1400	34	1.4		65	65
5/10 1000	45	1.5		65	65
1100	65	1.8		65	65
1200	65	1.8		65	65
1300	65	1.4		80	65
1400	63	1.2		80	65
1500	61	1.0		80	65

Polyelectrolyte Optimization Log

Time	Stroke	Turbidity
	10	
	15	
	20	
	25	
	30	
	35	
	40	
	45	
	50	
	55	
	60	
1200	65	1.8
1215	70	1.6
1225	75	1.5
1235	80	1.5
1245	85	1.5
	90	
	95	
	100	

Date 5/10
Location:
Raw Water Turbidity: 65
Speed Setting 65

Select 80 for new setting

Figure 2-55. Sample Logs

(c) If the raw water turbidity is now less than the lowest reading recorded during the current mission, start at a polyelectrolyte stroke setting of 1/2 of the present setting and carry out the start-up optimization procedure in para. 2-17g.

NOTE

The turbidity of lakes and wells will remain quite constant unless it rains for a long period. Rivers change very rapidly with rain (and perhaps tide). Sea water tends to change with wind speed and direction.

(3) Clean basket strainer.

NOTE

When basket strainer is blocked or needs cleaning, the basket strainer pressure drop sensor will turn on warning horn and yellow STRAINER PLUGGED light (1), Figure 2-56.

(a) Push ALARM SILENCE (2).

(b) Shutdown ROWPU to standby (para. 2-18) and push SYSTEM RESET (3).

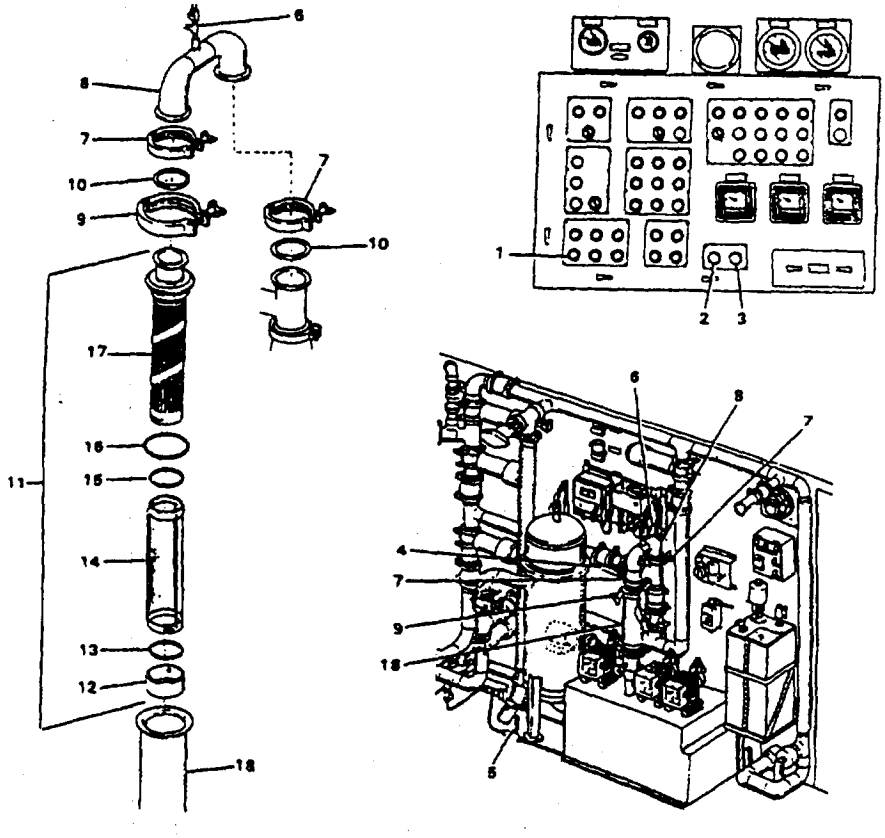


Figure 2-56. Replacing Outer Basket Strainer Screen (MODEL WTA-060 ONLY)

(c) Close feed valve (4). (MODEL WTA-060 ONLY)

(d) Open booster pump drain valve (5). (MODEL WTA-060 ONLY)

(e) Open vent valve (6). (MODEL WTA-060 ONLY)

(f) Disconnect clamps (7).

(g) Remove pipe section (8).

(h) Remove clamp (9).

(i) Lift out basket strainer assembly (11) from strainer vessel (18).

(j) Twist off cap (12) and remove seal (13). Remove outer strainer (14).

(k) Check condition of seal (16) and gaskets (10, 13 and 15), replace if cut or damaged.

(l) Install spare outer strainer (14), seal (16), gaskets (13 and 15) on inner strainer (17) and secure with cap (12). Insert the assembly (11) into the basket strainer vessel (18).

(m) Install gaskets (10).

(n) Install pipe section (8) with clamps (7) and (9).

(o) Close vent valve (6) and booster pump drain valve (5). (MODEL ROWPU-1 ONLY)

(p) Open feed valve (4). (MODEL ROWPU-1 ONLY)

(q) Return to normal operation (para. 2-19).

(r) Clean dirty outer strainer with wire brush for next change-over. If strainer is torn or otherwise damaged, notify organizational maintenance.

NOTE

Model ROWPU-1 is equipped with a dual strainer system which allows a basket strainer to be removed and cleaned without shutting down the ROWPU.

(3.1) On Model ROWPU-1 perform the following procedures for cleaning basket strainer.

(a) (Refer to Figure 2-56.1.) Before disassembly of a basket strainer, be sure to set valves (1) and (2) properly. If basket strainer (3) is being removed, open valve (1) and close valve (2). If basket strainer (4) is being removed, close valve (1) and open valve (2).

(b) Remove clamp (5), gasket (6), and clamp (7).

(c) Remove basket strainer assembly (8) from pipe (9).

(d) Unscrew cap (10) and remove seal (11), O-ring (12), outer strainer (13), O-ring (14), and O-ring (15) from inner strainer (16).

(e) Clean all dirt and debris from outer strainer (13) and inner strainer (16).

(f) Install O-ring (15), O-ring (14), outer strainer (13), O-ring (12), and seal (11) onto inner strainer (16).

(g) Screw cap (10) onto inner strainer (16).

(h) Place basket strainer assembly (8) onto pipe (9) and install clamp (7), gasket (6), and clamp (5).

(i) After assembly and installation of basket strainer, partially open valves (1) and (2) to check basket strainer installation for leaks. Tighten or reinstall fittings as needed.

(4) Replace all ten cartridge filter elements.

NOTE

When cartridge filters are dirty, the cartridge filter pressure drop sensor will turn on warning horn and yellow CARTRIDGE FILTER PLUGGED light (1, Figure 2-57).

(a) Push ALARM SILENCE (2).

(b) Shutdown ROWPU to standby (para. 2-18).

(c) Push SYSTEM RESET (3).

(d) Close cartridge filter block valve (4).

(e) Open cartridge drain valve (5) and filter vent (6).

NOTE

Wait until filter has fully drained before removing nut (7).

(f) Loosen clamp (8) using ratchet wrench. With crescent wrench remove clamp (8), cover (9), gasket (10), nut and washer (7), plate (11), retainer (12), 10 spring and seal assemblies (13), and 10 filter elements (14) from filter housing (15). Discard filter elements. Replace gasket (10) if cut or damaged.

(g) Install 10 new elements (14). Then install 10 spring and seal assemblies (13), retainer (12) and plate (11).

(h) Install nut and washer (7) and tighten leaving approximately 1 inch between plate (11) and retainer (12).

(i) Check and clean out gasket sealing area. Install gasket (10), cover (9), and clamp (8). Tighten clamp with ratchet wrench.

(j) Close drain (5) and vent (6).

(k) Start-up as described in para. 2-19 and resume operation.

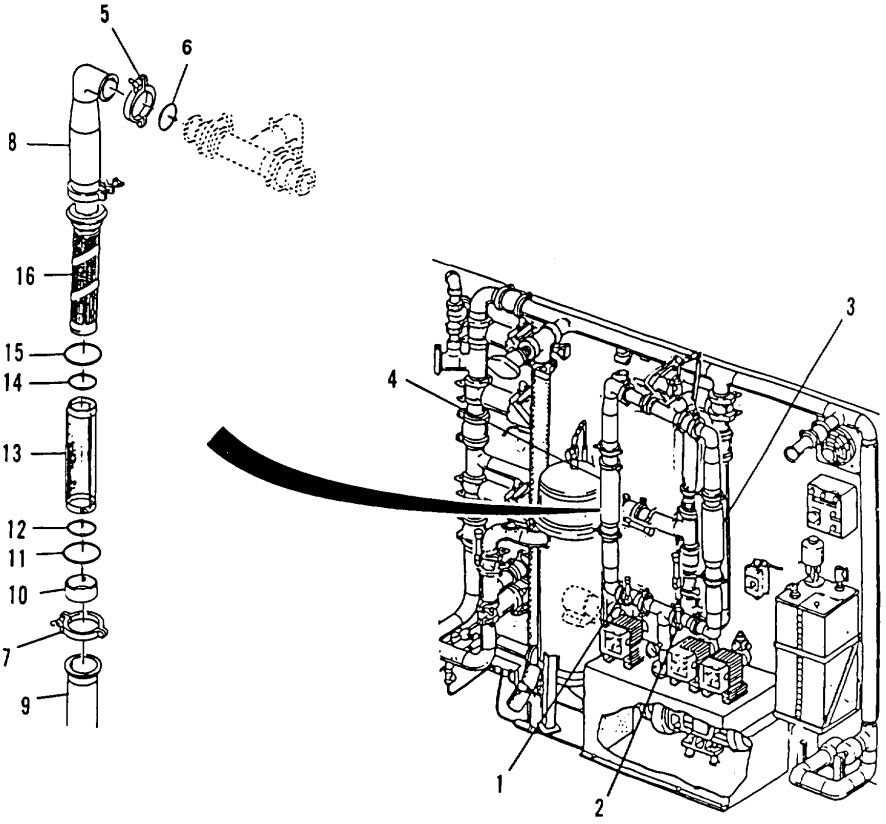


Figure 2-56.1. Replace Outer Basket Strainer Screen
(MODEL ROWPU-1 ONLY)

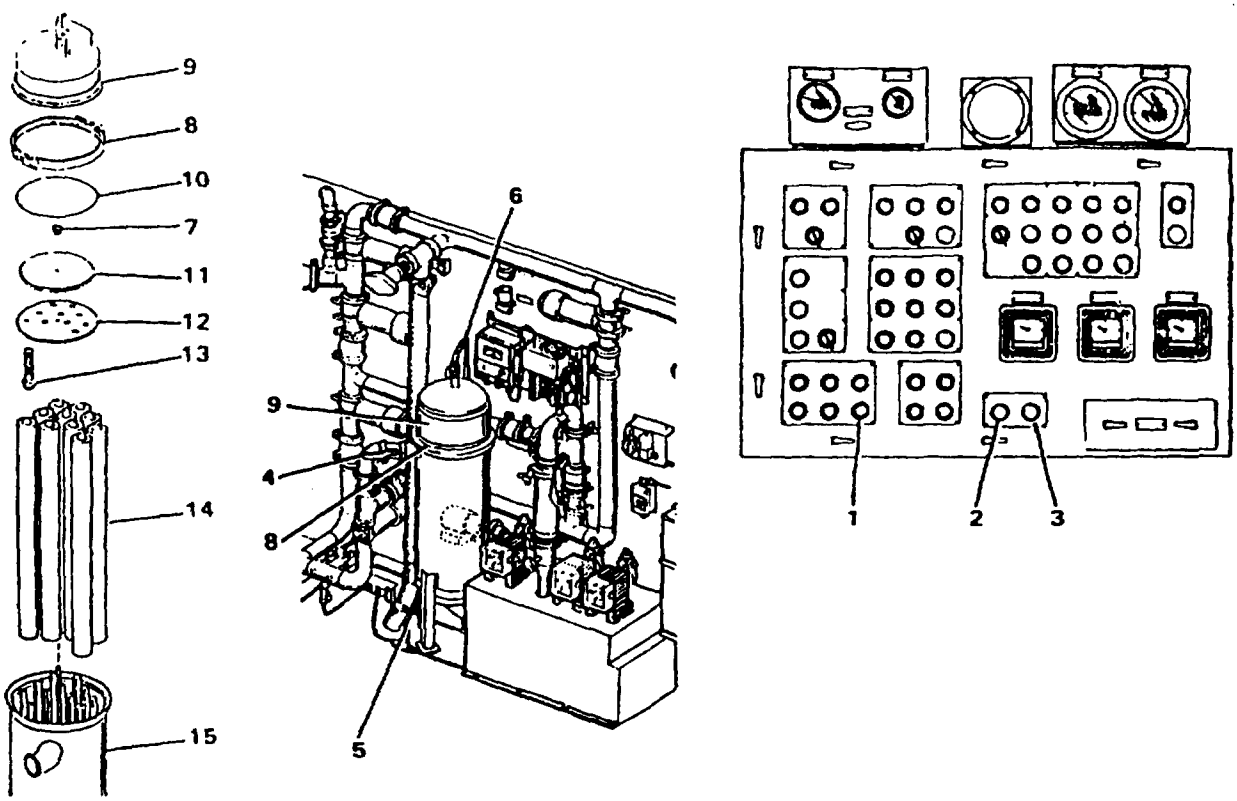


Figure 2-57. Replacing Cartridge Filter Elements

NOTE

All three chemical tanks are marked in one gallon increments. The sequestrant tank level should drop approximately one set of marks per hour. If not, refer to troubleshooting. The polyelectrolyte tank should be observed for a continuous drop in level. However, the rate of drop is dependent on the pump speed and stroke settings.

(5) Refill chemical tanks. When a tank reaches low level, the sensor will turn on the warning horn and yellow light. Tank must be refilled within 30 minutes. Routinely observe tank levels to assure steady drop in level relative to tank markings. Refill sequestrant and polyelectrolyte tanks.

(a) Refill the polyelectrolyte tank using 48 oz (4 oz per gallon) of polyelectrolyte.

(b) Refill the sequestrant tank according to Table 2-21.

(c) Add three packets of hypochlorite to the hypochlorite tank, or one packet for each 6 gallons of water added. The hypochlorite system should be cleaned and flushed at least weekly as described in para. 2-22c (1).

CAUTION

Make sure chemical pumps are adjusted for proper flow as described in para. 2-17.

NOTE

When adding chemicals, always fill half full of water, then add the chemicals and complete filling the tank with water. Mix solution with paddle for sequestrant and polyelectrolyte tanks or motorized mixer for the hypochlorite tank.

(6) Conduct "during operation" PMCS as directed in para. 2-10, 2-11 and Table 2-13. Check product water TDS. If the product water TDS exceeds limiting TDS calculated from Table 2-23, refer to troubleshooting procedures in para. 3-3 for instructions.

WARNING
Water over 1000 ppm TDS is not safe to drink.

(7) Conduct routine RO element cleaning procedure (para. 2-25) as shown in Table 2-26 or 2-27. Use the high pressure pump hourmeter (55, Figure 2-4) to monitor hours.

(8) Complete Data Log. Refer to Appendix H.

c. Alarm Shutdowns (Figure 2-58), The alert horn will sound and ROWPU will automatically shut down for the reasons listed below. Push ALARM SILENCE (1) and refer to troubleshooting chart (Table 3-1) to locate and remedy cause for shutdown.

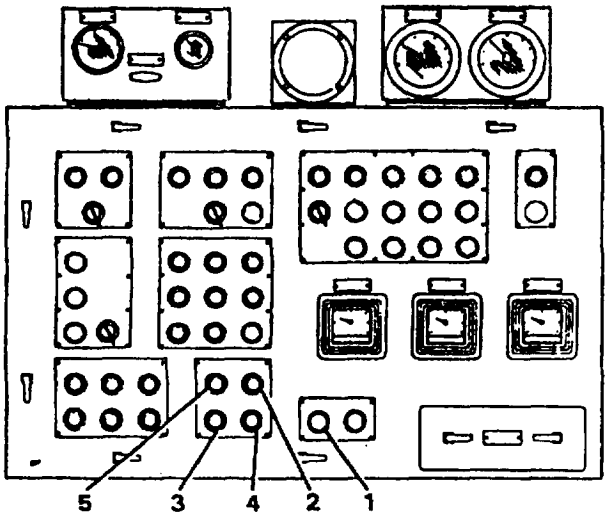


Figure 2-58. Alarm Shutdowns

(1) Feed water pressure to high pressure pump is low, FEED PRESSURE LOW red light (2) goes on.

(2) High pressure pump has excessive discharge pressure, HIGH PRESSURE PUMP PRESSURE HIGH light (3) goes on.

(3) Product water pressure is excessive, PRODUCT PRESSURE HIGH red light (4) goes on.

(4) Clean/flush tank level too low, CLEAN/FLUSH TANK LOW LEVEL light (5) goes on.

d. *RO Element Performance*. Use the portable TDS meter to measure the TDS at the four RO vessel sample valves (Figure 2-6, 16 thru 19) and at the combined sample (20).

(1) Compare the combined TDS with the maximum calculated using Table 2-23. If greater, refer to troubleshooting Table 3-1.

(2) Compare the TDS readings for the top two vessels (16 and 17). If the difference between the two is more than given by Table 2-26, the vessel with the higher TDS has internal O-ring leakage. Follow the procedures of para. 3-28 and check for damaged O-rings. Repeat this procedure for the bottom vessels (18 and 19).

Table 2-26. RO Vessel Maximum TDS Difference

Raw Water TDS	Maximum Vessel TDS Difference
100 to 1,500	50
1,500 to 2,500	50
2,500 to 5,000	50
5,000 to 10,000	75
10,000 to 15,000	110
15,000 to 25,000	210
25,000 to 35,000	300
35,000 to 40,000	400
45,000 to 50,000	500

e. *Routine Operational Services.* Tables 2-27 and 2-28 summarize the routine crew operational services needed to maintain operation throughout a mission.

Table 2-27. Routine Operational services When Operating With Polyelectrolyte

Operational Service	Ref.	Frequency or Alert
1. Backwash Media Filter	2-21	a. At least daily.
		b. 6 hours on rivers and lakes with organic activity, turbidity over 15 NTU and temperature over 70°F.
		c. Whenever outlet turbidity increases by more than 0.5 NTU over lowest reading since last backwash.
		d. Whenever media filter plugged warning light and horn come on or pressure drop reading exceeds 25 psi.
2. Clean Strainer Basket	2-24b(3)	a. Whenever strainer plugged warning light and horn come on.
3. Replace Cartridge Filter Elements	2-24b(4)	a. Whenever cartridge filter plugged warning light and horn come on or pressure drop exceeds 20 psi.
		b. Before beginning cleaning procedures.
4. Refill Chemical Tanks	2-24b(5)	a. Whenever chemical tank low light(s) and warning horn come on.
5. Media Filter Log		a. Hourly.
6. Data Logi		a. Hourlv.
7. Polyelectrolyte Optimization	2-24b(2)	a. Whenever lowest outlet turbidity during a filter run is more than 0.2 NTU higher than that recorded for other filter runs during the mission.
8. Routine RO Element Cleaning	2-25	
Citric Acid Cleaning		a. 100 hour operating intervals as determined from the High Pressure Pump Hourmeter. 200 hours on sea water.
		b. As a part of long term secured shutdown procedures.
Detergent Cleaning		a. Following citric acid cleaning.
9. Bisulfite Sanitization	2-26	a. Shutdown to temporary secured status.
		b. Following detergent cleaning when shutting down to long term secured status.

Table 2-28. Routine Operational Services When Operating Without Polyelectrolyte

Operational Service	Ref.	Frequency or Alert
1. Backwash Media Filter	2-21b,c	a. At least daily.
		b. Whenever media filter plugged warning light and horn come on or pressure drop reading exceeds 25 psi.
2. Clean Strainer Basket	2-24b(3)	a. Whenever strainer plugged warning light and horn come on.
3. Replace Cartridge Filter Elements	2-24b(4)	a. Whenever cartridge filter plugged warning light and horn come on or pressure drop exceeds 20 psi.
		b. Before beginning cleaning procedures.
4. Refill Chemical Tanks	2-24b(5)	a. Whenever chemical tank low light(s) and warning horn come on.
5. Data Log		a. Hourly.
6. Routine RO Element Cleaning	2-25	
NTP-A Cleaning		a. 25 hour operating intervals as determined from the high pressure pump hourmeter.
		b. As a part of long term secured shutdown procedures.
Detergent Cleaning		a. Following NTP-A cleaning at 100 hour intervals.
7. Bisulfite Sanitization	2-26	a. Shutdown to temporary secured status.
		b. Following detergent cleaning when shutting down to long term secured status.

2-25. RO ELEMENT CLEANING. Proper cleaning of the RO elements is critical to meet mission demands. Read and, as required, perform the cleaning procedures in this section to keep the ROWPU running efficiently. System clean will require 2000 gallons (7570 l) of potable water.

a. *General*. The sequence of procedures for cleaning are summarized in Tables 2-29 and 2-30.

Table 2-29. Cleaning Procedures When Operating With Polyelectrolyte

Procedure	Ref.
NOTE **Do not repeat backwashing (Step 1) when already completed as a part of shutdown procedures.**	
1. Backwash media filter (do not forward flush).	2-21 b, c
2. Replace cartridge filters.	2-24b (4)
3. Clean basket strainer(s).	2-24b (3)
4. Preliminary flush.	2-25b
5. Set-up to clean.	2-25c(1)
6. Citric acid clean.	2-25c(2), (3)
7. Flush RO elements two additional times.	2-25d(1)
8. Heat up to 80°F but not over one hour.	2-25d(2)
9. Set-up to clean.	2-25d(3)
10. Detergent clean.	2-25d(4), (5)
11. Return to normal operation.	2-25d(6)
or	
12. Continue with bisulfite sanitizing cleaning for shutdown to secured status.	2-26

Table 2-30. Cleaning Procedures When Operating Without Polyelectrolyte

Procedure	Ref.
NOTE **Do not repeat backwashing (Step 1) when already completed as a part of shutdown procedures.**	
1. Backwash media filter (do not forward flush).	2-21 b, c
2. Replace cartridge filters.	2-24b(4)
3. Clean basket strainer(s).	2-24b(3)
4. Preliminary flush.	2-25b
5. Set-up to clean.	2-25e(1)
6. NTP-A clean.	2-25e(2), (3)
7. At 25, 50 and 75 hour intervals return to normal operation unless preparing for shutdown to long term secured status.	2-25e(4)
or	
8. At 100 hour intervals or for shutdown to long term secured status, continue with detergent cleaning,	
9. Flush RO elements two additional times.	2-25d(1)
10. Heat up to 80°F but not over one hour.	2-25d(2)

Table 2-30. Cleaning Procedures When Operating Without Polyelectrolyte (Continued)

Procedure	Ref.
11. Set-up to clean.	2-25d(3)
12. Detergent clean.	2-25d(4), (5)
13. Return to normal operation.	2-25d(6)
or	
14. Continue with bisulfite sanitizing cleaning for shutdown to secured status.	2-26

b. *Preliminary Flush (Figure 2-59)*. The following preliminary flush must be made before any cleaning procedures can begin.

(1) Set valves and hoses.

(a) Close feed valve (4). Open clean bypass valve (5).

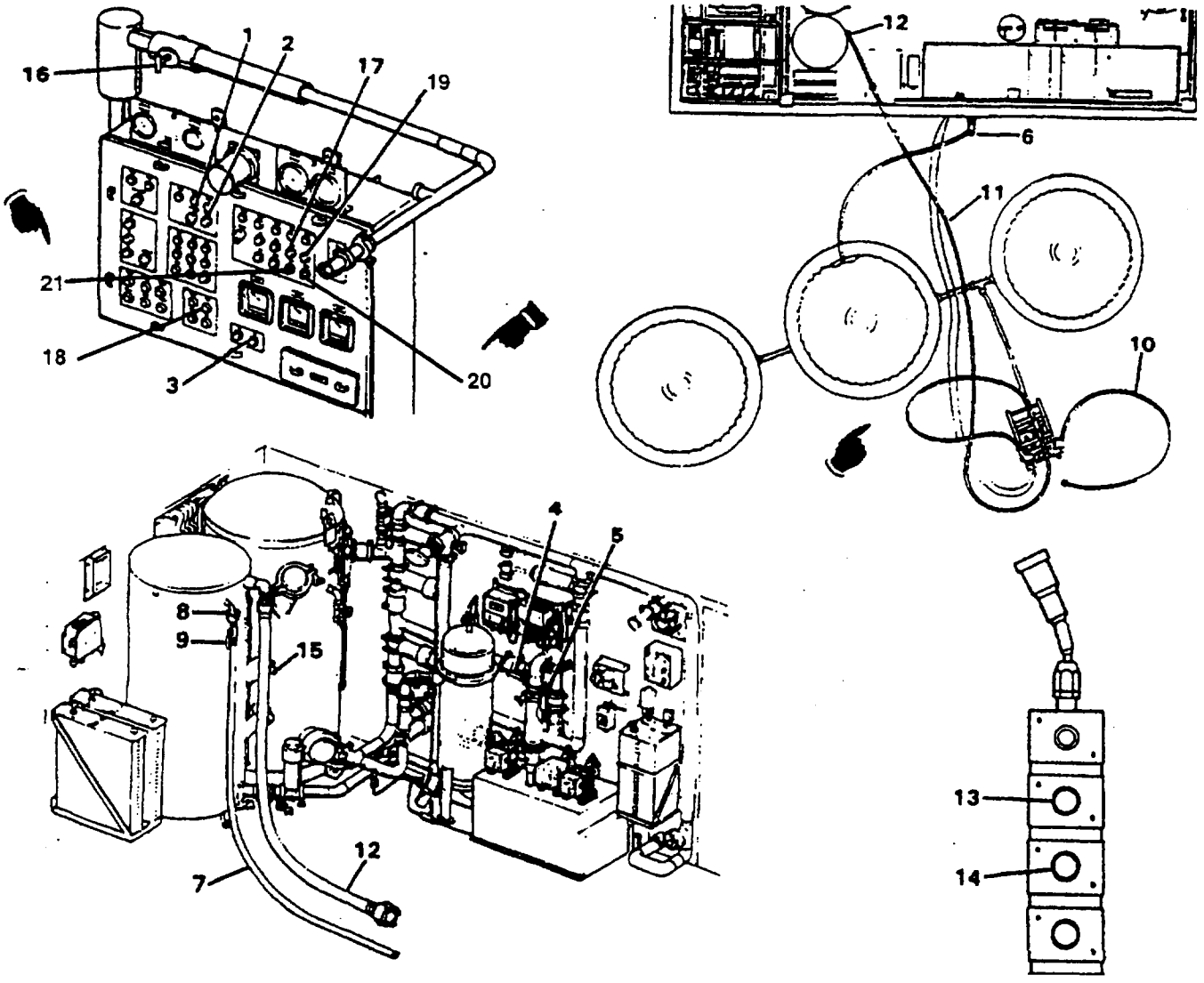


Figure 2-59. Preliminary Flush

(b) Close the product shut-off valve (6).

(c) Connect the product utility hose (7) to the clean/flush tank fill connection (8) and open the product utility hose valve (9).

(2) Turn OPERATION MODE switch (1) to SYSTEM CLEAN and push INITIATE (2).

(3) Fill clean/flush tank with potable water.

(a) Disconnect one dispensing hose (10) from distribution pump.

(b) Connect auxiliary hose (11) to pump.

(c) Pass auxiliary hose through doorway and connect to clean/flush tank overflow hose (12).

NOTE

Push DISTRIBUTION PUMP OFF pushbutton. Selector switch on distribution pump must be in ON position in order to control the pump from the start/stop station inside the secondary access door.

(d) Press DISTRIBUTION PUMP ON pushbutton (13).

(e) Fill CLEAN/FLUSH TANK to 100 gallon level. Press DISTRIBUTION PUMP OFF pushbutton (14).

(f) Remove chemical port cover (15) and pour in one 2 ounce bag of bisulfite. Remove any chemical that remains in port.

(g) Replace chemical port cover (15).

(h) Start the distribution pump and fill clean/flush tank to the top of the level gauge. Stop pump.

(4) Flush.

(a) Fully open system pressure control valve (16).

(b) Push and hold BOOSTER PUMP START(17) until FEED PRESSURE LOW light (18) goes off. Open cartridge filter vent. Close when water is seen.

(c) After flow is established, push HIGH PRESSURE PUMP START (19).

NOTE

Water will flush from clean/flush tank through system by-passing the media filter until the high pressure pump and booster pump stop.

CAUTION

If tank is empty and pump is not shut off, push HIGH PRESSURE PUMP STOP and BOOSTER PUMP STOP. Operation can continue by manually starting and stopping pumps. Notify unit maintenance.

NOTE

The set-up and flush of para. 2-25b must be completed before proceeding.

As a result of the flush procedure the following condition should exist:

- **Feed valve closed.**
- **Cleaning/bypass valve open.**
- **Product utility hose connected to clean/flush tank fill connection and valve opened.**
- **Product shut-off valve closed.**
- **System pressure control valve fully open.**
- **SYSTEM CLEAN green light ON. (OPERATION MODE switch set to SYSTEM CLEAN and INITIATE pushed).**

c. *Citric Acid Cleaning (Figure 2-60)*.

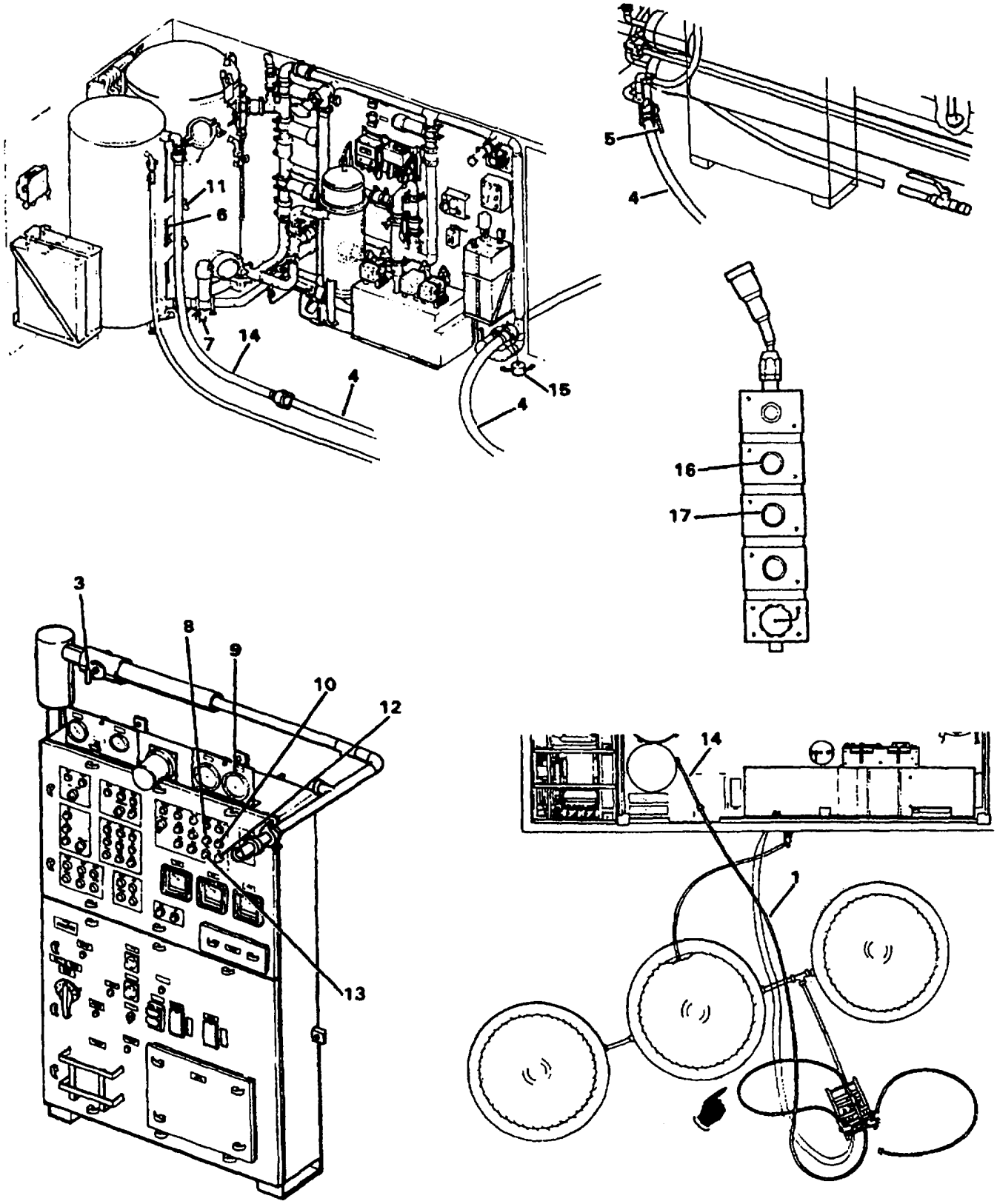


Figure 2-60. Citric Acid Cleaning

(1) Set-up to clean.

(a) Fill the clean/flush tank with potable water to the 100 gallon level using the procedures of para. 2-25 b(3).

(b) Remove auxiliary hose (1) from overflow hose (14).

(c) Fully close system pressure control valve (3).

(d) Connect the clean return hose (4) to the clean/flush tank overflow hose (14).

(e) Open the clean return valve (5).

WARNING

Use caution when using citric acid. Failure to do so could result in severe burns. Always wear chemical gloves, apron, and face shield. If citric acid comes in contact with skin or clothes, wash off immediately. If citric acid comes in contact with eyes, wash eyes immediately with clean water from eye wash station.

CAUTION

Make certain level of water in clean/flush tank is below chemical port. If level is above chemical port, open tank drain valve until level is below chemical port.

(2) Establish Circulation (Figure 2-60).

CAUTION

Pouring citric acid into the clean/flush tank too fast will cause the booster pump to clog up with citric acid.

NOTE

Check valve positions.
- **Clean return valve open.**
- **System pressure control valve fully closed.**

(a) Press BOOSTER PUMP START (8). Hold pushbutton in until feed pressure low light goes off.

NOTE

Wait until pressure on the cartridge filter pressure gage is at least 50 psig (345 kPa) before proceeding.

(b) Press HIGH PRESSURE PUMP START (10).

(c) Using the color comparator kit, perform a pH test on the water in the clean/flush tank by drawing a sample from the clean/flush tank fill hose or the media filter outlet sample valve (Model WTA-060 only).

WARNING

Keep face away from clean/flush tank port. Chemical fumes may irritate eyes.

CAUTION

The pH of the water circulating through the RO vessels must never drop below 3.5 ppm or elements may be damaged. If water circulating through the elements drops below 3.5 ppm, stop circulation immediately and perform a preliminary flush or return to normal operation.

(d) After establishing a known pH, remove chemical port cover (11) from clean/flush tank and add citric acid as needed until pH of the water circulating through the elements is as close to, but not below 3.5 ppm, as possible.

(e) Continue taking the pH test every 5 minutes, adding citric acid as needed and until pH is as close to 3.5 ppm as possible.

(f) Record the amount of citric acid added to the clean/flush tank each time and the temperature, ensuring not to exceed 10°F (43°C).

(g) Once pH is adjusted, install chemical port cover (11) and secure with wing nut.

(h) Circulate for 1 hour. Press HIGH PRESSURE PUMP STOP (12). After 1 minute press BOOSTER PUMP STOP (13).

(3) Flush cleaning solution (Figure 2-60).

(a) Close the clean return valve (5).

(b) Remove clean return hose (4) from the clean/flush tank overflow hose (14).

(c) Remove waste out cap (15) (inside) from waste out connection.

(d) Connect clean return hose (4) to waste out connection.

(e) Open the clean return valve (5).

NOTE

Be sure that the clean return hose is laid out without sharp kinks which will restrict the water flow.

(f) Press BOOSTER PUMP START (8). Hold pushbutton in until feed pressure low light goes off.

(g) Tank empties and pump stops.

CAUTION

If tank empties but pump does not shut off, push BOOSTER PUMP STOP. Operation can continue by manually starting and stopping the pump. Notify unit maintenance.

(h) Open clean/flush tank drain (7).

(i) Connect auxiliary fill hose (1) from distribution pump to overflow hose (14).

(j) When clean/flush tank is empty, press DISTRIBUTION PUMP ON (16) to rinse tank.

(k) When one minute has passed, close clean/flush tank drain valve (7). Press DISTRIBUTION PUMP OFF (17) when level reaches 75 gallons.

(l) Remove chemical port cover (11). Add contents of one small bag of sodium bisulfite. Reinstall chemical port cover.

(m) Press DISTRIBUTION PUMP ON (16) and, when clean/flush tank is full, press DISTRIBUTION PUMP OFF (17).

(n) Press BOOSTER PUMP START (8) to flush system. Hold pushbutton in until feed pressure low light goes off.

(o) When tank empties, the pump stops.

(p) Repeat steps (j) through (o) for a second flush.

(q) Continue with detergent cleaning.

d. *Detergent Cleaning (Figure 2-61)*.

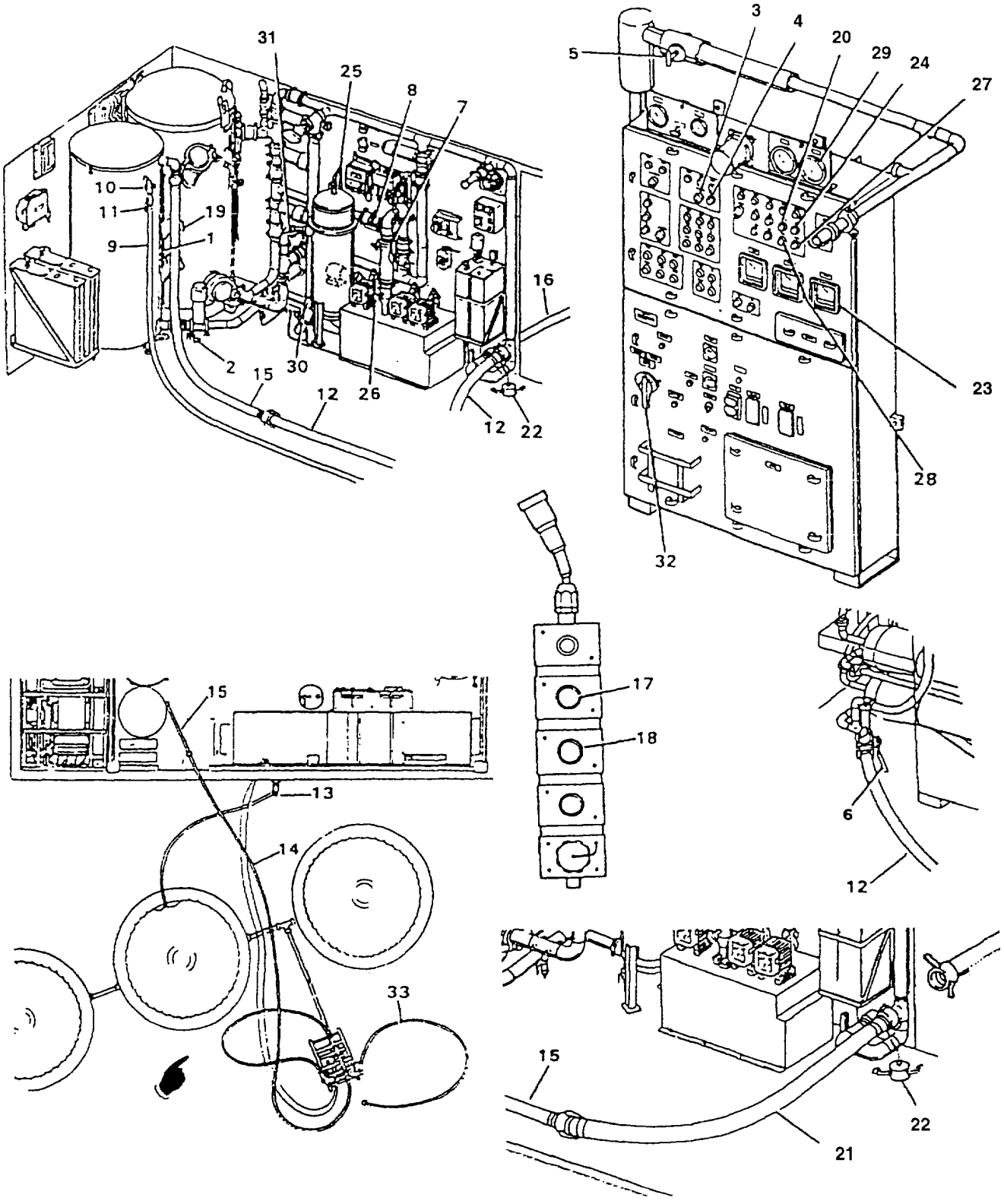


Figure 2-61. Detergent Cleaning

WARNING

Use caution when using detergent. Failure to do so could result in burns. Always wear chemical gloves and face shield. If detergent comes in contact with skin or clothes, wash off immediately. If detergent comes in contact with eyes, wash eyes immediately with clean water from the eye wash station.

CAUTION

Make certain level of water in clean/flush tank is below chemical port. If level is above chemical port, open tank drain valve until level is below chemical pod.

NOTE

The ROWPU should already be set up as follows as a result of citric acid or NTP-A cleaning.

- **Operational mode switch (3, Figure 2-61) set to system clean and light (4) on.**
- **System pressure control valve (5) fully closed.**
- **Clean return valve (6) open.**
- **Cleaning bypass valve (7) open. Feed valve (8) closed.**
- **Product utility hose (9) connected to clean/flush tank fill connection (10) and valve (11) open.**
- **Clean return hose (12) connected to waste out.**
- **Product shut off valve (13) closed.**
- **Clean/flush tank empty.**
- **Auxiliary fill hose (14) connected to distribution pump and clean/flush tank overflow hose (15).**
- **Waste hose (16) connected to waste out connection.**

(1) Flush RO vessels two additional times.

(a) Push DISTRIBUTION PUMP ON (17). When level reaches 75 gallons, push DISTRIBUTION PUMP OFF (18).

(b) Remove fill port cover (19). Add contents of one 2 ounce bag of bisulfite through fill port. Reinstall cover. Remove any chemical that lays in port.

(c) Push DISTRIBUTION PUMP ON (17). When tank has 200 gallons, press DISTRIBUTION PUMP OFF (18).

(d) Press BOOSTER PUMP START (20). Hold pushbutton in until feed pressure low light goes off.

(e) When tank empties, pump stops.

CAUTION

If tank empties but pump does not shut off, push BOOSTER PUMP STOP. Operation can continue by manually starting and stopping the pump. Notify unit maintenance.

(f) Repeat steps a through e for a second additional flush.

(2) Heat Up. Used when water temperature is below 80°F.

(a) Close the clean return valve (6).

(b) Disconnect and coil the clean return hose (12) out of the way.

(c) Remove waste out hose (16) from ROWPU van waste out connection. Install cap on connection.

NOTE

Disconnect waste out hose section connection closest to van to allow drainage before disconnecting.

(d) Remove waste out cap (22) (inside) and connect the cleaning heat-up hose (21).

(e) Fully open the system pressure control valve (5).

(f) Fill the clean/flush tank to 100 gallons (378 l) following steps 1a through c.

(g) Remove the auxiliary fill hose (14) from the overflow hose (15).

(h) Connect the cleaning heat-up hose (21) to the overflow hose (15).

(i) Press BOOSTER PUMP START (20). Hold pushbutton in until feed pressure low light goes off.

NOTE
Wait until water is flowing back into the clean/flush tank.

(j) Open cartridge filter vent (25), close when water is seen.

(k) Press HIGH PRESSURE PUMP START (24).

(l) Leave system pressure control valve (5) fully open.

(m) Circulate until water temperature reaches 80°F (27°C) but not more than 1 hour.

NOTE
Temperature can be read on the raw water temperature gage.

(n) Press HIGH PRESSURE PUMP STOP (27).

(o) When the system pressure stops dropping, press BOOSTER PUMP STOP (28).

(3) Set-up to clean.

(a) Fully close system pressure control valve (5).

(b) Disconnect the cleaning heat-up hose (21) at both ends. Coil out of the way.

(c) Reinstall waste out cap (22).

(d) Remove ROWPU van waste out connection cap and reconnect the waste out hose (16).

(e) Connect the clean return hose (12) to the clean/flush tank overflow hose (15).

(f) Open the clean return valve (6).

(4) Establish chemical circulation.

(a) Remove the outer strainer (14, Figure 2-56) from the basket strainer during detergent cleaning. Follow the procedures of para. 2-24b(3).

CAUTION
Pouring detergent into the clean/flush tank too fast will cause the Booster Pump to clog up with detergent.

NOTE
Be sure that the clean return valve is open and the system pressure control valve is fully closed. Also be sure the product utility hose valve is open.

(b) Push BOOSTER PUMP START (20). Hold pushbutton in until feed pressure low light goes off.

NOTE
Wait until pressure on the cartridge filter pressure gage (29) is at least 50 psig (345 kPa) before proceeding.

(c) Press HIGH PRESSURE PUMP START (24).

(d) Remove chemical port cover (19) from clean/flush tank.

WARNING
Keep face away from clean/flush tank port. Chemical fumes may irritate eyes.

(e) Fill a detergent container with water from the cartridge filter outlet sample valve and mix well. Slowly add 1 to 2 detergent containers into the chemical port.

NOTE

Foaming may cause the pumps to stop. If so, allow the foam to settle and restart the pumps. Only add detergent when the pumps are running.

(f) Install chemical port cover (19) after removing any chemical laying in port.

(g) Open the cartridge filter drain (30) for 3 seconds and close it.

(h) Circulate for 10 minutes.

(i) Open the cartridge filter drain (30) for 3 seconds and close it.

(j) Press HIGH PRESSURE PUMP STOP (27). After one minute, push BOOSTER PUMP STOP (28).

(k) Soak for 20 minutes.

(l) After the soak, circulate for ten minutes by starting the BOOSTER PUMP and HIGH PRESSURE PUMP. Open the cartridge filter drain for 3 seconds at the beginning and the end of the 10 minute circulation, while the pumps are running.

(m) Repeat the alternating circulation and soaking periods for two hours. Open the cartridge filter drain two times during each circulation.

(n) After the two hours are completed, detergent soaking can be continued for up to 24 hours total time, only if additional product water is not required to meet distribution requirements. During this extended soak, circulate for 10 minutes every 4 hours. Open the cartridge filter drain two times during each circulation.

(o) During the soak period, the ROWPU may be secured by closing the cartridge filter block valve (31), the cleaning bypass valve (7), turning the MAIN circuit breaker (32) off, and securing the generator. Be sure to open the cartridge filter valve (31) and clean bypass valve (7) before starting circulation.

(5) Flush cleaning solution.

(a) When soak is complete, if ROWPU was secured:

- Restart generator
- Turn MAIN circuit breaker (32) on.
- Open cleaning bypass valve (7) and cartridge filter block valve (31).

(b) Close clean return valve (6) and remove clean return hose (12) from the clean/flush tank overflow hose (15).

(c) Remove waste out cap (22) (inside) from waste out connection.

(d) Connect clean return hose (12) to waste out connection.

(e) Open the clean return valve (6).

NOTE

Be sure that the clean return hose is laid out without sharp kinks which will restrict the water flow.

(f) Press BOOSTER PUMP START (20), hold pushbutton in until feed pressure low light goes off.

(g) Tank empties and pump stops.

CAUTION

If tank empties but pump does not shut off, push BOOSTER PUMP STOP. Operation can continue by manually starting and stopping the pump. Notify unit maintenance.

(h) Open clean/flush tank drain (2).

(i) Connect auxiliary fill hose (14) from distribution pump to overflow hose (15).

(j) When clean/flush tank is empty, press DISTRIBUTION PUMP ON (17) to rinse tank.

(k) Press DISTRIBUTION PUMP OFF (18) when level reaches 75 gallons. Close clean/flush tank drain valve (2).

(l) Remove chemical port cover (19). Add contents of one 2 ounce bag of sodium bisulfite to chemical port and reinstall cover. Clean out any chemical left in port.

(m) Press DISTRIBUTION PUMP ON (17). When clean/flush tank has 200 gallons, press DISTRIBUTION PUMP OFF (18).

(n) Press BOOSTER PUMP START (20) to flush system. Hold pushbutton in until low pressure light goes off.

(o) Tank empties and pump stops.

(p) Repeat steps (j) through (o) for a second flush.

(q) Replace the outer strainer (14, Figure 2-56) in the basket strainer. Follow the procedures of para. 2-24b (3).

NOTE
For securing of ROWPU, proceed to step 7.

(6) To return to operation:

(a) Close clean return valve (6).

(b) Disconnect clean return hose (12) from waste out connection and coil out of the way.

(c) Replace waste out cap (22).

(d) Disconnect product utility hose (9) and close valve (11).

(e) Close cleaning bypass valve (7) and open feed valve (8).

(f) Fully open system pressure control valve (5).

(g) Set OPERATION MODE switch (3) to FILTER NORMAL

(h) Push INITIATE (4).

(i) Fully open product shut-off valve (13).

(j) Replace cartridge filter elements (para. 2-24 b (4)).

(k) Disconnect auxiliary fill hose (14) at both ends and coil out of way. Reconnect dispensing hose (33).

(l) Continue start-up procedure as described by para. 2-19.

NOTE
Product water TDS may be high for up to one hour after cleaning. It will drop back to normal after that time.

(7) If ROWPU is to be secured, continue with instructions provided in para. 2-22b (8) for short term or 2-23f (2) for long term.

e. *NTP-A Cleaning (Figure 2-62)*.

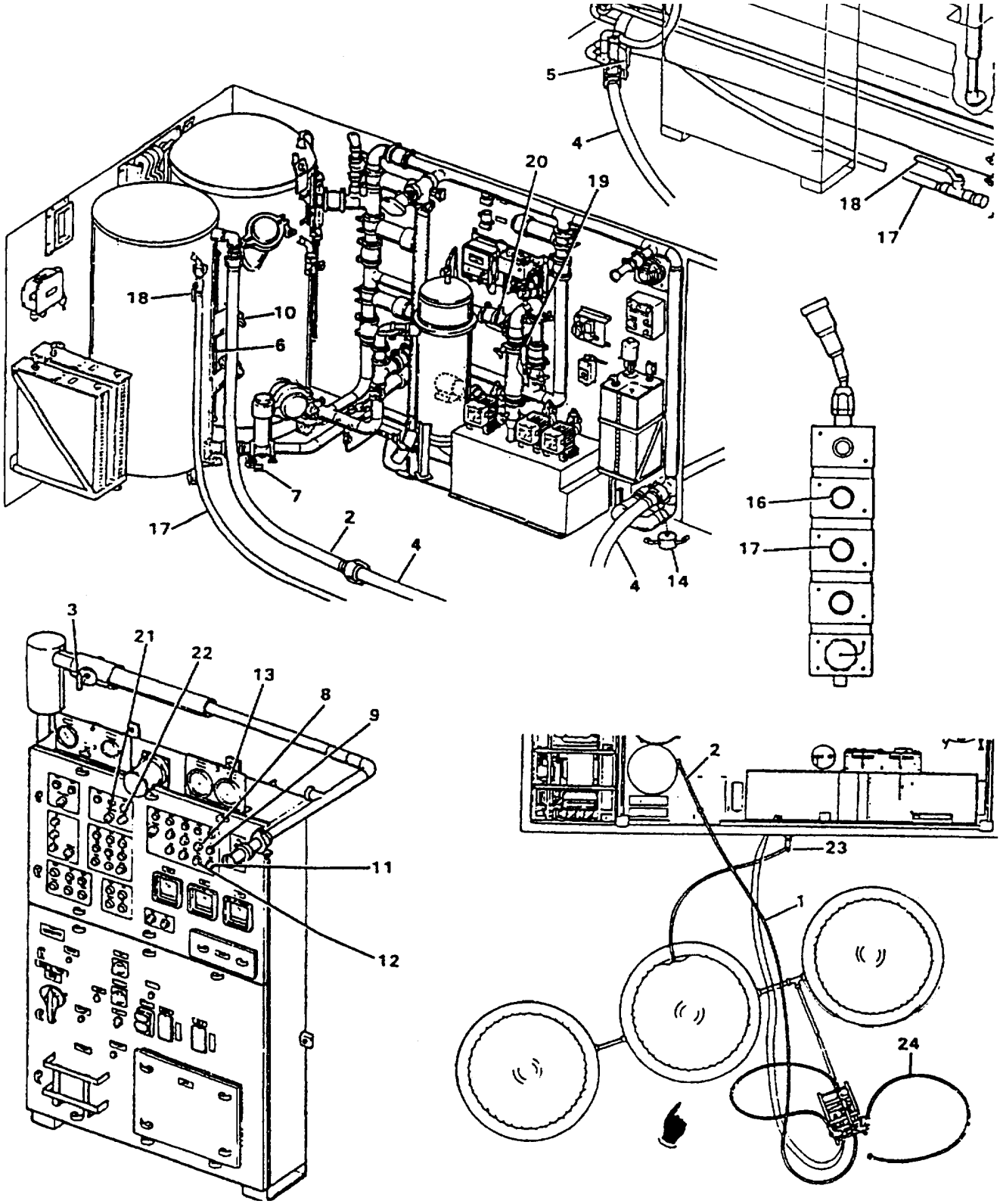


Figure 2-62. NTP-A Cleaning

NOTE

The set-up and flush of para. 2-25b must be completed before proceeding.

As a result of the flush procedure the following condition should exist.

- **Feed valve closed.**
- **Cleaning/bypass valve open.**
- **Product utility hose connected to clean/flush tank fill connection and valve opened.**
- **Product shut-off valve closed.**
- **System pressure control valve fully open.**
- **SYSTEM CLEAN green light ON. (OPERATION MODE switch set to SYSTEM CLEAN and INITIATE pushed.)**

(1) Set-up to clean.

(a) Fill the clean/flush tank with potable water to the 100 gallon level using the procedures of para. 2-25 b(3).

(b) Remove auxiliary hose (1) from overflow hose (2).

(c) Fully close system pressure control valve (3).

(d) Connect the clean return hose (4) to the clean/flush tank overflow hose (2).

(e) Open the clean return valve (5).

WARNING

Use caution when using NTP-A. Failure to do so could result in severe burns. Always wear chemical gloves, apron and face shield. If NTP-A comes in contact with skin or clothes, wash off immediately. If NTP-A comes in contact with eyes, wash eyes immediately with clean water from eye wash station.

CAUTION

Make certain level of water in clean/flush tank is below chemical port. If level is above chemical port, open tank drain valve until level is below chemical port.

(2) Establish circulation (Figure 2-62).

(a) Press BOOSTER PUMP START (8). Hold pushbutton in until feed pressure low light goes off.

NOTE

Wait until pressure on the cartridge filter pressure gage is at least 50 psig (345 kPa) before proceeding.

(b) Press HIGH PRESSURE PUMP START (9).

(c) Remove chemical pot-t cover (10) from clean/flush tank.

(d) Slowly empty two containers of NTP-A into clean/flush tank chemical port.

WARNING

Keep face away from clean/flush tank port. Fumes or mist may irritate eyes or skin.

(e) Install chemical port cover (10).

(f) Circulate for 10 minutes. Press HIGH PRESSURE PUMP STOP (11). After 1 minute press BOOSTER PUMP STOP (12). Soak for 20 minutes. Repeat the circulation and soak one additional cycle.

(3) Flush cleaning solution (Figure 2-62).

(a) Close the clean return valve (5).

(b) Remove the clean return hose (4) from the clean/flush tank overflow hose (2).

(c) Remove waste out cap (15) (inside) from waste out connection.

(d) Connect clean return hose (4) to waste out connection.

(e) Open the clean return valve (5).

NOTE

Be sure the clean return hose is laid out without sharp kinks which will restrict the water flow.

(f) Press BOOSTER PUMP START (8). Hold pushbutton in until feed pressure low light goes off.

(g) Tank empties and pump stops.

CAUTION

If tank empties but pump does not shut off, push BOOSTER PUMP STOP. Operation can continue by manually starting and stopping the pump. Notify unit maintenance.

(h) Open clean/flush tank drain (7).

(i) Connect auxiliary fill hose (1) from the distribution pump to overflow hose (2).

(j) When clean/flush tank is empty, press DISTRIBUTION PUMP ON (16) and fill tank to 75 gallons.

(k) Close the clean/flush tank drain (7). Press Distribution Pump Stop (17) when level reaches 75 gallons.

(l) Remove chemical port cover (10). Add contents of one 2 ounce bag of sodium bisulfite. Reinstall chemical port cover (10).

(m) Press DISTRIBUTION PUMP ON (16) and when clean/flush tank is full, press DISTRIBUTION PUMP STOP (17).

(n) Press BOOSTER PUMP START (8) to flush system. Hold pushbutton in until feed pressure low light goes off.

(o) Tank empties and pump stops.

(p) Repeat steps (j) through (o) for a second flush.

(q) At each 100 hour interval or as part of long term shutdown, continue with detergent cleaning (para. 2-25d).

(4) To return to operation.

(a) Close clean return valve (5).

(b) Disconnect clean return hose (4) from waste out and coil out of the way.

(c) Replace waste out cap (15).

(d) Disconnect product utility hose (17) and close valve (18).

(e) Close clean bypass valve (19). Open feed valve (20).

(f) Fully open system pressure control valve (3).

(g) Set OPERATION MODE switch (21) to filter normal.

(h) Push INITIATE (22).

(i) Fully open product shut off valve (23).

(j) Disconnect auxiliary fill hose (1) at both ends and coil out of way. Reconnect dispensing hose (24).

(k) Continue start-up procedure as described by para. 2-19.

2-26. BISULFITE SANITIZING CLEANING. (Figure 2-63).

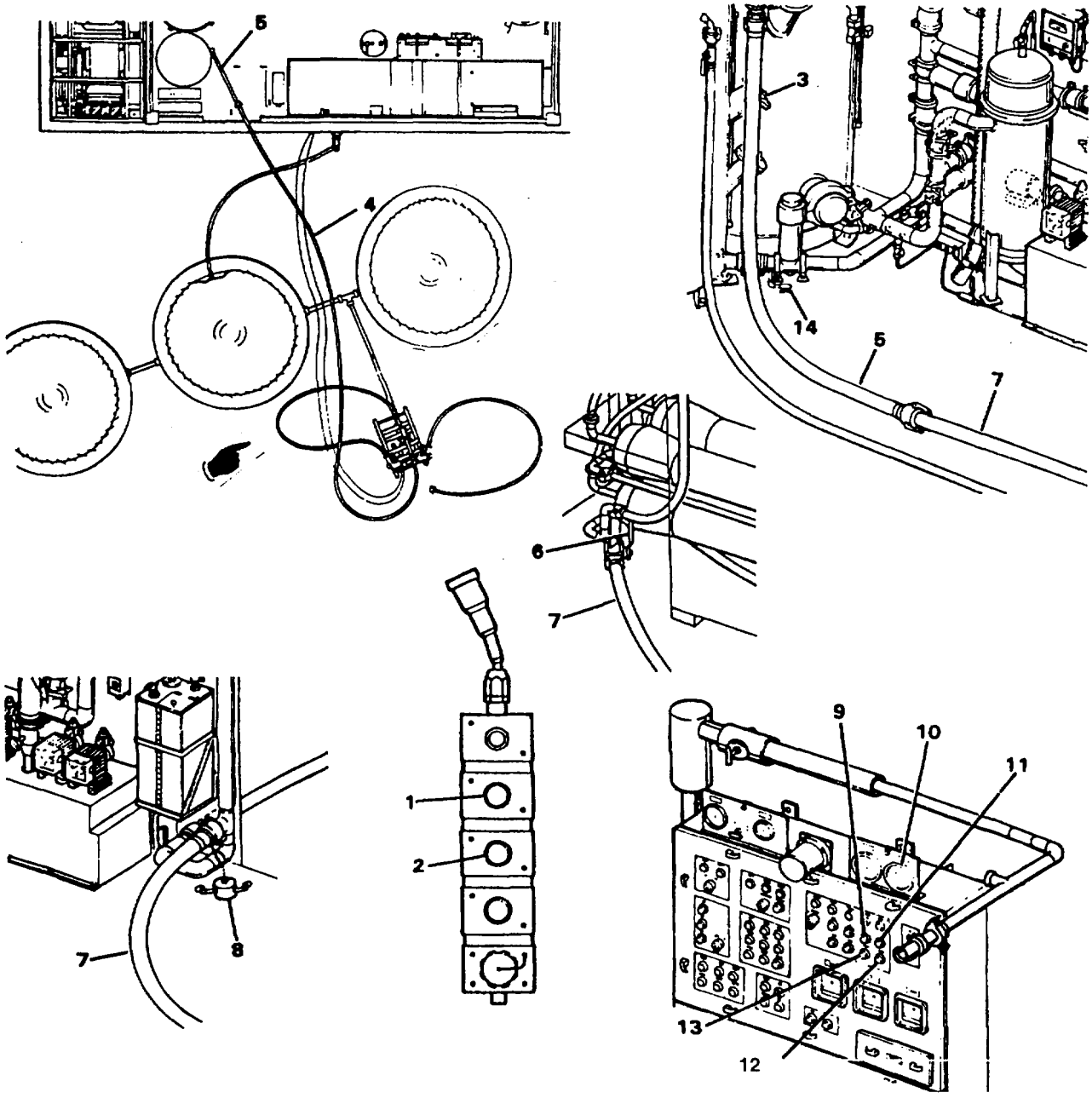


Figure 2-63. Bisulfite Sanitizing

NOTE

Bisulfite sanitizing cleaning is required as a part of short and long term shutdown to secured status to prevent bacterial growth within the RO elements. It always immediately follows detergent cleaning when preparing for long term secured shutdown.

NOTE

When done in sequence as a part of short and long term secured shutdown, the ROWPU has been flushed (para. 2-25b). This procedure follows flushing.

a. *Fill Clean/Flush Tank.*

(1) Press DISTRIBUTION PUMP ON (1). ■

(2) When tank level reaches 100 gallon mark, press DISTRIBUTION PUMP OFF (2).

b. *Set-Up to Clean*.

(1) Remove auxiliary fill hose (4) from clean/flush tank overflow hose (5).

(2) Close clean return valve (6).

(3) Disconnect clean return hose (7) from waste out connection.

(4) Install cap (8) on waste out connection (inside).

(5) Connect clean return hose (7) to clean/flush tank overflow hose (5).

(6) Open clean return valve (6).

(7) Close system pressure control valve (15).

c. *Circulate*.

(1) Push BOOSTER PUMP START (9). Hold pushbutton in until feed pressure low light goes off.

NOTE

Wait until pressure on the cartridge inlet/outlet pressure gage (10) is at least 50 psig (345 kPa) before proceeding. Make sure clean/flush tank has 100-110 gallons of water.

(2) Push HIGH PRESSURE PUMP START (11).

(3) Open chemical port (3) and pour in the contents of two 2 pound bags of bisulfite.

(4) Close chemical port (3).

(5) Continue to circulate for 1/2 hour.

NOTE

Check hose connections for leakage after pumps have been turned on.

(6) When 30 minutes have passed, push HIGH PRESSURE PUMP STOP (12).

(7) Wait one minute, then push BOOSTER PUMP STOP (13).

(8) Close clean return valve (6).

(9) Remove the clean return hose (7) from the clean/flush tank overflow hose (5).

(10) Remove waste out cap (8) (inside) from waste out connection.

(11) Connect clean return hose (7) to the waste out connection.

(12) Open the clean return valve (6).

NOTE

Be sure the clean return hose is laid out without any sharp kinks which will restrict water flow.

(13) Press BOOSTER PUMP START (9). Hold pushbutton in until feed low pressure light goes off.

(14) Clean/flush tank empties and pump stops.

CAUTION

If tank empties, but pump does not shut off, push BOOSTER PUMP STOP. Operation can continue by manually starting and stopping pump. Notify unit maintenance.

(15) Close clean return valve (6).

(16) Open clean/flush tank drain valve (14).

(17) Disconnect clean return hose (7) and coil out of way.

NOTE

This leaves the RO vessels full of the sodium bisulfite sanitizing solution. Drain only if the ROWPU will be subject to freezing (para. 2-31).

(18) Open system pressure control valve (15).

(19) Return to the shutdown procedures, continue with instructions provided in para. 2-22b (9) for short term or para. 2-23f (2) for long term.

2-27. OPERATION OF AUXILIARY EQUIPMENT. Auxiliary equipment deployed with the ROWPU includes:

a. M871 Trailer. Refer to TM 9-2330-358-14&P.

b. Diesel Generator. Refer to TM 5-6115-545-12 or TM 9-6115-645-10.

c. Potable Water Storage Tanks. Refer to TM 5-5430-225-12&P.

WARNING

Do not exceed load limits of hoist. Do not operate hoist without safety latches on hooks. Failure to observe these precautions could result in serious injury and damage to equipment.

d. Chain Hoist. The chain hoist is used for lifting the distribution pump and raw water pump out of, and into, the ROWPU during unloading (para. 2-14) and packing the ROWPU (para. 2-28). It is also used to move large items for maintenance. The hoist has a 1/2 ton capacity. It has safety latches on both the mounting hook and the load hook. Refer to para. 2-14c. Check Preventive Maintenance, Table 2-13.

2-28. PREPARATION FOR MOVEMENT.

a. Loading Procedures and Load Plans. The following instructions will describe in detail the proper procedure when loading a 3000 gph ROWPU, Models WTA-060 and ROWPU-1. The packing instructions for both models will be identical unless otherwise indicated. This packing guideline is provided to ensure each ROWPU is packed correctly to avoid damaging equipment while being transported. NCO's must understand the importance of proper loading procedures and that they will be held accountable for damages caused by incorrect packing procedures.

(1) The interior of the van should be cleaned each day during operations when filtered and potable water is most abundant This will make cleaning easier at the close of an operation.

(2) The floor of the van and any other equipment should be washed with either fresh filtered water or potable water only. When purifying with saltwater, do not use filtered water to clean the interior of the van or any other equipment. Water from the cartridge filter sample hose has not gone through the RO process and therefore is filtered saltwater not filtered fresh water This will cause corrosion to the equipment.

(3) Enough potable water should be available at the end of a mission for the purpose of distribution and field cleaning equipment before packing. Equipment cleaning should begin 2 to 3 days prior to shutdown to allow the equipment to dry.

(4) Before packing the van, ensure the ROWPU is as clean as possible and all end item components am clean and dry. Equipment stored wet will mold, grow bacteria, and will have an unpleasant order. Equipment with such conditions cannot be used for treatment purposes.

(5) 100% inventory by hand receipt must be conducted after each mission. Hand receipt holders must be watchful of items being taken into the van to ensure they are properly marked on the hand receipt. Serial numbered items must be accounted for when loading. All storage boxes must be inventoried before they are loaded. Any shortages will be noted on DA Form 2062 and turned in. An investigation will be conducted on any sensitive or high dollar items listed as missing.

b. System Support Items (Table 2-31). The support items are packed into four separate storage boxes. Dividers are provided for box 1; heavy items in boxes 2, 3 and 4 should be on bottom to prevent damage to equipment.

Table 2-31. Contents of Storage Boxes

Box 1. Chemicals
- Dividers (4)
- Eyewash Additive, 2 oz. (2)
- Citric Acid, 2-1/2 lb. (2)
- Glycerin Lubricant, 16 oz.
- Sodium Bisulfite, 2 oz. (30)
- Sodium Bisulfite, 2 lb. (12)
- Box, Storage, Bisulfite
- Tool, Ratchet 3/8 sq. Drive

Box 2. Tools and Test Equipment
- Cartridge Element, Air Compressor (3)
- Over Screen, In-Line Strainer
- Hose Assembly, Eyewash Pressure
- Nut, Plated Steel 3/8-16 UNC-2B (2)
- T-Bolt, Coupling Cartridge Filter (2)
- Test Kit, Color
- Meter, TDS
- Meter, TDS Range Extender
- TDS Meter Carrying Case
- Test Kit, Chlorine
- Meter, Turbidity
- Apron
- Liquid Measure Cup
  - MIL-M-43530, Size 1

Box 3. Tools and Replacement Parts
- Sealant, Pipe Threads Size II
- Coupling Clamp 1-1/2
- Gasket, Coupling Half 1/2 (2)
- Gasket, Coupling Half 1 (2)
- Gasket, Coupling Half 2 (4)
- Gasket, Coupling Half 2-1/2 (4)
- Gasket, Coupling Half 3 (4)
- Packing, Preformed (16)
- Lead Assembly, Ground Wire, 180 inch
- Lead Assembly, Ground Wire, 240 inch
- Gasket, Flat 4
- Lubricant, Aerosol
- Gasket, Victaulic 1-1/2 IPS (4)
- Hose Assembly, Utility Air/Water Flush
- Lamp, Incandescent, 100 Watt (4)
- Light
- Replacement Handle
  - w/Screws (6) (MODEL WTA-060 ONLY)
- Replacement Handle (6) (MODEL ROWPU-1 ONLY)
- Cable Assembly
- Water Flush Adapter Assembly
- Lamp, Incandescent, Pilot Lamp (3)
- Brush, Platers
- Tubing, Jumper, Solenoid Valve
- Hose Adapter, Hex. Union Male 1/2-20
- Gasket 1 - 1/2 IPS (2)
- Gasket, Flat 3-3/8 (2)
- Packing, Preformed
- Battery, D Size, Pkg. of 2 (2)
- Flashlight
- Binder, Loose-Leaf
- Paper, Loose-Leaf
- Gloves
- Tool, Knife, Utility
- Blade, Knife Utility, Pkg. of 5
- Tool, Open End Wrench No. 10
- Rule, 24 inch Long
- Screwdriver, 8 inch
- Tool, Socket 3/8 sq. Drive x 9/16
- Tool, Strap Wrench, 1 to 5 IPS (2)
- Tool, Wrench, Hex. Key 1/4
- Accessory Kit, Turbidity Meter, Portable
- Tool, Socket 3/8 sq. Drive x 7/8
- Paddle, Stirring
- Wipes, Hand
- Desiccant, Replacement Can (MODEL WTA-060 ONLY)
- Clamp, T-Bolt (2)
- Gage, Air
- Wrench, Open End 9/16 x 5/8

Box 4. Miscellaneous
- Face Shield
- Hose Assembly, Fuel Line
- Meter, Flow Rate Indicator
- Strainer Assembly, Suction
- Elbow (2)
- Pump Assembly
- Lamp, Replacement, 500 Watt
- Coupling, w/Gasket 2 (4)

Packing Crate 1
- Detergent, Membrane Cleaner (5)
- NTP-A Cleaner (8)
- Polyelectrolyte (5)
- Sequestrant (1)
- Calcium Hypochlorite
- Extension 50 Ft Cord

Packing Crate 2
- RO Elements (12)

NOTE

If the ROWPU van is to be shipped by air or if the van or high pressure pump assembly is to be removed from the trailer for any reason, notify unit maintenance so that interconnecting hoses between the van and high pressure pump assembly can be disconnected and other pre-shipment service performed.

c. Preparation for Packing System Components.

(1) Deleted.

WARNING

Make sure the circuit breaker for the raw water and distribution pump is turned off prior to proceeding. If the cold weather kit is in use make sure the circuit breaker for the heat lamp is turned off. Failure to do so could result in electrocution.

(2) Disconnect and coil all electrical cables and ground wire. Cap electrical outlets.

(3) Pull and disassemble ground rods.

(4) Pull in the anchor, intake strainer, and raw water suction hose sections using anchor rope.

NOTE

All three crewmembers may have to pull on rope to disengage anchor.

(5) Disconnect intake strainer from raw water suction hose.

(6) Disconnect, drain and cap all exterior hoses; coil canvas hoses, cap outer ends after coiling.

(7) Deflate the storage tanks in accordance with the TM 5-5430-225-12.

(8) Use straps to pull the raw water pump and carry distribution pump to the nearest access door.

(9) Disassemble components for two cyclone separators for Model WTA-060 or components for one cyclone separator for Model ROWPU-1 (Figure 2-29) and carry components to nearest access door.

(10) Remove external adapters from the van. Cap outlets.

d. Packing System Components. Pack the ROWPU in the following order as shown in Figure 2-64.

(1) Place contents listed in Table 2-31 back into storage boxes.

(2) Install gate (1) (Figure 2-64, Sheet 1 or Sheet 2) on accessory table.

(3) Stack cartridge filter boxes (2) in place at right side of gate behind control panel.

WARNING

Use caution when handling the chemicals (polyelectrolyte, sequestrant, NTP-A, detergent) and discard any chemicals that leak. High Test Hypochlorite (HTH) is never stored inside the ROWPU. A special storage compartment located under the trailer is used for this purpose. HTH is highly corrosive and is considered dangerous. Any packages that leak or are partially opened should be discarded.

(4) Place detergent jugs and chemical bottles (3) at the right side of the gate next to the filter boxes behind the control panel. Ensure all bottles are upright when stacked.

(5) On Model ROWPU-1, attach two straps #6 (Figure 2-64, Sheet 2) to hooks on the back of lab table and hang straps up and out of the way. Model WTA-060 uses two straps #13 (Figure 2-64, Sheet 1).

(6) Place distribution pump skid (small pallet) (4) upside down on table.

(7) Place raw water pump skid (large pallet) (5) right side up on top of distribution pump skid (4) so that the two skids interlock and lay flat against each other on the lab table.

NOTE

When rolling a cotton hose, ensure it is dry and layed out with the white side facing up and the side with the writing face down so when rolled the name of the hose will appear on the outside. Begin rolling the hose at the end without the carrying straps and roll tightly, keeping the edges even and neat. Once rolled, set the coil upright and press down on the hose while inserting the metal buckle through the middle of the base, and fasten in carrying configuration. If the hose is rolled correctly, the name will appear on the outside and will not fall apart when carried with the strap.

(7) Coil and place the four raw water discharge hoses (6) in the rear on top of raw water pump skid (5) in two stacks of two at slanted angles.

(8) Coil and place six waste out hoses (7) in front of the raw water discharge hoses (6) in two stacks of three at slanted angles.

(9) Coil and place two dispensing hoses with nozzles (8) in the rear on top of the raw water discharge hoses (6). Place one hose on each stack.

(10) Coil and place auxiliary hose (9) on top of the waste out hose stack on the right front side close to main control panel.

(11) Coil and place the cleaning heat-up hose (10) on the lab table between the pump skids and the gate.

(12) Place strainer assembly (11) on top of the waste out hose stacks with the large end to the left and the camlocking end to the right so that it is flat. Ensure strainer body is upside down (flat side up and rounded side down).

NOTES

- **When using any strap, ensure that all the slack is pulled out before tying down.**
- **Route straps over hose end of strainer assembly, not over the top of the strainer body.**

(13) Using two straps #6 (Model ROWPU-1) or two straps #13 (Model WTA-060), tie down strainer assembly (11) and hose stacks using the two hooks on the front of lab table.

WARNING

Separator is heavy and can injure personnel. Always use two personnel to move separator.

(14) On Model ROWPU-1, position the cyclone separator (12) (Figure 2-64, Sheet 2) upside down with the flat side of the insert arm against the back wall of the ROWPU. On Model WTA-060, position the left separator (12) (Figure 2-64, Sheet 1) upside down against the back wall and then position the right separator (12) right side up, next to left separator (12).

(15) On Model ROWPU-1, tie down separator (12) using two straps #7 (Figure 2-64, Sheet 2) and the hooks provided. Model WTA-060 uses two straps #14 (Figure 2-64, Sheet 1).

(16) Coil and place the NBC drain hose (13), two NBC operation hoses (14) and the funnel tubing (15) upright on the floor between the cyclone separator(s) (12) and the lab table.

(17) Stack storage boxes #3 and #4 (16, 17) on the end of lab table as shown in (Figure 2-64, Sheet 3).

(18) Run strap #5 (Model ROWPU-1) or strap #8 (Model WTA-060) through handles of storage boxes (16, 17) and attach strap #5 or strap #8 to lab table. Tighten strap #5 or strap #8.

NOTE

Storage box #1 contains chemicals (Sodium Bisulfite and Citric Acid) used in the treatment process. Discard either of these chemicals if the packages leak. Always note any chemical shortages on the component hand receipt and the shortage annex (DA Form 2062).

(19) Place storage box #1 (18) on lab table next to storage box #2 (19), leaving enough room between the boxes to store the heat lamp cables.

NOTES

- **Do not disconnect the heat lamp cables from the heat lamp assemblies.**
- **If electrical cables am not rolled correctly, packing will be extremely difficult. Ensure all cables are rolled large and even with the width of the lab table.**

(20) Position the raw water pump heat lamp (20) in the rear on top of storage box #1 (18) so the lamp faces clean/flush tank. Roll and position the electrical cable upright between storage boxes #1 (18) and #2 (19).

(21) Position the distribution pump heat lamp (21) in the front on top of storage box #1 (18) so lamp faces clean/flush tank. Roll and position the electrical cable upright next to raw water pump heat lamp cable between boxes #1 (18) and #2 (19).

(23) Roll and position the raw water pump extension cord (22) and raw water pump heat lamp extension cord (23) around both heat lamps (20, 21).

(24) Attach strap #1 (Model ROWPU-1) or strap #9 (Model WTA-060) to the front of the lab table and then take the strap through the storage box and heat lamp handles and securely fasten to the back side of the lab table. Unhook strap #1 or strap #9 from front of table. Twist strap #1 or strap #9 close to the hook assembly, then reattach strap #1 or strap #9 to the underside of the lab table. Tighten strap #1 or strap #9.

(25) Neatly fold and position the raw water pump and distribution pump coves (24) on top of storage box #2 (19).

(26) Position CO monitor test kit (25) to the rear and on top of covers (24).

(27) Fold and stack the three ground cloths (26) together behind storage boxes #3 (16) and #4 (17).

(28) Stack the three tank repair kits (27) on lab table behind storage boxes #3 (16) and #4 (17) and to the right of ground cloths (26).

(29) Attach two straps #3 (Model ROWPU-1) or two straps #10 (Model WTA-060) (Figure 2-64, Sheet 3) to floor hooks located just below lab table. Drape straps #3 or #10 over storage boxes until ready for use.

CAUTION

The raw water and distribution pump suction hoses must not be touching or resting on or near the chemical injection pumps. This will damage the pumps when the ROWPU is being transported.

NOTE

Ensure that all raw water and distribution pump suction hoses are interlocked before they are placed inside the ROWPU.

(30) Position and stagger stack three raw water suction hoses (28) in the center of the floor between the four strap hooks.

(31) Neatly roll two sump drain hoses w/fittings (29) and place in the very center of the three stacked suction hoses (28) allowing clear space at the ends of the inside stack.

(32) Stagger stack two more raw water suction hoses (28) on top of the three stacked suction hoses (28).

(33) Tightly roll and place two sump drain hoses w/o fittings (30) on top of the sump drain hoses w/fittings (29) remembering to keep the ends of the inside stack clear.

(34) Stagger stack the last five raw water suction hoses (28), distribution pump suction hose (male to male end) (31), and the distribution system hose (female to female end) (32) on top of the suction hose stack.

(35) On Model ROWPU-1, the following couplings are placed on top of the sump drain hose stack:

a. Distribution pump discharge (male) (33).

b. Product shut-off valve (34).

c. Raw water feed (small) (35).

d. Raw water system (L-shaped) (36).

e. Separator out pipe section (T-shaped) (37).

f. Waste out (38).

g. Special tee (39).

(36) On Model WTA-060, the following couplings are placed on top of the sump drain hose stack:

a. Distribution pump discharge (female) (40).

b. Product shutoff valve (41).

c. Raw water feed (large) (42).

d. Raw water system (U-shaped) (43).

e. Separator out pipe section (T-shaped) (44).

f. Waste out (45).

g. Special tee (46).

NOTE

Before packing the product out hoses and cyclone separator hose(s), ensure that they are not interlocked. These hoses will be packed standing upright in a horse shoe configuration.

(37) Position the five product out hoses (47) and one separator hose (48) (Model ROWPU-1) or two separator hoses (48) (Model WTA-060), standing upright in horseshoe fashion with the coupling ends in the clear space provided on each side of the sump drain hose stack.

(38) Place the following items neatly inside the raw water suction hose stack in the following order:

a. Two distribution pump suction hoses (small) (49).

b. One raw water pump drain hose (50).

c. One cyclone separator drain hose (51) (Model ROWPU-1) or two cyclone separator drain hoses (51) (Model WTA-060).

d. Priming pitcher (orange container) (52).

e. Prime assist pump (53).

f. Funnel (54).

(39) Using the two straps #3 or straps #10 already in place, criss-cross the straps only over the stagger stacked hoses and attach straps to the two floor hooks on the opposite side. Tighten straps so hose stack can not move from side to side.

WARNING

Each storage tank weighs 130 lbs (59 kg). Three people are required to carry each tank.

(40) Using strap #3 (Model ROWPU-1) or strap #12 (Model WTA-060), attach one end of strap to the floor hook in front of the media filter and position the strap out of the way until needed.

(41) Store two storage tanks (55) in an upright position and place both as far back between the media filter and cartridge filter as possible.

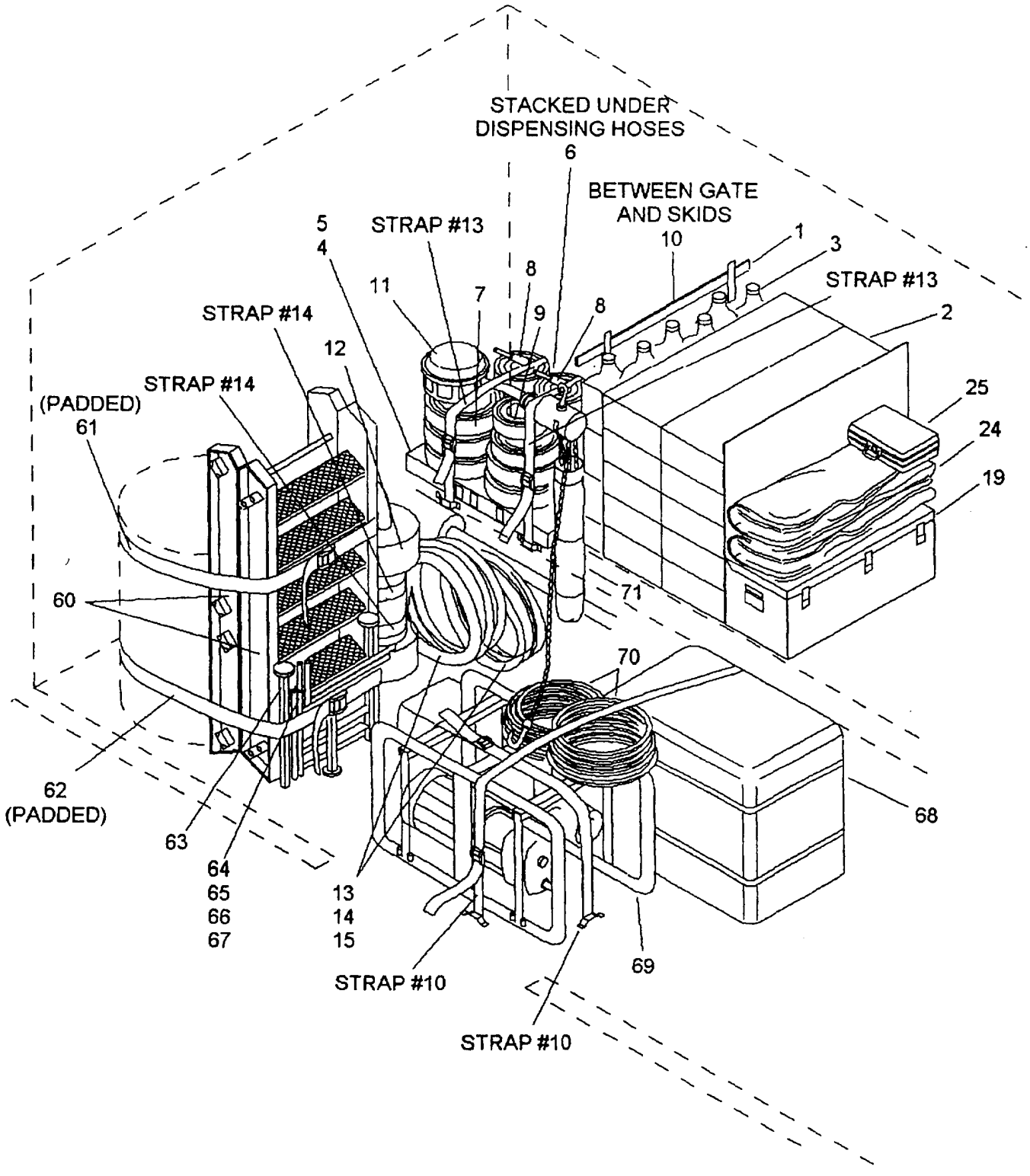


Figure 2-64. Packing the ROWPU (Sheet 1 of 3)
(MODEL WTA-060 ONLY)

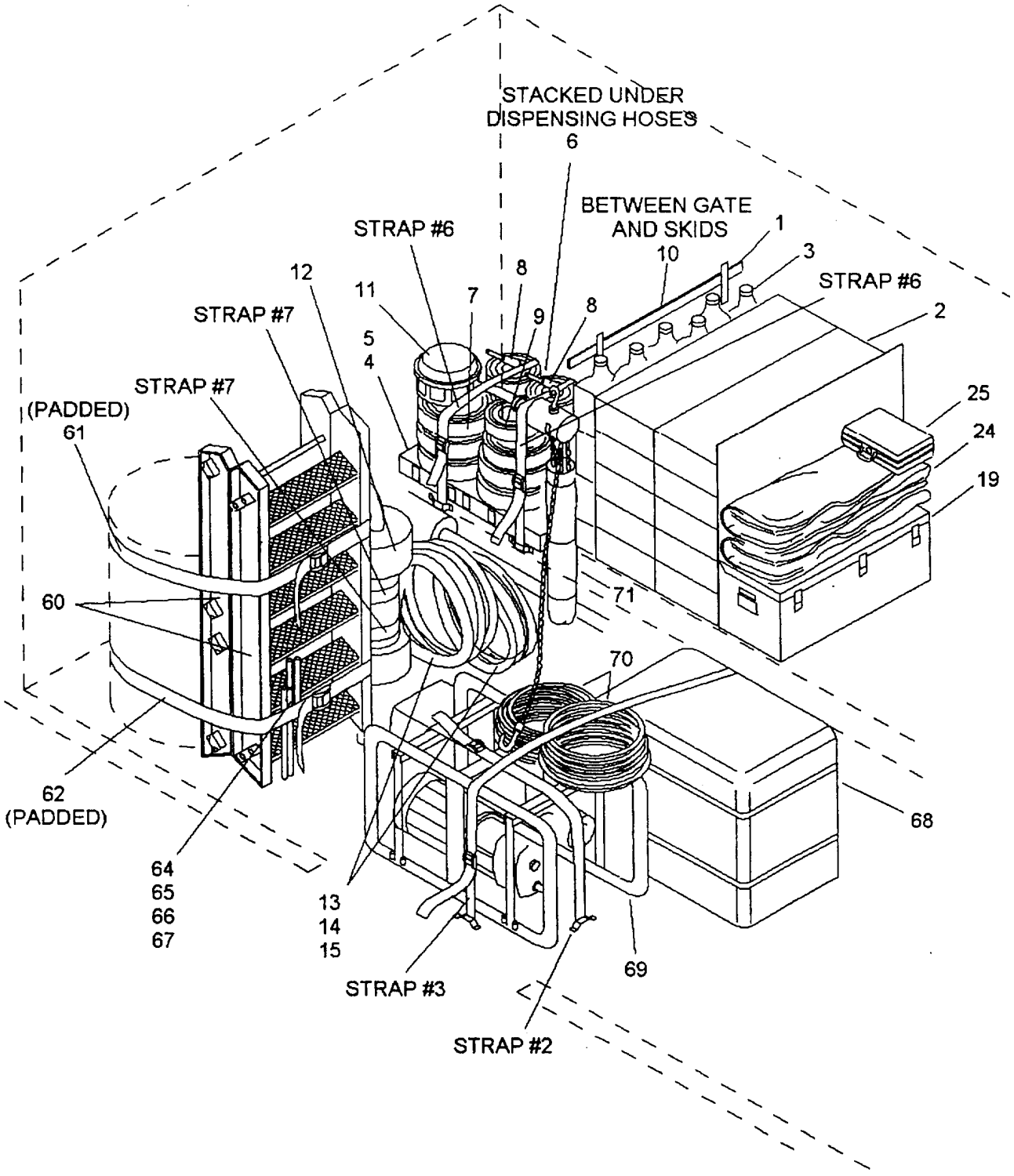


Figure 2-64. Packing the ROWPU Sheet 2 of 3)
(MODEL ROWPU-1 ONLY)

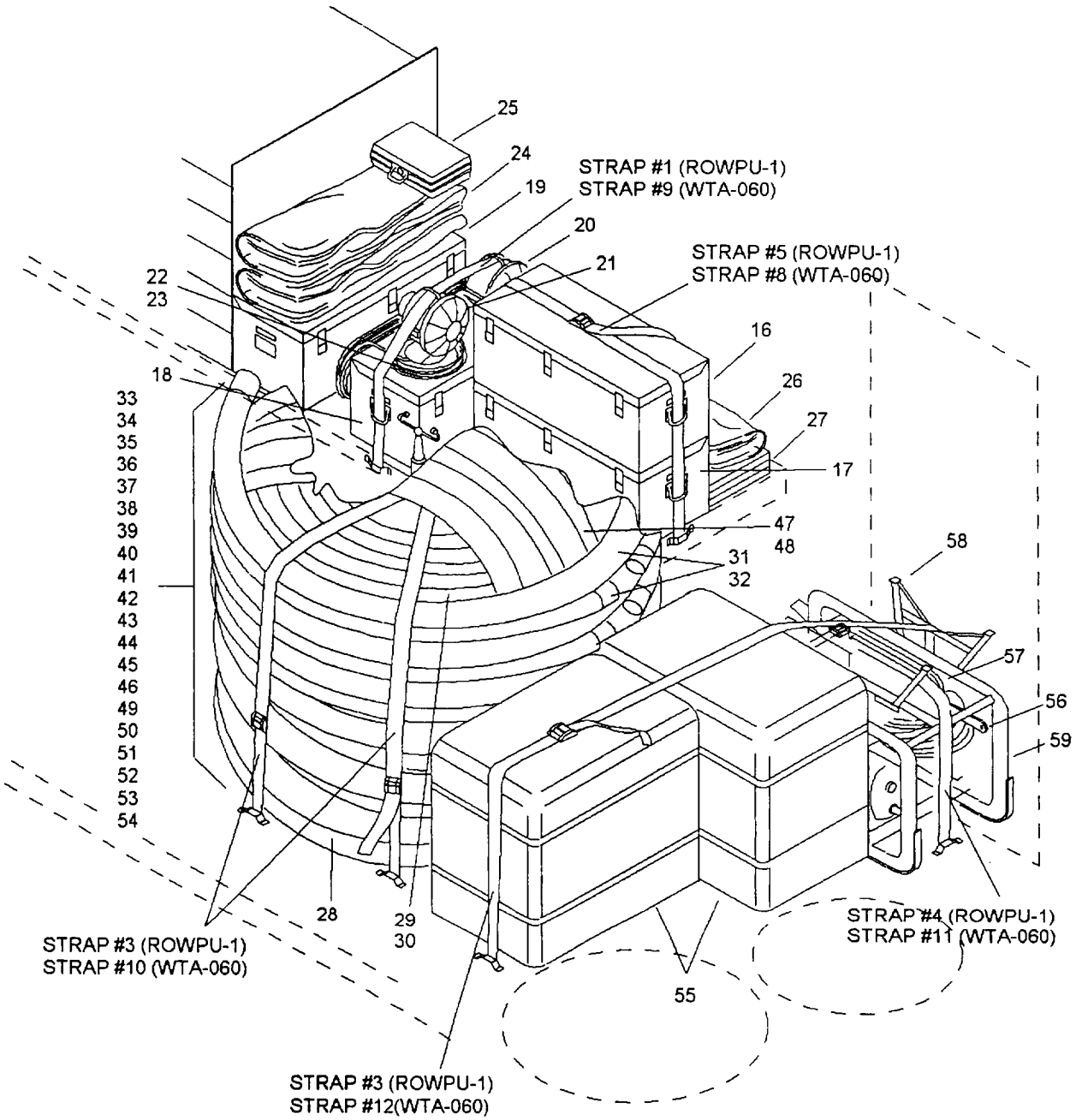


Figure 2-64. Packing the ROWPU (Sheet 3 of 3)

WARNING

Make sure load hook is attached at or near balance point of any load being moved. Failure to do so could result in violent swinging or dropping of load. This could result in serious injury and damage to equipment.

WARNING

Crewmember on ground should stand clear of pump frame to avoid being hurt in event pump falls or is released too quickly.

WARNING

Check chains on hoist for link damage or wear regularly. Damaged or worn chains must be replaced immediately to prevent accident. Notify unit maintenance.

(42) Disassemble access ladder (Figure 2-65), distribution side.

(a) Remove handrails (1).

(b) Unhook snap hooks and remove chains (2) from stake pockets (3) on trailer.

NOTE

Ensure that the distribution pump power cable is neatly rolled and placed inside the pump assembly frame. Do not disconnect the power cable from the pump assembly.

(43) Attach chain hoist (1, Figure 2-66) to eyebolt (2) over distribution side access door and to eyebolt on distribution pump (3). Using chain hoist, lift the distribution pump into van and position distribution pump with drain pipe facing door.

(44) Disconnect chain hoist hook and take down chain hoist from eyebolt and rehook at front door as shown in Figure 2-67.

(45) Using generator ladder, store anchor (56) (Figure 2-64, Sheet 3), anchor rope (57), and stool (58) (upside down) on top of distribution pump (59).

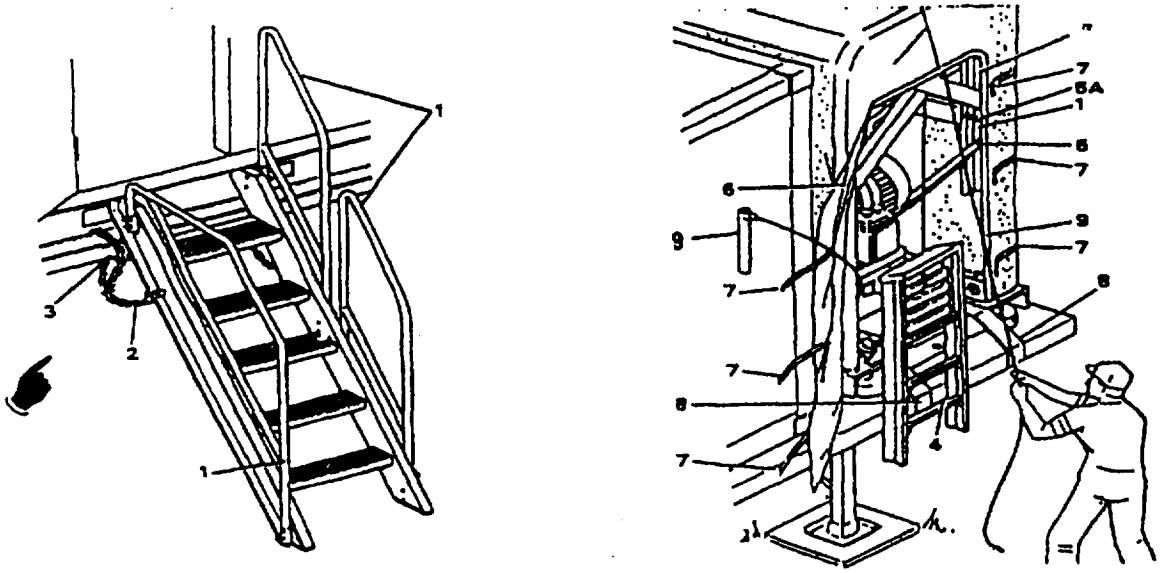


Figure 2-65. Loading the Ladders

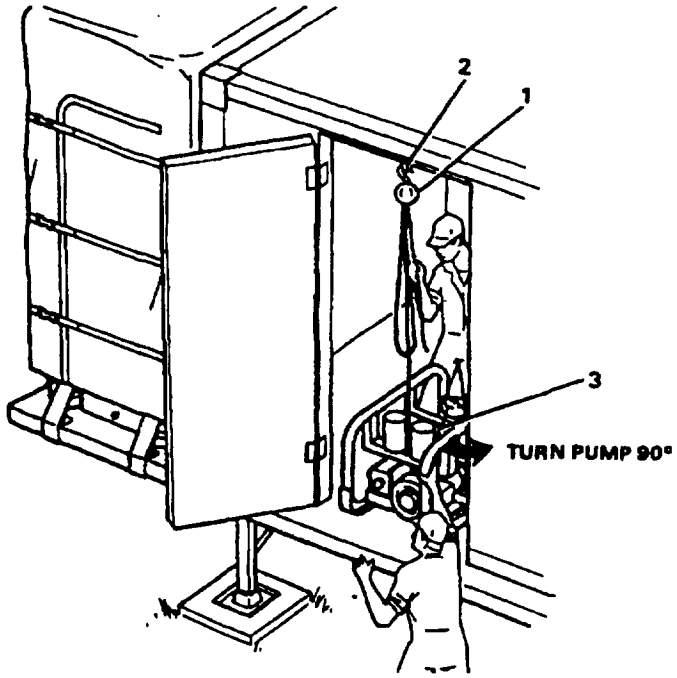


Figure 2-66. Loading the Distribution Pump

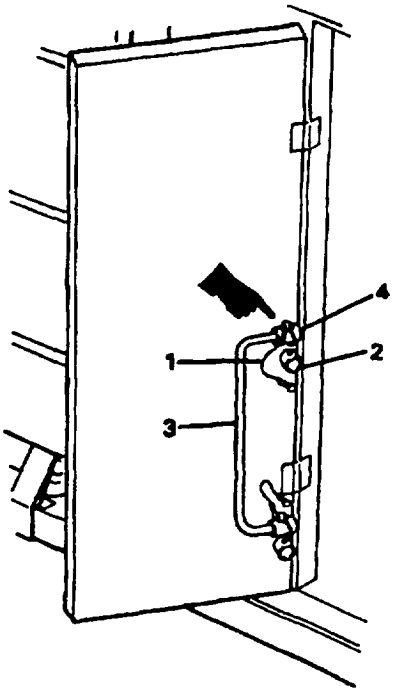


Figure 2-66.1. Handrail Storage

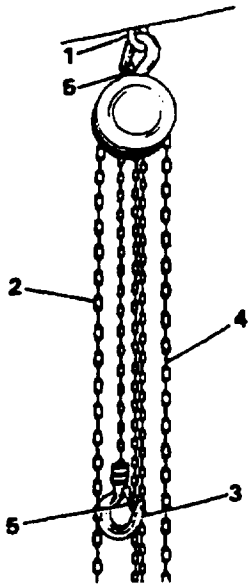


Figure 2-67. Loading Raw Water Pump

(46) Refer to Figure 2-64, Sheet 3. Using strap #4 (Model ROWPU-1) or strap #11 (Model WTA-060), attach strap to floor hooks on right and left side of distribution pump (59) and tighten strap.

(47) Position strap #3 or strap #12, already in place, over both storage tanks (55), and distribution pump (59) and attach and tighten strap to floor hook in front of the doorway.

(48) Place the empty 5-gallon jug (not illustrated) on the top rear of the polyelectrolyte and sequestrant tanks.

NOTE

Ensure vent window is closed before shutting and securing the door.

(49) Close and secure door (product side).

(50) Put handrail on raw water side of the ISO shelter door into position for movement as follows:

(a) Remove pins (1, Figure 2-66.1) from brackets (2).

(b) Pull out handrail (3) and replace so that it is flush with the door.

(c) Replace pin (1) in brackets (4).

(51) Disassemble access ladder (60) (Figure 2-64, Sheet 1 or 2). Follow step (42).

NOTE

One crewmember must be inside van, two crewmembers outside.

(52) Hook padded straps (61 and 62) in position.

(53) Store access ladders (60), separator frame (63) (Model WTA-060 only) and sandwich in ground rods (64), ground wire (65), slip hammer (66) and ground rod clamp (67).

(54) Secure by tightening straps (61 and 62)). On Model WTA-060, keep pads of straps (61 and 62) over corner of ladder and separator frame when tightening.

(55) Attach strap #3 (Model ROWPU-1) or strap #10 (Model WTA-060) to floor hood in front of control panel and have strap out of the way.

WARNING

Each storage tank weighs 130 lbs. (59 kg). Three people are required to carry each tank.

(56) Position the last storage tank (68) standing on end against control panel, being careful not to damage the panel. The tank may need to be moved slightly to the right f the raw water pump (69) will not fit completely through the door.

(57) Store raw water pump power cables (70) on top of raw water pump. Keep eyebolt accessible.

(58) Hook chain hoist in eyebolt, hoist raw water pump through door and rotate 90 with caution plate facing door (Figure 2-66). Disconnect chain hoist from raw water pump (69) and place the chain in the chain hoist bag (71) and tie closed. Leave the chain hoist hanging in the doorway.

(59) If moved, reposition the storage tank (68) in front of control panel.

(60) Position strap #2 (Model ROWPU-1) or strap #10 (Model WTA-060) over pump (69) and attach the ends to the floor hooks on the left and right side of the pump (69). Tighten the strap securely.

(61) Place strap #3 or strap #10, already in place, over storage tank (68) and pump (69), and connect the end to floor hook in front of pump. Tighten strap securely.

(62) Secure van door.

(63) Using generator ladder (4) (Figure 2-65), store hand rails (1 and 5) (2 long ones first then 4 short) in the pockets provided, and secure with straps (SA) provided on the side frame of the high pressure pump.

(64) Zip cover (6) closed down past second door strap (7) and secure top two straps (7).

(65) Deflate stable level air bags and use handle (9) to secure both 3 in. straps.

(66) Connect rope (9) to ladder using snap hook.

(67) Hoist ladder (4) and secure rope (9) using snap hook in eyebolt.

(68) Secure ladder (4) with strap in cross pattern.

(69) Zip cover all the way closed and secure lower strap (7).

NOTE

When transporting the ROWPU, the exterior plugs can be opened to drain the ROWPU while being transported, or they may be left closed. If traveling long distances (over 25 miles) it is best to leave the drain plugs closed to minimize road dirt collection inside the ROWPU piping.

(70) Ensure that all electrical plug caps on the ROWPU are installed before transport and the generator DC circuit breaker is pulled out. Make sure generator doors are securely fastened.

SECTION IV. OPERATION UNDER UNUSUAL CONDITIONS.

2-29. GENERAL. This section contains instructions for use of ROWPU in unusual conditions.

2-30. HOT WEATHER OPERATION.

a. *Temperature Limits.* Operation of the ROWPU changes when outside temperatures or source water temperatures exceed 85°F (29°C). The capability and reliability of the ROWPU may be reduced if temperatures exceed those listed below:

- Maximum deployment temperature: 110°F (43°C).
- Maximum storage temperature: 145°F (63°C).
- Maximum RO element storage temperature: 110°F (43°C).
- Maximum source water temperature: 110°F (43°C).

b. *Motors.* Motors may overheat when the ROWPU is used in hot weather in direct sunlight. Shade netting should be used to protect raw water and distribution pump motors in extreme conditions.

c. *Main Contro/ Pane/ (Figure 2-68).* If temperatures inside the ROWPU reach 120°F (49°C) motor starter thermal overloads may trip. Keep ISO container (van) doors open. Push appropriate starter resets (1) if overload trips occur.

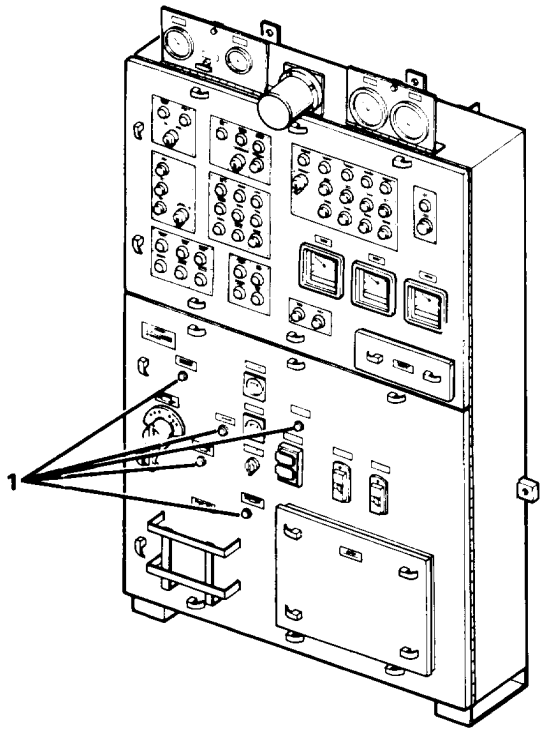


Figure 2-68. Starter Resets

d. *High Pressure Pump Assembly.* Open both access flaps to provide ventilation and cooling.

WARNING

To avoid unsafe work conditions do not allow the temperature inside the ROWPU to rise above 120°F (49°C). Keep doors open and water flowing to help cool the ROWPU.

e. *Storage.*

(1) The RO elements must not be stored where temperatures may rise above 110°F (43°C). If there is a possibility of higher temperatures, move RO elements to another storage site.

(2) The ROWPU itself maybe stored at up to 145°F (63°C) inside temperature.

CAUTION

Do not store the ROWPU where direct sunlight can cause the temperature inside the ROWPU to rise above 145°F (63°C).

2-31. COLD WEATHER OPERATION. Take special care of the ROWPU in cold weather. Parts of the ROWPU will be damaged if they freeze. If the temperature is expected to drop below 32°F (0°C), the ROWPU must be protected. Precautions must be taken. The winter kit must be used.

a. *Limitations.* Freeze up will disrupt operation, perhaps for several days, and may cause damage. Limitations should not be exceeded.

(1) Minimum deployment temperature: -25°F (-32°C).

(2) Maximum shutdown time without draining exterior hoses: 15 minutes.

(3) Maximum shutdown time without power and without draining raw water and distribution pumps: 15 minutes.

(4) Maximum shutdown time at -25°F (-32°C) without heaters operating before freeze up problems begin:

(a) Without draining and purging the filters and chemical systems: 30 minutes (doors closed).

(b) Without draining the RO vessels: 30 minutes (doors closed).

(c) Fully drained and purged: one hour (doors closed).

(5) Maximum shutdown time with one space heater operating from the diesel generator batteries without excessive battery discharge: 1 hour.

(6) Items which will be damaged if allowed to freeze:

- Color test kit.
- Available chlorine color test kit.
- Turbidity standards.
- RO elements, if not removed from vessels and properly drained.
- Polyelectrolyte.
- Sequestrant.

(7) Minimum storage temperature for ROWPU except items subject to freeze damage: -28°F (-37°C).

NOTE

Refer to FM 10-52 Field Water Supply manual before performing the following steps.

(8) Preparation for winter deployment.

(a) Move ROWPU to warm area.

(b) Load RO elements.

(c) Move raw water and distribution pump pallets to accessible area.

(d) Move raw water and distribution pump covers to accessible area.

NOTE

The 24 VDC cable connector and diesel fuel inlet are on an access panel on the generator end of the van.

(e) Install 24 VDC cable from van to generator.

(f) Connect diesel fuel line from generator fuel out fitting to diesel fuel inlet.

(g) Perform PMCS on generator for cold operation.

(h) Perform PMCS on high pressure pump assembly.

(i) Stan van diesel heater no. 2.

(9) Winter deployment.

(a) Site van as close to water source as possible.

(b) Install ground rods and ground cables.

(c) Start generator and supply power to ROWPU.

(d) Start high pressure pump assembly electric heater.

(e) Start air compressor and close all air bleed valves.

(f) Start van diesel heater no. 1.

(g) Turn on carbon monoxide monitor.

(h) Deploy raw water pump and start heat lamp.

(i) Deploy distribution pump and start heat lamp.

(j) Finish unloading van.

(k) Assemble raw water pump discharge hoses, cyclones, and feed hoses.

(l) Assemble distribution system.

(m) Set valves in ROWPU van to proper position

(n) Obtain turbidity and color of raw water.

(o) Check cartridge filters.

(p) Set up polyelectrolyte system.

(q) Install raw water pump suction hoses.

(r) Start ROWPU.

(s) Install heated maintenance tent over distribution system if possible.

(t) Follow routine operation guidelines and cold weather operation guidelines.

(10) Winter deployment shutdowns.

(a) For less than 15 minutes downtime, follow routine shutdown procedures.

(b) For more than 15 minutes downtime (with power), drain raw water system completely and maintain distribution system circulation.

(c) For more than 30 minutes with no heat

- Drain ROWPU completely.
- Air purge filters.
- Air purge chemical systems.
- Drain distribution system.

(d) For more than 15 minutes down time (without power), drain all external pumps and hoses completely.

(11) Winter start-ups from frozen conditions.

(a) If frozen, thaw out per para. 2-31c.

(b) Refer to para. 2-35 for a frozen media filter warm-up.

(12) End of mission shutdowns.

(a) Follow normal procedures for cleaning and sanitizing.

(b) Drain and roll up hoses in raw water system when no longer needed.

(c) Drain distribution system as soon as not needed.

(d) Air purge media filter.

(e) Air purge chemical systems.

(f) Pack up ROWPU.

(g) Leave van diesel heater no. 2 on.

(h) Transport to warm storage and supply auxiliary power to keep van above freezing. If this is not possible, remove, drain, and store RO elements.

b. *Weather Protecting Equipment and Features* The ROWPU has some cold weather protection built in. The winter kit has other needed items.

(1) General. When on deployment, the best operating approach is to avoid freeze up. The equipment can be drained to avoid damage from ice formation, however, if allowed to freeze, two to three days will be needed to thaw out the critical equipment before resuming operation. Plan ahead to avoid freeze up.

(2) Built-in features include:

(a) The ROWPU container is insulated and weather sealed.

(b) The container floor drain sumps include electric heat tracing pads to prevent freezing when the main control panel sump heat switch is on.

(c) Space heaters. Two diesel fueled space heaters are provided in the ROWPU van for heating during transport and mission operation.

(d) The high pressure pump assembly has a built in electric heater.

The van heaters draw fuel from the diesel generator fuel tank at 1/6 gallon per hour each. The electrical power is 24 VDC supplied as follows:

- From the diesel generator batteries.
- From a power supply when the generator is operating and the main control panel heater switch is on.
- From a power supply when auxiliary 120 VAC power is connected and the main control panel heater switch is on.

If not powered through the power supply, power is drawn automatically from the diesel generator batteries. At -25°F (-32°C) one heater may safely be powered for one hour without risk of excessive battery discharge.

(e) Auxiliary power connection. A connection for an external 120 VAC power supply is provided. With the heater power supply switch on, this will power the space heaters through the power supply. Cable must be two wire plug with ground wire.

(f) Air purge. The media filter and NBC filter both include a connection to use ROWPU service air to rapidly purge the water from these filters to avoid severe freeze up.

(3) Winter kit (Figure 1-6) includes:

(a) Two electric heat lamps (2 and 3) are provided, one for the distribution pump and one for the raw water pump. These lamps are to be connected to heater outlets at each side of the ROWPU and provide heat to the inside of the pump covers when the pumps are not operating.

(b) A non-floating intake strainer (1) is provided for use when taking water from an ice hole.

(c) A cable (5) to connect one of the diesel heaters to the generator battery during transport or when the power to the ROWPU is off.

(d) An extension cable (4), if required, for the raw water pump heat lamp.

(e) Covers to cover the raw water pump and distribution pump.

(f) Skids to keep the raw water pump and distribution pump off the ground.

c. *Freeze Protection, General Guidelines and Instructions.*

(1) RO vessels and elements. Freeze up during deployment must be avoided to assure continued ROWPU availability.

(a) Use the space heaters to maintain ROWPU van temperature over 35°F (2°C). Do not exceed time limitations without heat.

(b) Draining will avoid freeze up of feed and waste piping which may generate damaging ice pieces upon start-up.

(c) Draining does not remove all water from the vessels and RO elements. The RO elements are like a wet cloth and hold some water after draining. If ice is present in the RO element or vessel when the ROWPU is started, the elements may be damaged. Damage is noted by a high product water TDS because of water passing directly through holes in the membrane material.

(d) If the ROWPU is drained and allowed to freeze, thawing will require 2 days with additional heat provided to bring the temperature up to at least 85°F (30°C) or 8 days at 45°F (7°C).

(e) If freezing cannot be avoided, the elements should be removed, stood on end for 30 minutes to assure drainage, and properly sealed in an air tight plastic bag.

(f) Stand-by power should be available to prevent freezing in the event of generator failure.

(2) Chemicals. Both polyelectrolyte and sequestrant will freeze, but will not lose performance when thawed. Completely thaw before using. If cloudy, mix before using.

(3) Media filter, Freeze up during deployment should be avoided to assure continued availability.

(a) If freezing cannot be avoided, drain and air purge to avoid solidly freezing the media and internals.

(b) If drained only and allowed to freeze, thawing will require similar time and heat as required for the RO elements (para. 2-31c(1)(d)).

(c) If drained and purged before freezing, the filter can be returned to service.

(4) NBC Filter. The NBC filter should be treated the same as the media filter.

(5) Chemical Systems. The chemical tubing will freeze if not purged. Damage is unlikely, however, thawing time will delay availability. Protection is provided by air purging according to long term shutdown procedures.

(6) Raw Water Pump. When deployed for a cold weather mission, the pump is covered with a cover and the heat lamp is installed. The heat lamp keeps the pump casing warm when the pump is not operating. While the pump is operating, the water flow will prevent freezing. When securing the ROWPU, or when the diesel generator fails, the pump must be drained within 15 minutes.

(7) Distribution Pump. When deployed for a cold weather mission, the pump is covered with a cover and the heat lamp is installed. The heat lamp keeps the pump casing warm when the pump is not operating. While the pump is operating, the water flow will prevent freezing. When securing the ROWPU, or when the diesel generator fails, the pump must be drained within 15 minutes.

(8) Piping. Flowing water will not easily freeze, so there is little danger of freeze up while the ROWPU is running. When the ROWPU is shut down during cold weather, however, water in the pipes can freeze. Expansion during freezing will damage piping. Therefore, the ROWPU must be drained when the temperature in the ROWPU cannot be maintained above 32°F (0°C).

(9) Lay-Flat Hoses. When the ROWPU is running there is little danger of hoses freezing. The hoses will not freeze rapidly, Ice may build up, however, at the end connectors and begin to restrict the water flow. Covering with 12 inches of dirt or snow will reduce this problem. Ice will begin to form in the hoses within a short time after shutdown at -25°F (-32°C). If the ROWPU is to be shut down longer than 15 minutes, hoses must be disconnected at all joints and fully drained. Start-up is simplified if lay-flat hoses are also rolled and placed within the ROWPU until needed.

(10) Product Tanks. Ice formation is slowed by inserting an open dispensing nozzle into two tanks and the product hose into the third tank. The distribution pump is kept operating. The tanks will still slowly freeze from the outside walls until sufficient ice is formed to prevent further freezing. Ice will also form at the metal connectors. This can be minimized by berming dirt or snow over the connections. The best approach is to erect a tent (not provided with ROWPU) over the tanks and maintain a temperature around 20°F (-7°C).

d. *Choosing a Water Source.* If the water source is frozen, a hole through the ice must be cut. The water temperature will be different at different depths. Usually the warmest water will be found near the bottom. Sometimes the warmest water will be between 6 and 12 inches below the ice. Seawater freezes at 28°F (-2°C). Care must be taken to obtain water over 32°F (0°C), since the product water may freeze. Shallow water bays should be avoided since the water below the ice will be highly concentrated with dissolved solids. Try to choose a water site where the equipment can be set up with the minimum amount of hoses. The more that are used increases the likelihood of freezing problems.

e. Assembly and Preparation for Use in Cold Weather (Figure 2-69). Cold weather set-up is a little different from normal set-up. Procedures are rearranged to bring the diesel generator set on line as early as possible to power the space heaters. One heater is run continuously during transport drawing power from the diesel generator batteries. More than one hour without the diesel running may excessively discharge the batteries and may lead to battery freeze up.

NOTE

Keep doors closed whenever possible during unpacking and set-up.

(1) Set trailer (para. 2-14b).

(2) Establish electrical power.

(a) Ready diesel generator (para. 2-14e).

(b) Check ground cables for tightness at both ends.

(c) Connect utility cable from tractor 24 VDC connector to the generator 24 VDC slave connection. Keep tractor engine running to provide boost.

(d) Conduct generator PMCS and ensure generator is prepared for cold weather operation IAW TM 5-6115-545-12.

(e) Start generator IAW TM 5-6115-545-12 and trim to 60 Hz and 440V. Close circuit breaker.

(f) Disconnect slave cable.

(g) Open door on raw water side, step up access ladder and turn MAIN circuit breaker (1) handle to ON Push SYSTEM RESET button (2). Turn on lights (3 or 4).

(3) Start diesel heaters. __

(a) Turn HEATER POWER SUPPLY ON/OFF (5) to ON.

NOTE

If CO monitor alarm lights or audio alarm come on, press alarm reset (1 7) and refer to paragraph (i) thru (k) below.

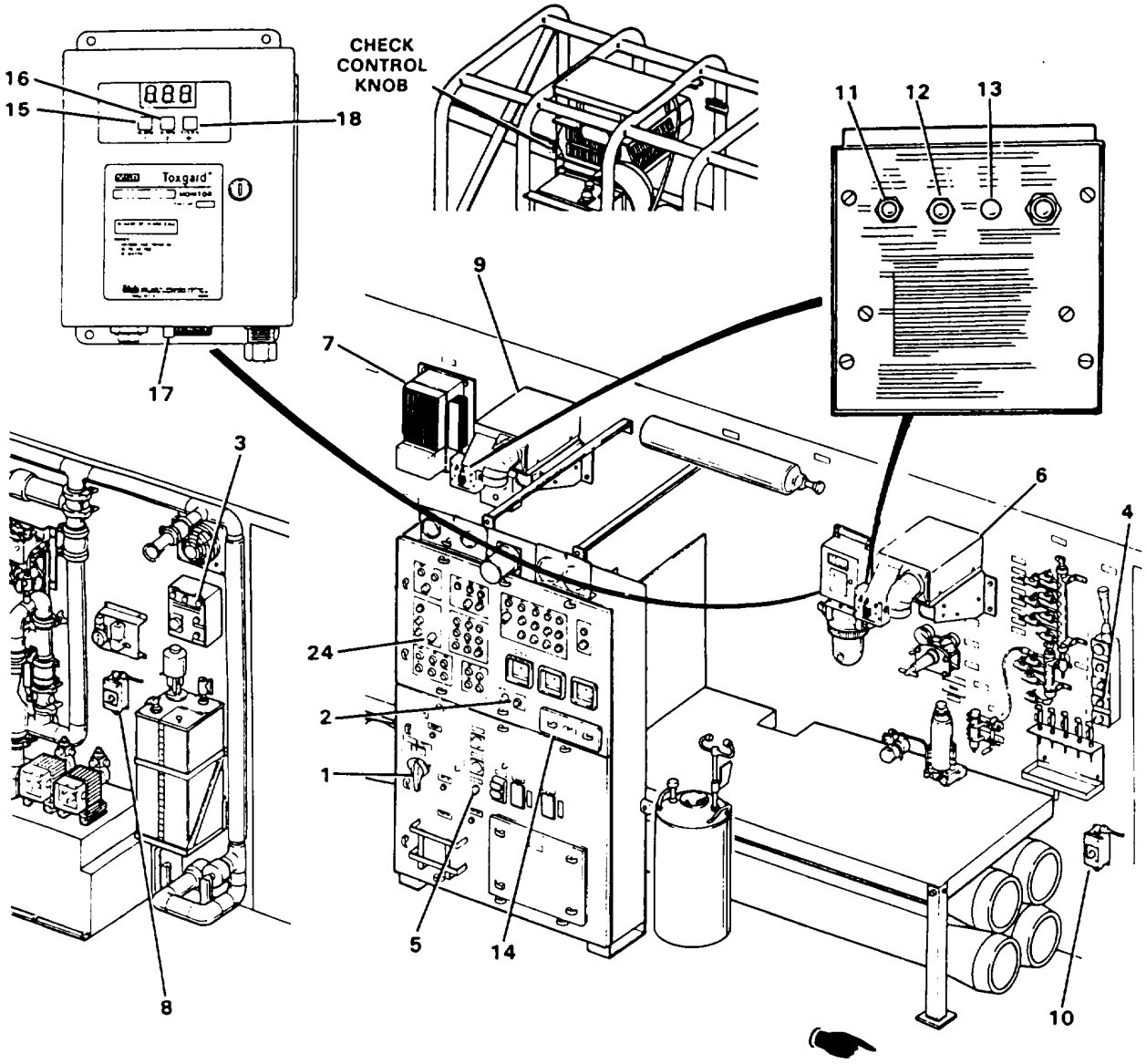


Figure 2-69. Establishing Power-and Operating Heaters **(Sheet 1 of 3)**

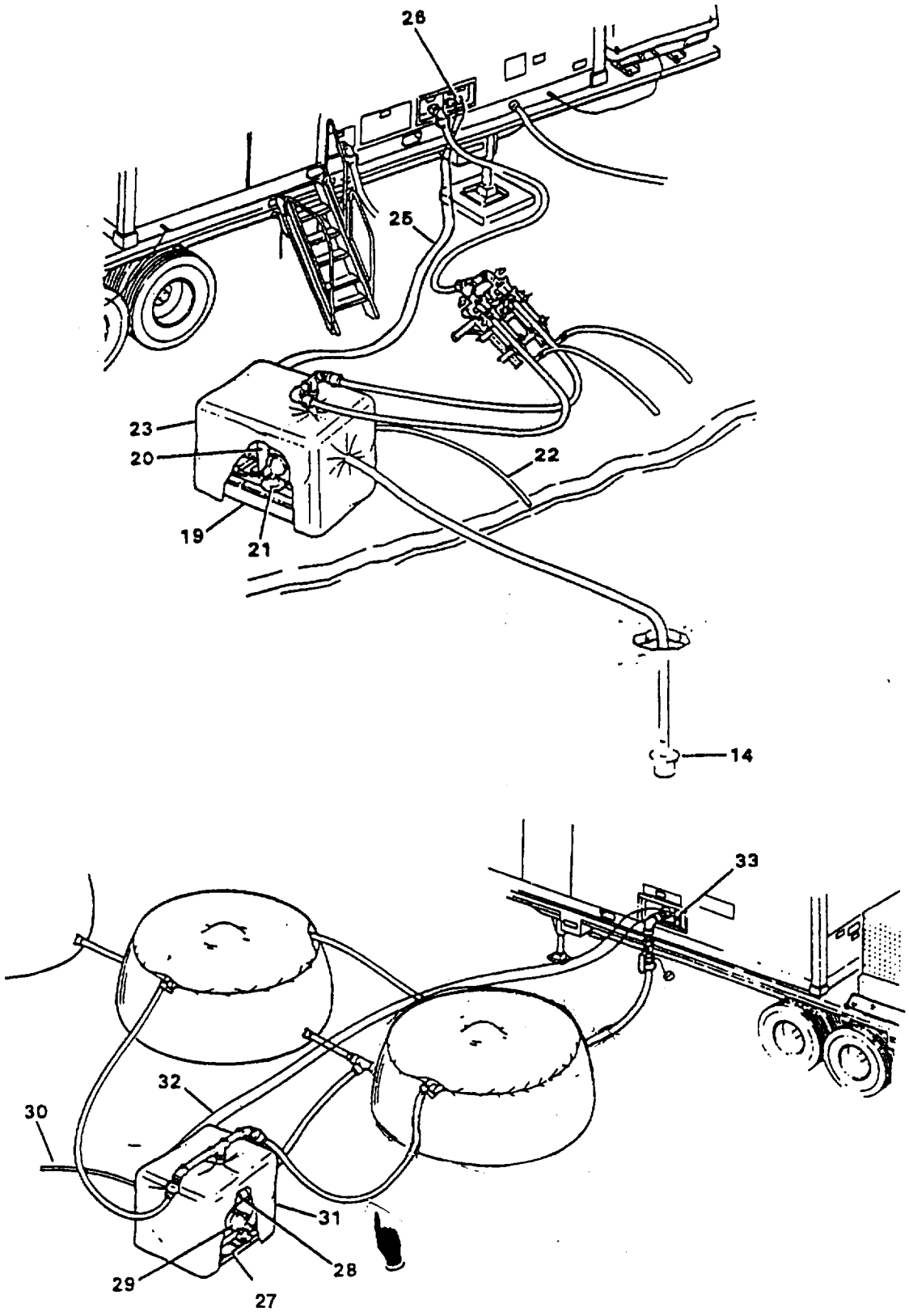


Figure 2-69. Establishing Power and Operating Heaters (Sheet 2 of 3)
(MODEL WTA-060 ONLY)

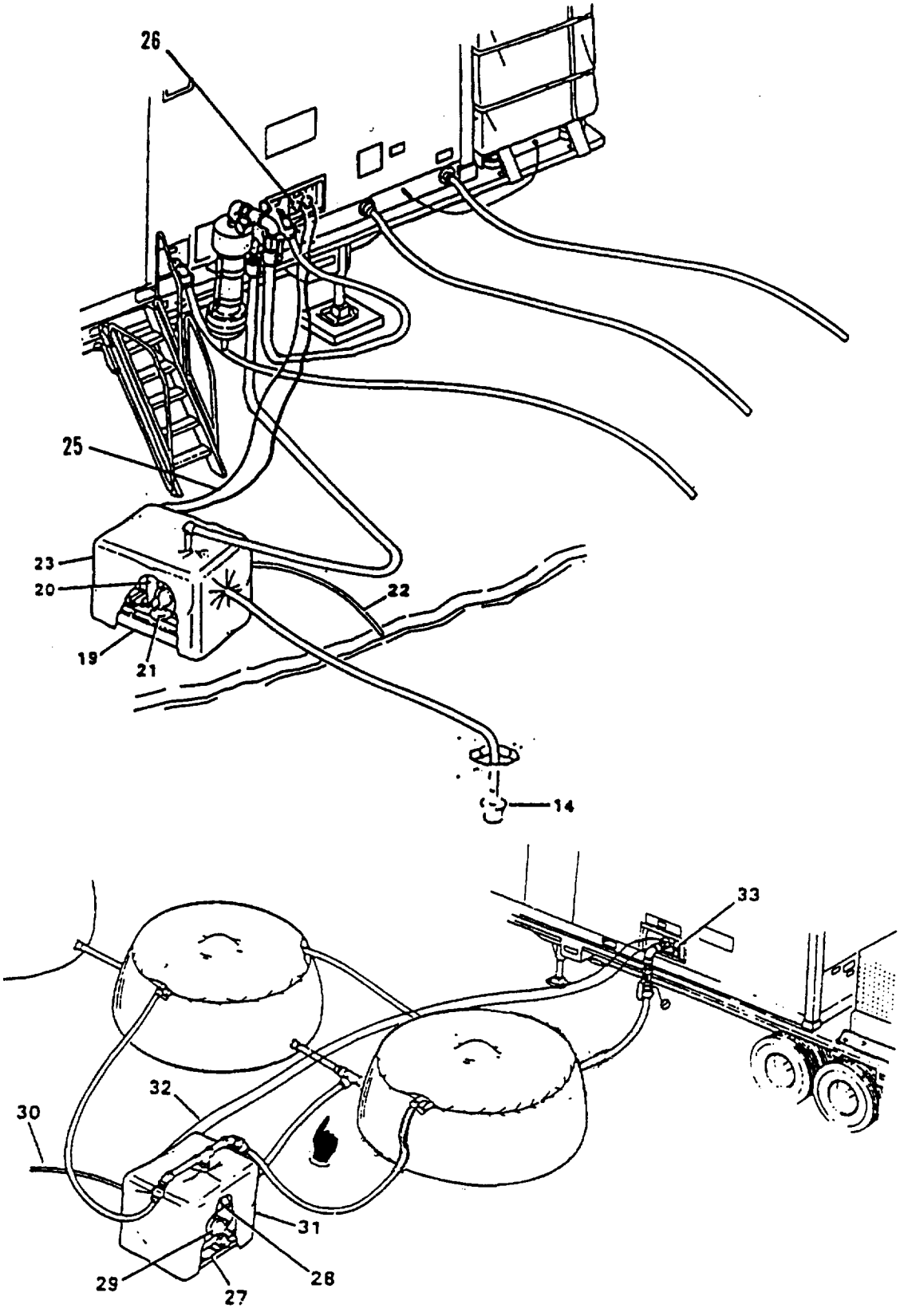


Figure 2-69. Establishing Power and Operating Heaters (Sheet 3 of 3)
(MODEL ROWPU-1 ONLY)

NOTE

No. 2 heater (6) should be running as pan of transport and setup. Start heater no. 2 first. If both heaters require starting, start only one at a time. Starting requires extra power. The power supply (7) does not supply sufficient power to start both heaters at the same time. Thermostat (8) controls heater no. 1 (9), thermostat (10) controls heater no. 2 (6).

(b) Set thermostat (10) to desired ambient temperature.

(c) Switch AUX switch (11) to PREHEAT and hold in this position for 30 seconds.

(d) Switch MAIN switch (12) to START.

(e) After 10 seconds, release AUX switch (11) and after 45 seconds switch MAIN switch (1 2) to RUN Green HTR OPER light (1 3) should come on.

(f) If light (13) goes off, repeat procedure. If heater still does not work troubleshoot heaters.

(9) Open the circuit breaker cover and turn the PUMP SKID HEATER circuit breaker on.

(h) Check control knob on front of heater. Insure that knob is turned to maximum setting (clockwise).

NOTE

If the carbon monoxide monitor sounds an audible alarm or either the yellow ALARM 1 (1 5) or red ALARM 2 (16) lights are lit, press alarm reset (17).

(i) Check the CO monitor green SYSTEM OK indicator light (18). If it is not lit, refer to diesel heater and CO monitor troubleshooting.

NOTE

The CO monitor Is set to sound an audible alarm and turn on ALARM 1 when level of CO exceeds 25 ppm. Audible alarm will sound and ALARM 2 will light up at over 50ppm. OSHA standards for an 8 hour period safe maximum CO level! is 50 ppm. If levels of CO in van exceed 25 ppm (ALARM 1), determine whether the source of CO is the diesel heaters in the van or an extend source. If CO source is external to the van, close doors and inlet air vent.

(j) Notify organizational maintenance

WARNING

If CO level exceeds 50 ppm, evacuate the van. CO is deadly.

(k) If CO level can not be reduced to less than 50ppm, all personnel must leave the van. The ROWPU will operate by itself and only an hourly check by crewmembers will be required. Do not enter the van unless necessary, and then only for a minimal amount of time.

WARNING

Do not enter van alone during a red ALARM 2 condition. Always have another crewmember available to insure safety. CO is deadly.

(4) Deploy Raw Water System as described in paragraph 2-14d except for the following:

(a) Remove intake strainer and attach Ice hole strainer(14)to raw water suction hose. Push strainer through Ice note at least 2 feet

(b) Place wood skid (19) at desired location and place raw water pump (20) on skid.

(c) Mount heat lamp (21) on wood skid (if not already in place).

(d) Attach the drain hose (22)

(e) Place the cover (23)over the raw water pump assembly Secure edges with snow. dirt,. rocks. unused hoses etc.

WARNING

Be sure PUMP HEAT/SUMP HEAT ON/OFF switch (24) is set to OFF position before connecting heat lamp power cable. Failure to do so could result in electrocution.

(f) Connect heat lamp power cable (251 to outlet (26) on ROWPU van

(g) Turn PUMP HEAT/SUMP HEAT ON/OFF(24)switchto ON. This will turn on pump heat Iamps and van sump heat tracing.

(h) Do not prime raw water pump until ready to use. Do not prime pump until heat lamp has warmed the pump.

CAUTION

Failure to properly warm the raw water pump before priming wiII result in an immediate freeze up of the pump and possible damage.

NOTE

When raw water pump is first started, lift cover and be sure pump is rotating by looking at the shaft between the pump and motor. If not, stop immediately and allow heat lamp to warm pump.

(5) Deploy Potable Water Distribution System as described in paragraph 2-14 except for the following:

(a) Place wood skid (27) at desired location and place distribution pump (28) on skid.

(b) Mount heat lamp (29) on wood skid (if not already in place).

(c) Attach the drain hose (30).

(d) Place the cover (31) over the distribution pump assembly. Secure edges with snow, dirt, rocks, unused hoses, etc.

WARNING

Be sure PUMP HEAT/SUMP HEAT ON/OFF switch (24) is set to OFF position before connecting heat lamp power cable. Failure to do so could result in electrocution.

(e) Turn PUMP HEAT/SUMP HEAT ON/OFF (24) switch to OFF.

(f) Connect heat lamp power cable (32) to outlet (33) on ROWPU van.

(g) Turn PUMP HEAT/SUMP HEAT ON/OFF (24) switch to ON. This will turn on pump heat Iamps and van sump heat tracing.

(h) Do not connect dispensing hoses until ready to start distribution pump. Keep dispensing hoses reside ROWPU van.

CAUTION

Failure to properly warm the pump before starting wiII result in an immediate freeze up of the distribution pump and possible damage.

NOTE

When distribution pump is first started, lift cover and be sure pump is rotating by looking at the shaft between the pump and motor. If not, stop immediately and allow heat lamp to warm pump.

f. *Initial Adjustments, Checks, and Self Tests.* See paragraph 2-15 For first start-up or start-up from secured or drained conditions, refer to para. 2-17 with the following variations.

(1) If the ROWPU has not been allowed to freeze, proceed as follows

(a) Establish normal diesel generator power supply, start both heaters and turn PUMP HEAT/SUMP HEAT ON-OFF switch to ON position if not already accomplished.

NOTE

If hoses were rolled and stored in ROWPU, normal procedures may be followed.

(b) If hoses were not rolled and stored, then roll the hosing under foot breaking loose any ice inside.

(c) Disconnect raw water intake hose at ROWPU and place end away from immediate area

(d) Prime and start raw water pump. Allow flow to blow ice from end of the hose. The hose may have to be walked on to break up ice. Stop pump Reconnect hose. Restart pump.

NOTE

Hoses may have to be disconnected to remove ice plugs at metal connectors.

CAUTION

Do not start high pressure pump until the heat lamp (operated by the PUMP SKID HEATER circuit breaker has been on for at least 1 hour. Failure to allow for this warming will result in immediate freeze up and possible damage.

(e) Follow normal start-up procedures described in paragraph 2-17.

(f) Disconnect hoses from storage tank outlets. Inspect for ice plugs at storage tank outlets

(g) Fill tanks with about 12 inches of water. Attach dispensing hoses. FIX handle of each dispensing nozzle to open position, and put each nozzle under water in a tank and then start pump. The resulting flow will help stop freezing.

NOTE

Do not start distribution pump until it has been warmed by the heat lamp.

NOTE

If nozzles are not immediately placed under water, they may become so cold that the pumped water wiII immediately freeze when contacting the nozzles.

(2) If the ROWPU was allowed to freeze, proceed as follows:

(a) Establish normal diesel generator power supply, start both heaters and the hi-pump heater and turn PUMP HEAT/SUMP HEAT ON/OFF switch to ON position.

(b) If RO elements were removed, install (para. 3-28).

(c) If RO elements were not removed, set heater thermostats to maximum and wait 8 days

NOTE

The thawing can be accelerated by ducting a shelter heater to heat the inside of the van. If 85°F (29.4°C) can be obtained, only 2 days will be required.

(d) Follow procedures, para. 2-17, up to the media fitter forward flush just before start-up.

(e) After starting booster pump, adjust the feed flow to 50 gpm (189 Ipm) using the feed valve. Continue this 50 gpm (189 Ipm) flush for 30 minutes.

(f) Increase the feed flow to 100 gpm (378 Ipm) using the feed valve. Continue for an additional 30 minutes.

NOTE

If the media filter pressure gage shows a pressure drop over 20 psi (138 kPa) there is ice blockage. See para. 2-35 for emergency procedure.

(g) Complete start-up.

g. Cold Shutdown to Standby. Follow shutdown procedures in paragraph 2-18 and in addition perform the following steps:

(1) Do not shut down diesel generator. Generator is needed to power heat lamps. van and high pressure pump space heaters and sump heat tracing.

(2) Do not shut down distribution pump. Leave dispensing nozzles open in product water tanks. Circulation of water will prevent freezing.

CAUTION

Hoses will begin to freeze if standby shutdown lasts more than 15 minutes. When the ROWPU is shut down for longer than 15 minutes, all raw water and waste hoses must be drained. Disconnect the canvas hoses and roll up to push all water out. Disconnect suction hose segments which are out of water.

h. *Cold Shutdown to Secured Conditions.* Shut down ROWPU as described in para. 2-22 or 2-23 with the following variations (Figures 2-70 and 2-71):

(1) While the media filter is being backwashed, remove the product hose sections (1) and the product shut-off valve (2). Cap the van connection.

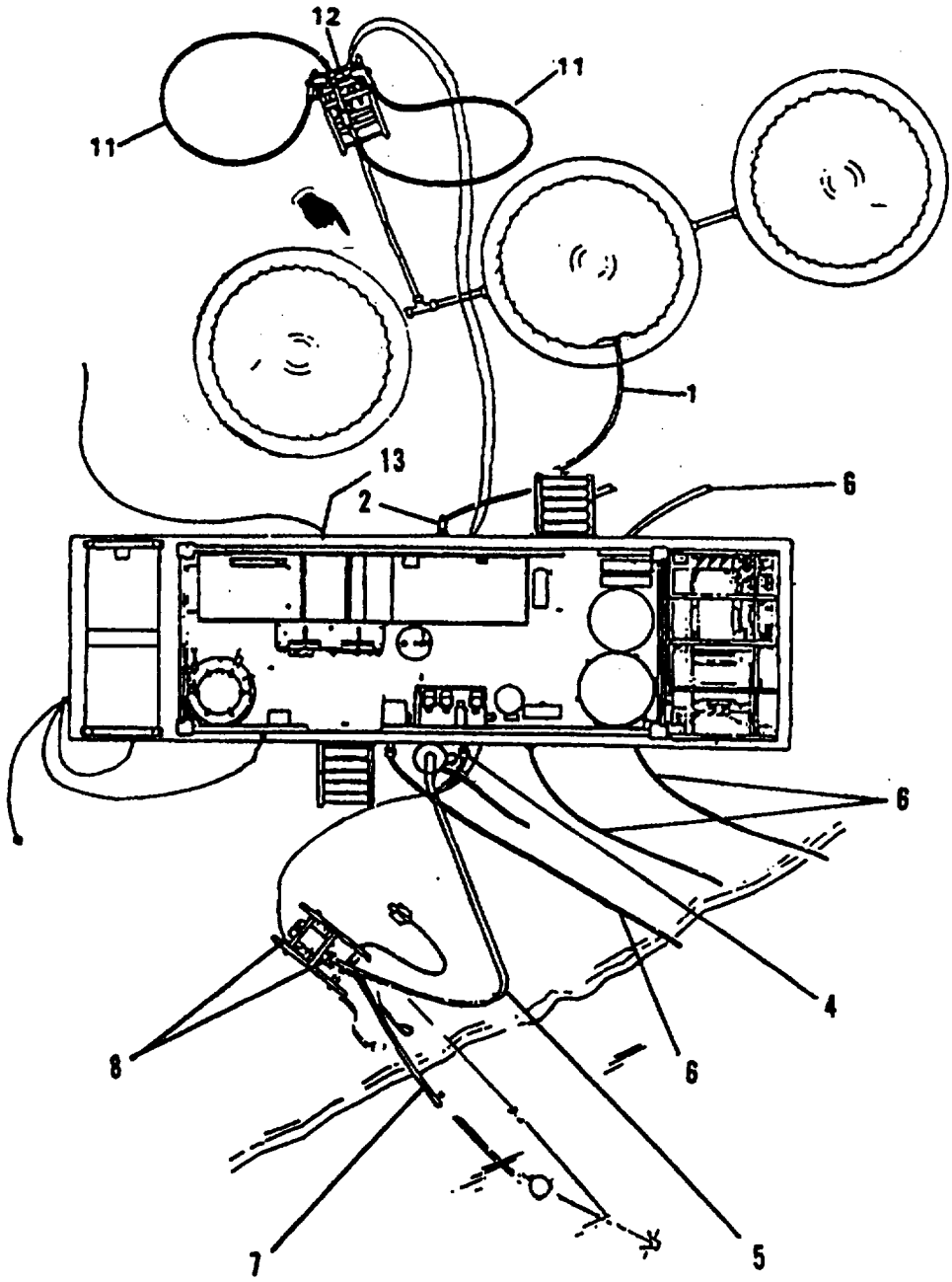


Figure 2-70. Shutdown to Secured Conditions (External to Van) (MODEL WTA-060 ONLY)

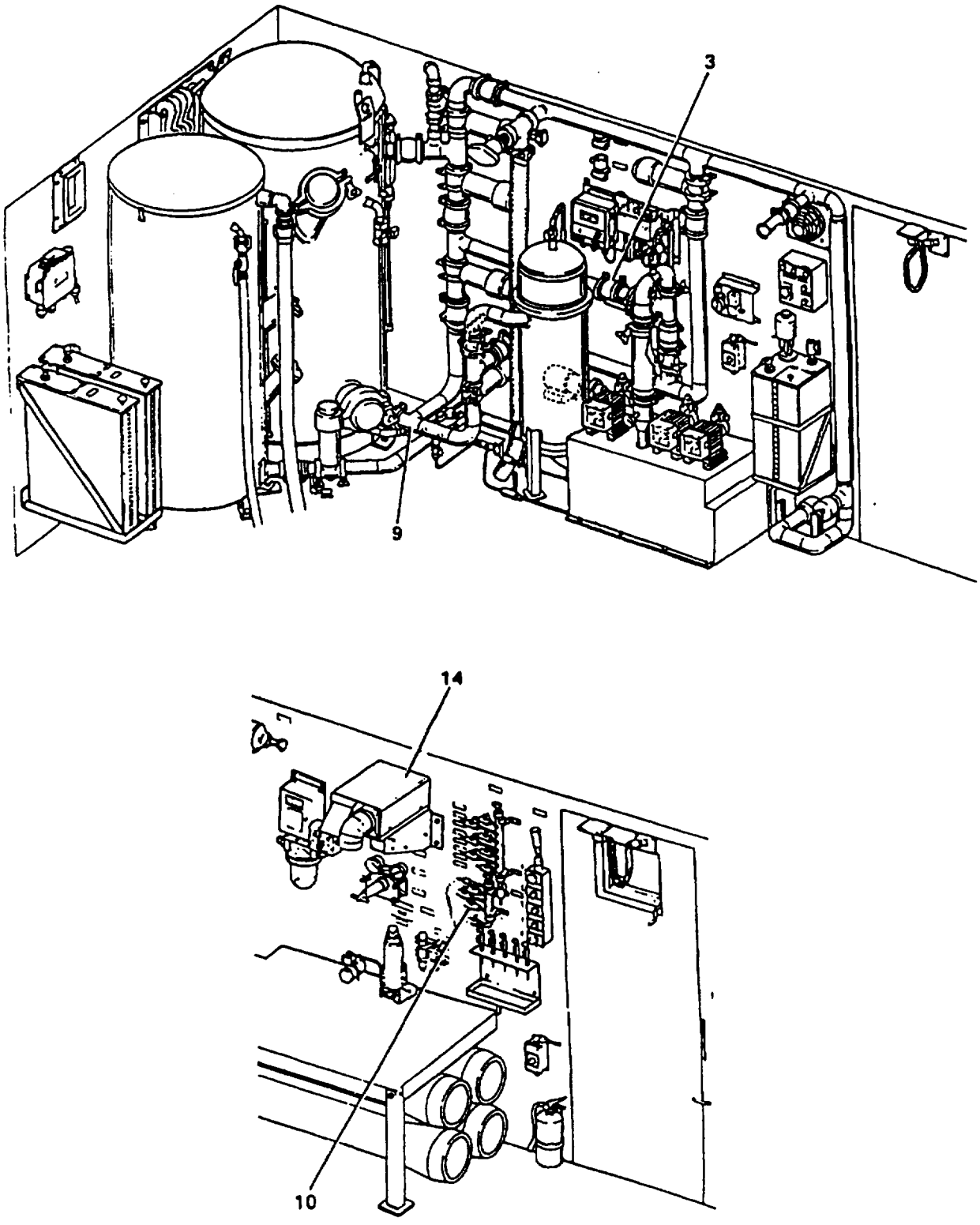


Figure 2-71. Shutdown to Secured Conditions (Inside Van)
(MODEL WTA-060 ONLY)

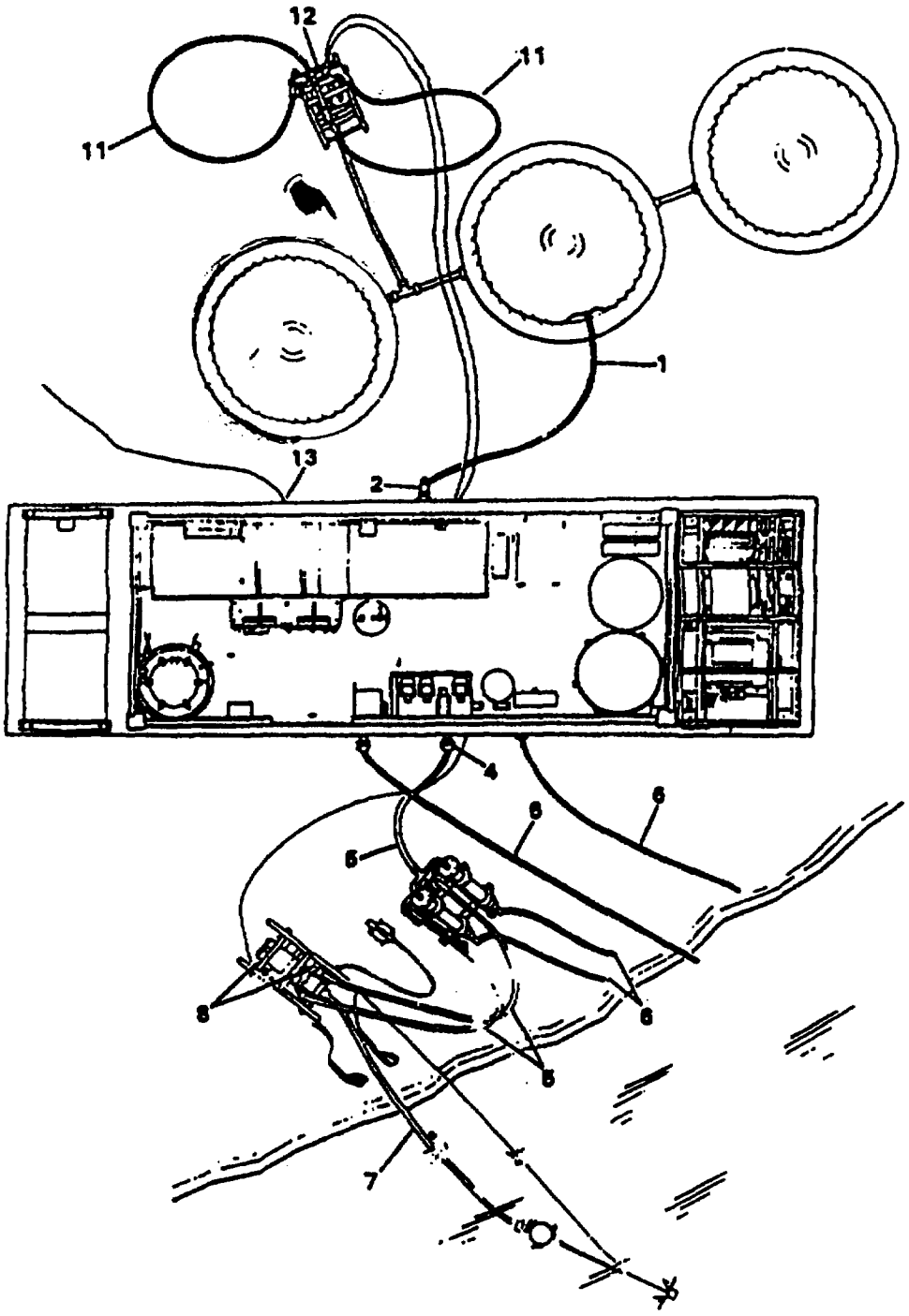


Figure 2-71.1. Shutdown to Secured Conditions (Inside Van) (MODEL WTA-060 ONLY)

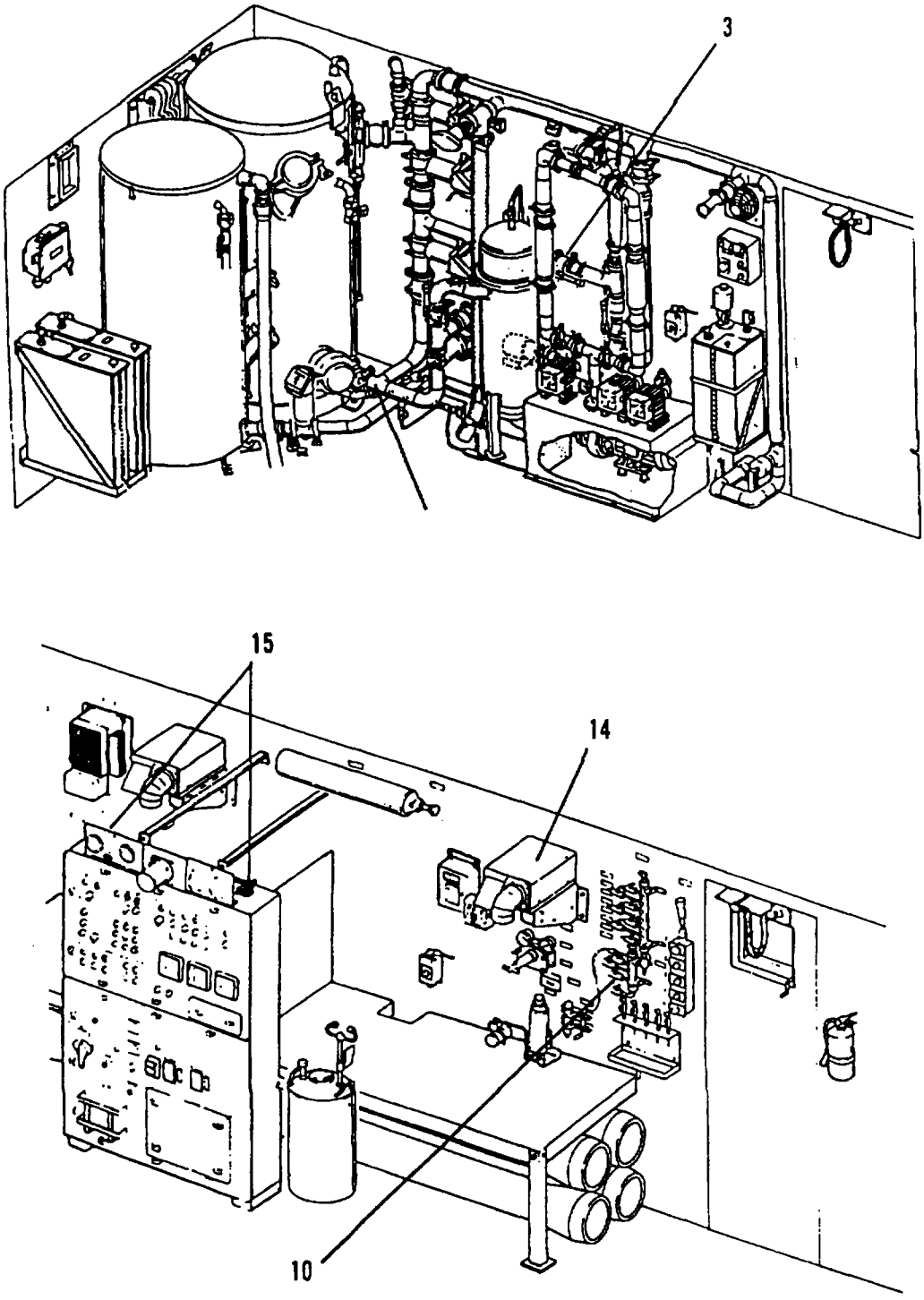


Figure 2-71.2. Shutdown to Secured Conditions (Inside Van) (MODEL ROWPU-1 ONLY)

(2) Immediately after backwashing is complete, close the feed valve (3), remove the raw water discharge hose and adapter (4) and install the cap on the van connection. Disconnect all raw water hose sections (5) and quickly walk out the hose sections to remove water. Roll up hoses and place inside van.

(3) Disconnect all waste hose sections (6) and walk out remaining water. Reconnect for use during cleaning procedures

(4) Disconnect and drain all deployed raw water suction hose sections (7).

(5) Open raw water pump drain and priming valves (8). (If priming valve is capped, first remove cap.)

(6) With the exception of when the clean/flush tank is being filled, leave the distribution pump running with dispensing nozzles placed open inside the tanks to which the pump is connected. Drain the third tank and remove it from the system.

(7) After beginning the RO cleaning or sanitizing procedure, drain and purge the media filter.

(a) Open the media filter lower drain (9).

(b) Open the media filter air purge block (10).

(c) Continue the air purge until only air is observed at the drain.

CAUTION

Watch the air pressure gage. Do not allow pressure to drop below 200 psig. Close valve and wait for additional air pressure.

(d) Close the air purge block (10). Leave media filter lower drain valve (9) open.

(8) If on an NBC mission, drain and purge the NBC filter (para. 2-33h).

(9) When cleaning and/or sanitizing procedures are complete, drain the water tanks, disconnect the hoses (11) and open the pump drain valve (12). Immediately roll up the dispensing hoses with the nozzles locked open to remove the water. Place inside the van.

(10) Maintain operation of the space heaters to avoid freeze up.

(a) Continue to maintain operation of the diesel generator to provide power for the heaters.

NOTE

Prolonged operation of the diesel generator at low load will decrease the reliability.

(b) An auxiliary power connection (13) is provided to provide 120 VAC power to the van space heaters. Power can be supplied by an auxiliary generator or another ROWPU at the water point allowing the diesel generator to be secured

NOTE

The space heater's power automatically shifts to the diesel generator batteries when the generator is shut down and auxiliary power is not supplied. The HEATER POWER SUPPLY ON/OFF switch (5, Figure 2-68) will control the heaters when 120 VAC is available. When drawing from the batteries, stop heater no. 1. The batteries will power heater no. 2 (14) for 1 -hour without excessive discharge. Fuel consumption is 1/6(.6 1) gallon per hour per heater.

(11) If the ROWPU will be placed in storage below 320F, the RO elements must be removed immediately after draining the RO vessels and before the heaters are stopped.

(12) On Model ROWPU-1, Open all drain valves (15) behind the pressure gages on the control panel.

i. Preparation for Movement. Prepare for movement as described in para. 2-28 with the following variations.

(1) Maintain generator and heater operation until pack-up is complete.

(2) Movement for Immediate redeployment.

(a) Open all vents and drains. Do not leave RO element sanitizing solution in the RO vessels. Uncap all ROWPU van external connections.

{b) Air purge the media filter and NBC filter (if used).

(c) Air purge all three chemical systems.

NOTE

Draining and purging lessens the impact of heater failure during transport.

(d) Follow normal pack-up procedures.

(e) Stop heater no. 1.

(f) Open enclosure door and turn carbon monoxide monitor power switch OFF.

(g) Close doors tightly.

(h) Secure generator.

NOTE

The one operating heater will prevent freeze up during transport. After 1 hour, battery drain may be excessive.

(3) Movement with delayed redeployment.

(a) Follow procedure (2) except do not open RO vessel drains.

NOTE

Drained RO elements will not remain free from biological growth for more than a few days when drained.

(b) Arrange for auxiliary power supply to maintain heater operation after movement. Start heater no. 2. Make note of fuel requirements.

(c) Alternatively, follow the procedure for movement to storage.

(4) Movement to storage.

NOTE

RO elements will be removed (para. 3-28) to a warm storage area. Notify unit maintenance to prepare packaging for elements.

(a) Follow steps for long term shutdown and steps 2a, b and c.

(b) Remove RO elements (para. 3-28) and properly package immediately after draining.

(c) Complete pack-up.

(d) Secure heaters and diesel generator.

(5) Winter kit pack-up.

NOTE

During winter movement, winter kit items will be accessible to operators.

(a) The two wood skids and two covers are packed under hose on back table.

(b) The remainder of the winter kit is packed in a storage box (4, Figure 2-64) which is strapped to the table inside the van during transport.

(c) The winter kit storage box has ample room for storage of winter kit items and no special pack-up procedures are required.

j. Generator Breakdown. See TM 5-6115-545-12.

(1) If an auxiliary power supply is available, immediately connect to the auxiliary 120 VAC power connection to continue heater operation. Other operating ROWPU'S at the water point can provide the necessary power from the generator 120 VAC utility outlets. All that is needed is an extension cord.

(2) If auxiliary power is not available, drain all water from entire system.

(a) Stop heater no. 1.

(b) Open all vents and drains inside the van.

(c) Open the high pressure pump drains and drain valve by discharge accumulator.

(d) Disconnect the discharge hose at the cyclone separator outlet manifold. When water drainage slows, disconnect all hose sections and walk out the water. Leave van cap off.

(e) Open the raw water pump drain and disconnect the pump discharge hose and separator inlet manifold hose.

(f) Remove and walk out waste hose sections. Leave van cap off.

(g) Disconnect distribution pump and hoses Open pump drain. Open dispensing nozzles and walk out hoses. Remove product hose sections and product shut-off valve. Leave van cap off.

(h) Drain product tanks.

(i) Drain and air purge the media filter (para. 2-31h).

(j) If on an NBC mission, drain and air purge the NBC filter (para. 2-33h).

(k) Air purge the chemical systems (para. 2-22c (1) and 2-23h).

(l) Shut off diesel heater no. 2 after no longer than one hour.

NOTE

As a temporary measure, 24 VDC can be provided by a vehicle 24 VDC slave connection and cables. Connect the slave cable from the vehicle to the generator 24 VDC connector. Keep vehicle engine running.

2-32. OPERATION IN SANDY AND DUSTY AREAS (ARID/DESERT ENVIRONMENT).

a. Keep all lubricants tightly sealed and all lubrication points clean. Lubricate more often.

b. Keep unit doors closed as often as possible.

c. Clean sand and dust off unit, inside and out, as often as possible.

d. Desert soil/sands have low moisture content making low resistance grounding difficult. Refer to FM20-31 and TC 11-6.

e. Keep storage tanks well sealed.

WARNING

Do not use water to clean sand off electrical connectors. Electrocution or arcing could occur. Use compressed air to clean away packed sand.

f. Clean sand and dust from nozzle, hose connections, plugs and fittings as often as possible.

g. Ensure lids on chemical feed tanks are tightly closed.

h. Keep electrical control cabinets well sealed.

i. Keep covers on high pressure pumps at all times.

2-33. PURIFICATION OF NBC CONTAMINATED SOURCE. A water source may be contaminated by sabotage, disaster, or warfare. Contaminants can be N (nuclear), B (biological) or C (chemical) agents. The ROWPU can purify NBC contaminated water to safe drinking standards. Refer to paragraph 1-9.

WARNING

When deployed on an NBC decontamination mission, a Toxilogical Agent Protective (TAP) outfit or appropriate MOPP level protective gear, as approved by the supervisor, must be worn.

a. *Assembly and Preparation for Use (Figure 2-72).* Follow normal procedures given by paragraph 2-14 and connect the NBC filter as follows:

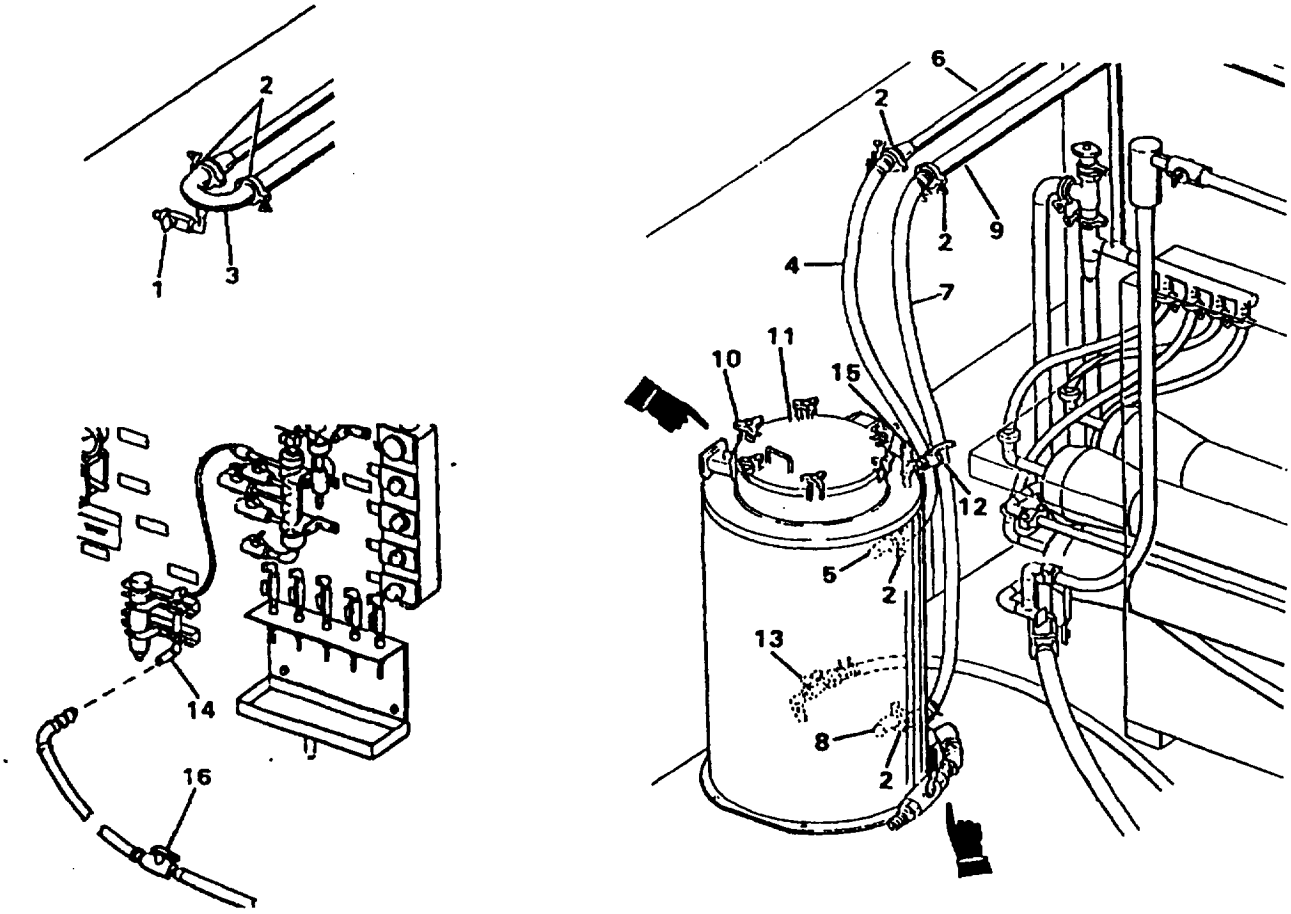


Figure 2-72. NBC Filter Set-Up

(1) Open vent valve (1).

(2) Remove damps (2) and product water fitting (3).

(3) Connect the short NBC jumper hose (4) to the upstream product connection (6). Attach remaining end to the upper filter inlet (5). Secure with clamps (2) and gaskets.

(4) Connect the longer NBC jumper hose (7) from the down stream product connection (9). Attach remaining end to the lower filter outlet (8). Secure with clamps (2) and gaskets.

b. *Initial Setup, Checks and Self Tests.*

WARNING

To avoid exposure to NBC contamination, NBC media must be replaced at every 100 hours of operation. If operating in an NBC environment and ROWPU is shut down before 100 hours of operation, replace NBC media.

(1) Log the high pressure pump hourmeter reading at first start-up on the NBC mission and at each NBC media replacement. Replace the NBC media at 100 hour intervals. Remove the NBC media as detailed by 2-33f(1). Replace as detailed by 2-33b(1 and 2).

(2) Loosen the clamps (10) and open the NBC filter cover (11). Check to assure that NBC filter media is in the filter.

(3) If empty, refill.

(a) Empty eleven containers of ion exchange resin (35 lb each) into the filter.

(b) Empty nine containers of activated carbon (35 lb each) into the filter on top of the resin.

WARNING

The NBC filter cover is heavy, use care when closing to avoid injury.

(c) Wipe the flange surface clean, close the filter cover (11) and tighten the clamps (10).

(d) Close vent valve (12).

c. *First Start-Up and Start-Up from Drained Conditions.* See para. 2-17 except vary as follows:

WARNING

Water coming out of the vent valve (12) will be contaminated. Make certain to avoid skin contact with contaminated water. Use a clearly marked container to collect this water. Failure to do so could result in death.

(1) Before starting high pressure pump, open NBC filter vent valve (12) and close drain (13).

(2) Close vent valve (12) when water is first observed.

WARNING

To avoid death or injury, do not direct water to the storage tanks until cleared by the medical team.

(3) Following medical team clearance, direct the water to storage.

d. *Shut Down to Temporary Secured Status — Up to 3 Days.* Refer to paragraph 2-22. Open NBC filter vent (12) and drain (13) whenever draining is required.

e. *Shut Down to Long Term Secured Conditions.* Refer to paragraph 2-23 with the following variations.

NOTE

All three storage tanks must be full to provide water required for long term secured shut down.

(1) Remove the NBC filter media (Figure 2-73).

WARNINGS

- When deployed on an NBC decontamination mission, a Toxilogical Agent Protective (TAP) outfit or appropriate MOPP level protective gear, as approved by the supervisor, must be worn.
- Qualified NBC personnel should be contacted to assist in the marking and monitoring of the contaminated waste dump site.

(a) Remove the floor mats from the NBC filter area.

(b) Connect the NBC media blow out hose (1) to the blow out valve (2) and position the hose outlet for a safe discharge.

(c) Remove hose (4) and cap the inlet.

(d) Shift hose (4) upper position to the product connection (6).

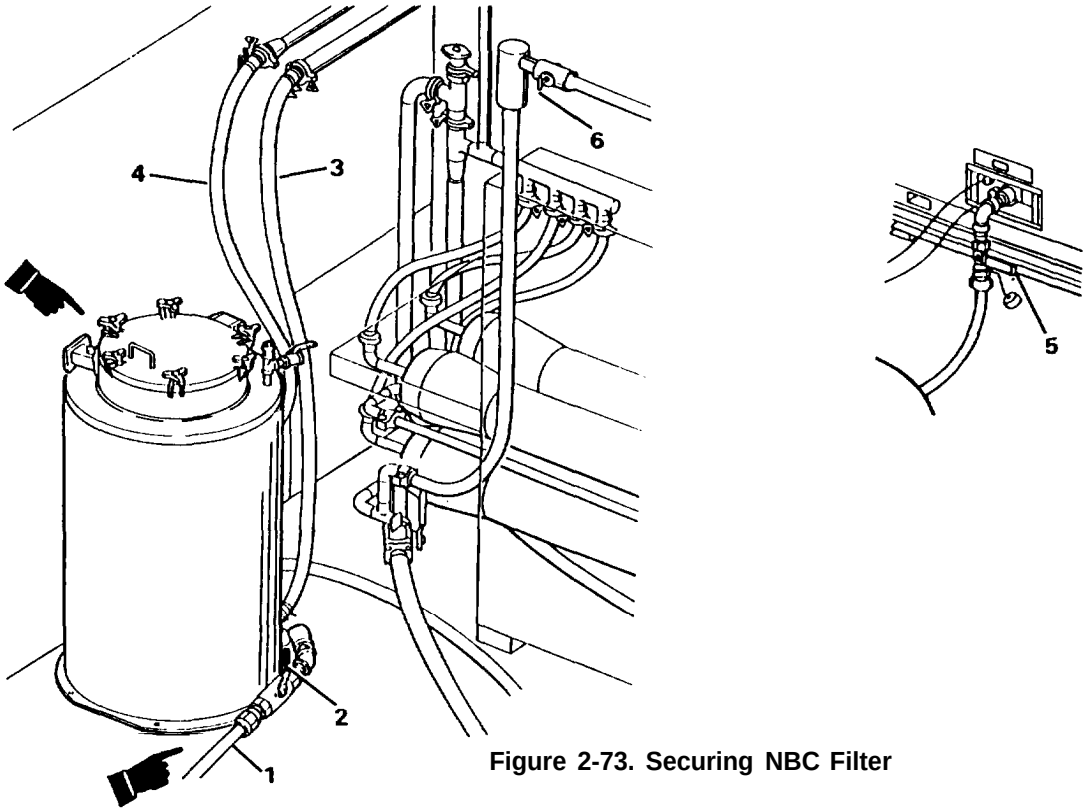


Figure 2-73. Securing NBC Filter

WARNING

Be sure to discharge to a properly prepared and marked sump.

(e) Start the ROWPU.

(f) Slowly adjust the system pressure control valve (6) to provide sufficient flow to flush the spent media from the filter slowly.

NOTE

Too much water flow may result in product pressure over 35 psig (241 kPa) causing automatic shut down. Watch the pressure as the water flow is increased.

(g) When only water is observed in the discharge, fully open the system pressure control valve (6).

(h) Shut down the ROWPU.

NOTE

Perform steps (a (3) thru c (3)) as required during NBC operation.

WARNING

To avoid death or injury:

- Tasks (i) through (f) must be performed wearing TAP suit.
- Prolonged wearing of TAP suit may lead to heat exhaustion.

(i) Check floor for contamination. If found, decontaminate floor.

(j) Backwash the media filter four times (para. 2-21), but DO NOT add bisulfite to the clean/flush tank.

NOTE

To proceed with processing NBC contaminated water, repeat steps (a (3) thru c (3)).

f. To return to normal procedure, continue with step f. (1).

(1) Clean inlet strainer (para. 3-7). Transport debris to disposal sump.

(2) Repair cartridge filter (para. 3-20). Dispose of contaminated cartridge filters in accordance with Property Disposal Officer (PDO).

(3) Clean basket strainer (para. 3-22). Transport debris to disposal sump. At the end of the NBC mission, dispose of contaminated overscreen in accordance with PDO.

(4) Replace RO elements (para. 3-28) at the end of NBC mission. Dispose of contaminated RO elements in accordance with PDO.

(5) Flush water (para. 4-25b).

WARNING

Chlorine may not neutralize all chemical agents. Refer to NBC personnel to determine chemical agent present.

NOTE

This procedure will run chlorinated water through the system to destroy biological agents.

(a) Disconnect raw water pump power cable first at the van, then at the raw water pump.

(b) Disconnect hoses and open pump drain and priming valves.

NOTE

The van raw water inlet should be capped.

(c) Move the raw water pump to a location near the storage tanks.

(d) Pull in suction hoses and disconnect sections. Bring hose sections to pump.

(e) Connect previously deployed suction hose sections to the pump. Wash off suction hoses and intake strainer thoroughly using the distribution pump.

(f) Place strainer in one water tank and push in extra hose.

(g) Connect all previously deployed sections of raw water discharge hose directly to the raw water pump. Layout hose so end is near the raw water source.

(h) Disconnect hose connecting the third water tank and cap both the tank and hose.

(i) Add hypochlorite to the two connected tanks. Add three packets to each tank. Add slowly and spread over the water surface.

(j) prime the raw water pump following normal procedures (para. 2-17b). Pump through discharge hoses for 3 minutes. Stop pump and crimp the hose section nearest the pump.

(k) Disconnect ail but one hose section. Connect remaining section to the van raw water inlet.

(l) Start-up normally (para. 2-19). Leave system pressure control valve fully open.

(m) Continue to operate for 30 minutes. Fill clean/flush tank using the cartridge filter utility hose. Do not add bisulfite.

(n) Backwash media filter, para. 2-21. When completed, close feed valve.

(o) Remove intake strainer and hose from the tank and place into the third storage tank.

(p) Start up again and operate as before for 10 minutes.

(q) While operating, fill the clean/flush tank to 50 gallons (189l) using the product utility hose. The product shut off valve will have to be closed to provide pressure but must be opened before closing the utility hose valve. Add two large bags of bisulfite. Continue filling to 100 gallons (379 l).

(r) Shut down to standby (para. 2-18).

(s) Follow bisulfite sanitizing cleaning procedure (para. 2-26).

(t) Complete normal shutdown procedures (para. 2-23i).

g. Refer to FM3-5 for general NBC decontamination procedure. Further decontamination of ROWPU to be accomplished at decontamination site.

2-34. MANUAL OVERRIDE PROCEDURES.

a. Manual Operation of Automatic Valves for Model WTA-060. It an air operated valve fails to cycle as expected, the valve can be manually controlled until the cause of the failure is determined and repair has been made. All the automatic valves in the ROWPU can be hand operated when necessary. This paragraph gives the instructions for manually operating the valves and tells how the valves should be set for various modes.

(1) Identify failed automatic valves.

(a) Blue lights indicate which valves are open.

(b) Check that all blue lights work by pushing UGHT TEST (26, Figure 2-4).

(c) Compare open valves with listing of valves which should be open for operating condition (see below).

(d) The actual valve position can be checked by removing the orange cap from the valve actuator. The center red capped stem is in when the valve is open.

(2) Set automatic valve for manual operation (Figure 2-74).

CAUTION

Do not pull on the wires to disconnect the connector as the connector pins will be damaged. Separate the connector halves by gently pulling on both sides of the connector center split line until the connector slides apart.

(a) If the valve actuator (5) is supported by a bracket (1). loosen the nut(2) and bolt (3). Do not remove the support halves (4). Close the appropriate air valve. Disconnect the electrical connector.

(b) If the valve actuator (5) is not supported by a bracket, close the appropriate air block valve (Figure 2-8) and disconnect the electrical connector (6).

(c) Remove the clamp (7) between the valve actuator (5) and valve (8).

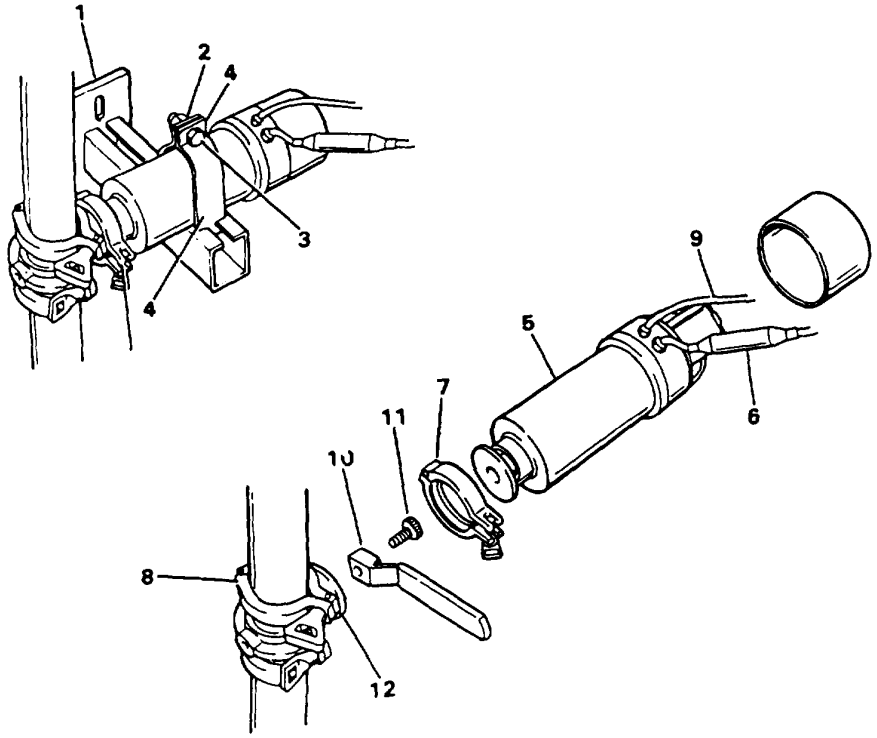


Figure 2-74. Setting of Automatic Valves for Manual Operation

☛(MODEL WTA060 ONLY)

(d) If the valve actuator is supported by a bracket, merely slide the actuator away from the valve. If the valve actuator is not supported by a bracket, set the actuator to the side, being careful not to kink the air hose (9) or supporting the weight of the actuator by the air hose.

(e) Place a blue manual handle (10) from storage box no. 3 (45, Figure 2-24) on the valve stem. Secure with thumbscrew (11, Figure 2-74) packaged with valve handle. Using manual handle, turn valve to correct position.

(3) When manual operation is no longer required, replace the actuator.

(a) Actuator electrical connector (6) must be unplugged.

(b) Shut down to standby.

(c) Using manual handle (10), open valve (8).

(d) Place actuator (5) over valve stem (12) and align so that valve actuating pin lines up with hole in the actuator. Use actuator body to slightly turn valve stem as needed for alignment.

(e) Replace clamp (7), tighten.

CAUTION

The cable connector is keyed to ensure proper connection. Make sure that the two halves of the connector are aligned before attempting to make the connection.

(f) Connect electrical cable (6).

(g) Tighten nut (2) and bolt (3), if used.

(h) Open air block valve (Figure 2-8).

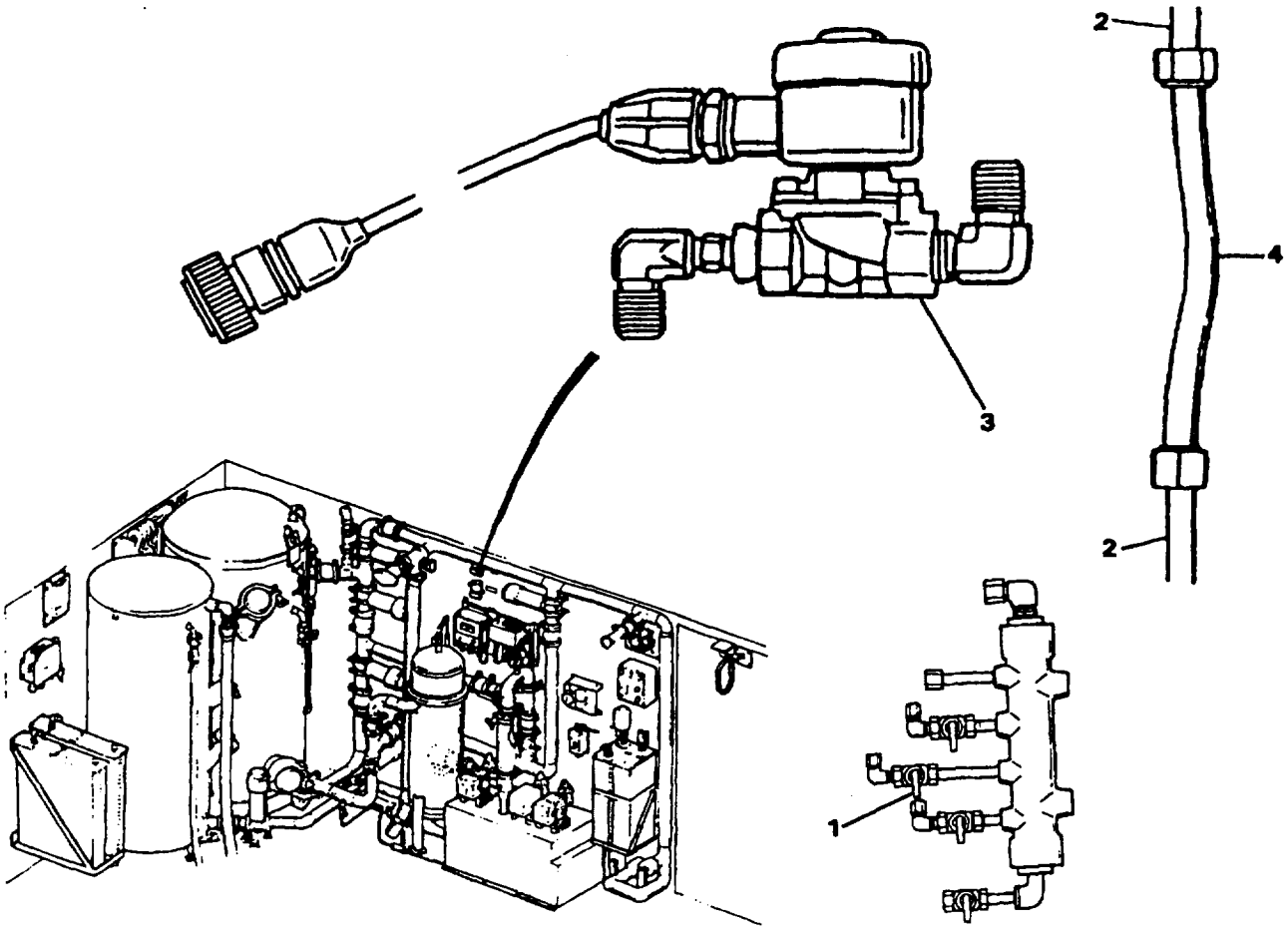


Figure 2-75. Bypassing Air Backwash Valve

NOTE

Backwash air inlet solenoid failure will be noted by the absence of air flow noise at the second backwash step. Another indication is that the air system air pressure gage does not drop in pressure when backwashing.

(4) Air backwash valve. This backwash air inlet solenoid valve can be bypassed to allow a complete manual backwash (Figure 2-75).

(a) Close the backwash air block valve (1).

(b) Disconnect the tubing (2) at both ends of the backwash valve (3).

(c) Remove jumper tube (4) from storage box no. 3 (Figure 2-24).

(d) Connect jumper tube (4, Figure 2-75) to free ends of disconnected tubing.

(e) Partially open the backwash air block valve (1) during backwash. Air flow will be delivered. Watch that the system air pressure gage does not drop below 150 psig (1034 kPa). Close backwash air block valve (1) if it does.

(5) Filter Normal Valve Positions (Figure 2-76). Position the manually operated automatic valve(s) according to positions listed below and then follow normal star-up procedures (para. 2-17).

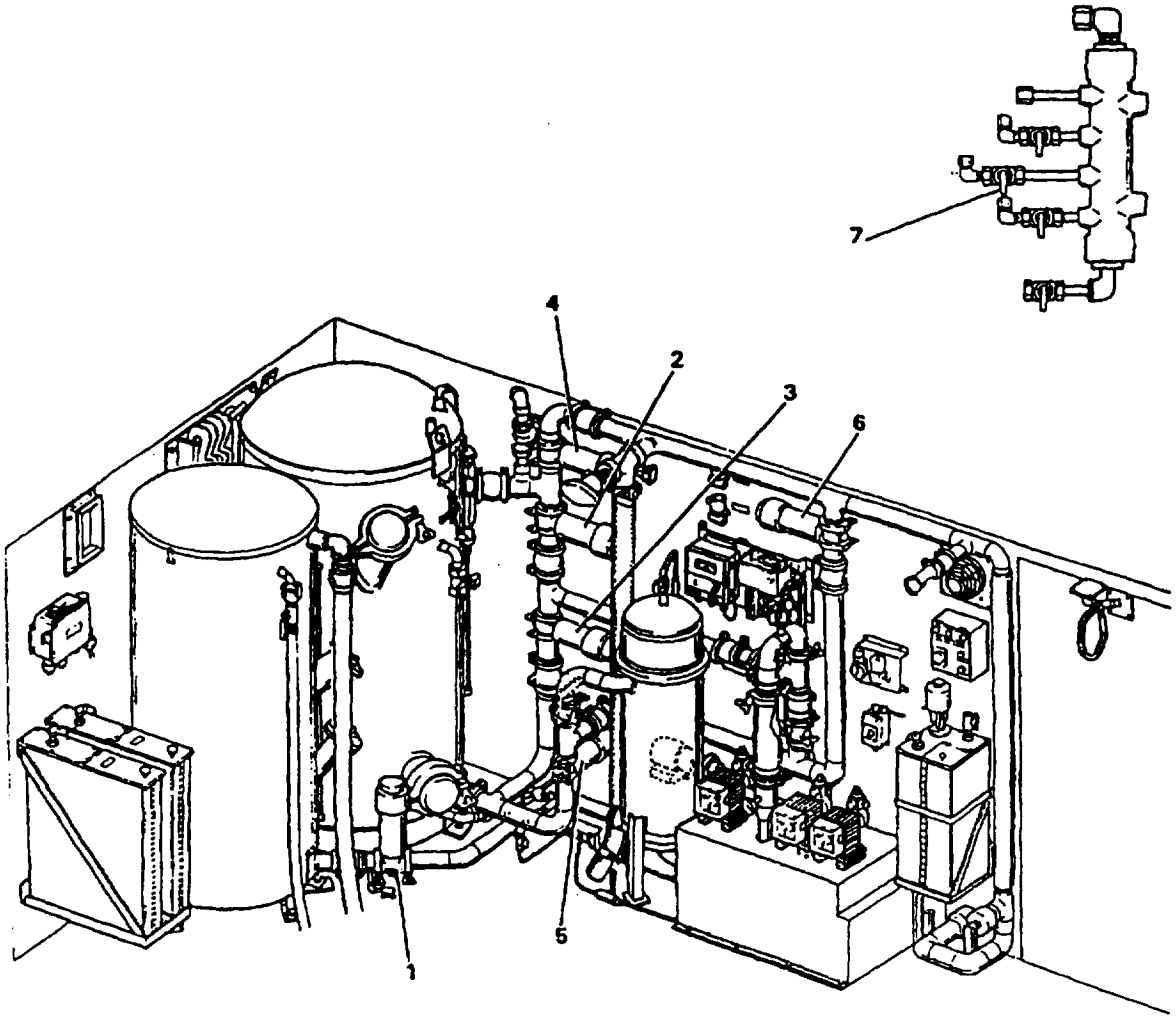


Figure 2-76. Manually Operated Automatic Valve Position (MODEL WTA-060 ONLY)

(a) Clean/flush outlet valve V5 (1) - closed.

(b) Media filter inlet valve V16 (2) - open.

(c) Backwash inlet valve V15 (3) - closed.

(d) Backwash outlet valve V17 (4) - closed.

(e) Media filter outlet valve V35 (5) - open.

(f) Media filter flush valve V36 (6) - open.

(6) System Clean Valve Positions.

(a) Clean/flush tank outlet valve V5 (1) - open.

(b) All other automatic valves - closed.

(7) Shutdown. When the ROWPU is shut down and drained, open all manually operated automatic valves to allow complete drainage.

a. Manual Operation of Automatic Valves for Model ROWPU-1. If an air operated valve fails to cycle as expected, the valve can be manually controlled until the cause of the failure is determined and repair has been made. All the automatic valves in the ROWPU can be hand operated when necessary. This paragraph gives the instructions for manually operating the valves and tells how the valves should be set for various modes.

(1) Identify failed automatic valves.

(a) Blue lights indicate which valves are open.

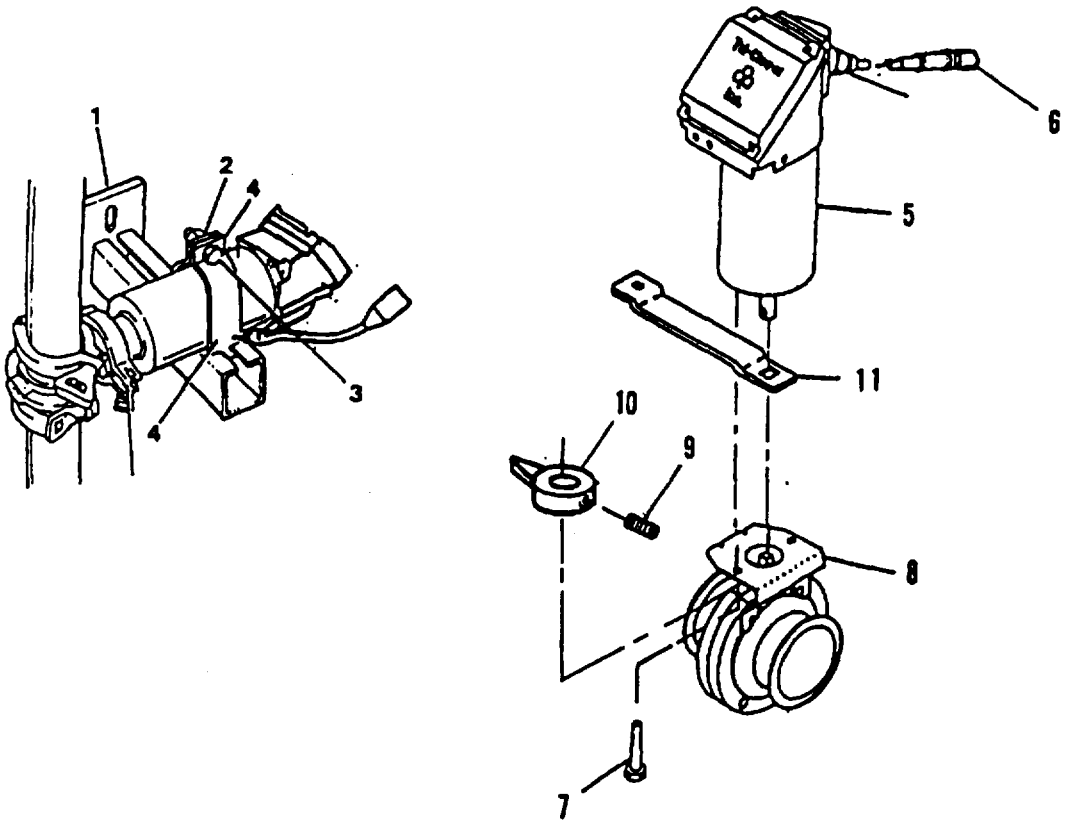


Figure 2-76.1. Setting of Automatic Valves for Manual Operation. (Model ROWPU-1 only)

(b) Check that all blue lights work by pushing LIGHT TEST (26, Figure 2-4).

(c) Compare open valves with listing of open valves which should be open for operating condition (see below).

(d) The actual valve position can be determined by looking at the position indicator (10) in the actuator mounting bracket.

(2) Set automatic valve for manual operation (Refer to Figure 2-76.1).

(a) Shut ROWPU down to standby.

CAUTION

Do not pull on the wires to disconnect connector as the connector pins will be damaged. Separate the connector halves by gently pulling both sides of the connector center split line until the connector slides apart.

(b) If the valve actuator (5) is supported by a bracket (1), loosen the nut (2) and bolt (3). Do not remove the support halves (4). Close the appropriate air valve. Disconnect the electrical connector.

(c) If the valve actuator (5) is not supported by a bracket (1), close the appropriate air block valve (Figure 2-8) and disconnect the electrical connector (6).

(d) Remove two screws (7) attaching valve actuator (5) to mounting bracket (8).

(e) Loosen set screw (9) from position indicator (10).

CAUTION

Air lines and electrical cables may be damaged if the valve actuator is allowed to hang from them. Do not allow the valve actuator to hang loosely by air lines or electrical cables.

(f) If the valve actuator (5) is supported by a bracket (1), slide the valve actuator away from butterfly valve and remove position indicator (10).

(g) If the valve actuator (5) is not supported by a bracket (1), slide the actuator from the butterfly valve and carefully lay the actuator on its side and support it as needed to keep the valve actuator from hanging by air lines or electrical cables, then remove position indicator from valve.

(h) Place handle (11) from storage box no. 3 (45, Figure 2-24) on valve stem.

(i) Using handle (11), turn valve into desired position to open or close valve.

(3) When manual operation is no longer required, replace the actuator.

(a) Shut ROWPU down to standby.

(b) Using handle (11) place valve in open position. Valve is in open position when hole in valve stem is parallel to piping.

(c) Remove handle (11) and place position indicator (10) onto valve stem.

(d) Slide valve actuator (5) into position indicator (10) and install two screws (7) to attach valve actuator (5) to mounting bracket (8).

(e) Tighten set screw (9) into position indicator (10).

CAUTION

The cable connector is keyed to insure proper connection. Make sure that the two halves of the connector are aligned before attempting to make the connection.

(f) Connect electrical cable (6) to valve actuator (5).

(g) Tighten nut (2) and bolt (3), if used.

(h) Open air block valve (Figure 2-8).

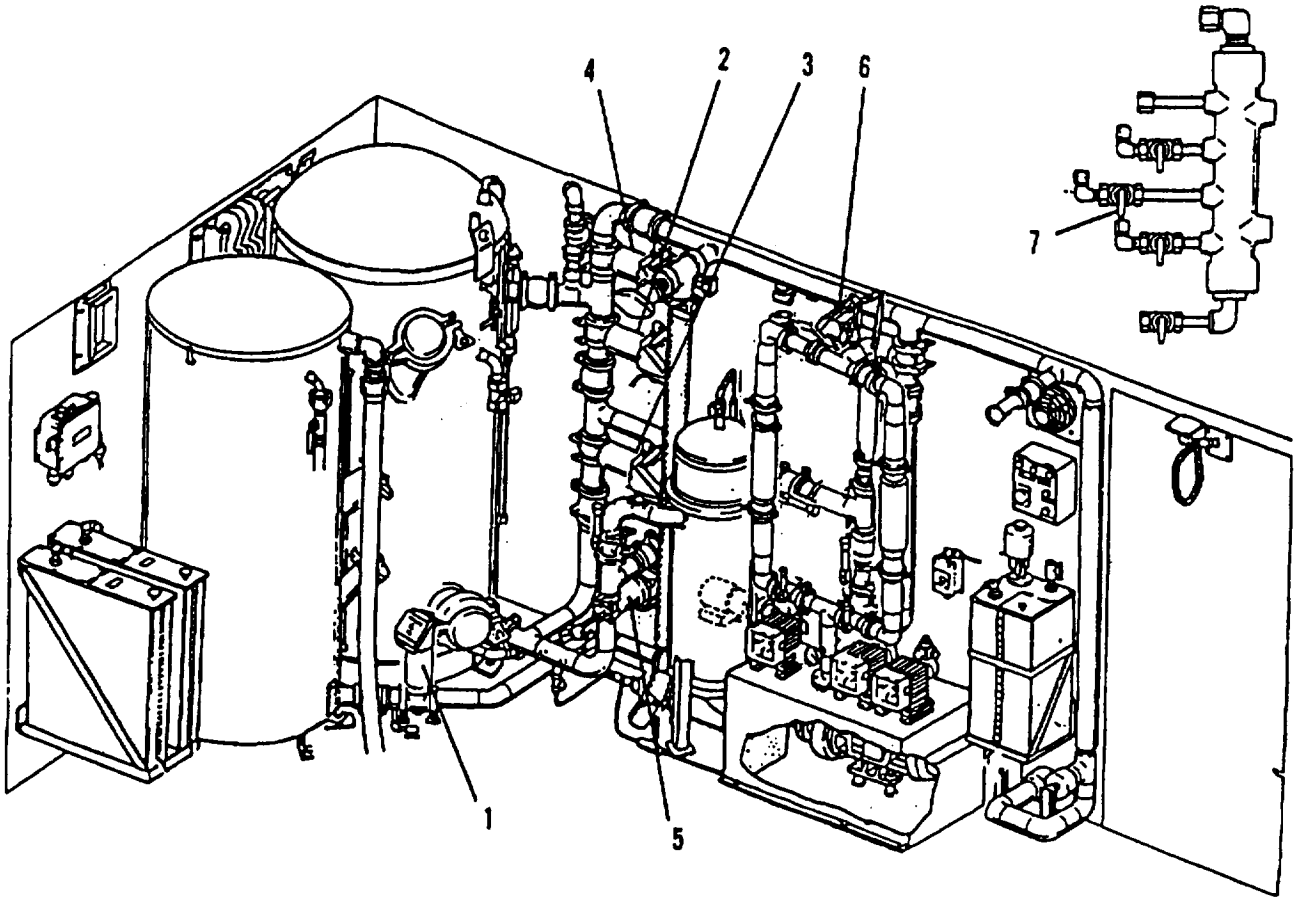


Figure 2-76.2. Manually Operated Automatic Valve Position (MODEL ROWPU-1 ONLY)

(4) Filter Normal Valve Positions (Figure 2-76.2). Position the manually operated automatic valve(s) according to positions listed below and then follow normal start-up procedures (para. 2-17).

(a) Clean/flush outlet valve (1) - closed.

(b) Media filter inlet valve (2) - open.

(c) Media filter backwash inlet valve (3) - closed.

(d) Media filter backwash outlet valve (4) - closed.

(e) Media filter outlet valve (5) - open.

(f) Media filter flush valve (6) - open initially. Closed after forward flush on start-up.

(5) System Clean Valve Positions.

(a) Clean/flush tank outlet valve (1) - open.

(b) All other automatic valves - closed.

(6) Shutdown. When the ROWPU is shut down and drained, open all manually operated automatic valves to allow complete drainage.

b. Partial Manual Operation of Automatic Valves During Backwash of Media Filter. Use this procedure to manually operate one or two automatic valves according to the following sequence. (Refer to Figures 1-11 and 2-2).

NOTE

The manually operated automatic valve(s) must be properly opened or closed at the same time as the automatic valves cycle.

(1) Backwash step 1, drain down after pushing INITIATE (8) on main control panel (approximately one minute).

(a) Clean/flush outlet valve V5 (1) - closed.

(b) Media filter inlet valve V16 (2) - open.

(c) Backwash inlet valve V15 (3) - closed.

(d) Backwash outlet valve V17 (4) - closed.

(e) Media filter outlet valve V35 (5) - open.

(f) Media filter flush valve V36 (6) - open.

(g) Air backwash valve V22 (7) - closed.

CAUTION
Do not switch valve positions until media filter pressure drops below 3 psig (21 kPa).

(2) Backwash step 2, air/water backwash (approximately 1 minute).

(a) Clean/flush outlet valve V5 (1) - closed.

(b) Media filter inlet valve V16 (2) - closed.

(c) Backwash inlet valve V15 (3) - open.

(d) Backwash outlet valve V17 (4) - open.

(e) Media filter outlet valve V35 (5) - closed.

(f) Media filter flush valve V36 (6) - closed.

(g) Air backwash valve V22 (7) - partially open. Monitor air system pressure and if it drops below 150 psig (1034 kPa) before step 3 starts, close valve.

NOTE
Remember to adjust feed flow to 30 gpm (1 14 l/m) using the feed control valve.

(3) Backwash step 3, water backwash (10 minutes).

(a) Clean/flush outlet valve V5 (1) - closed.

(b) Media filter inlet valve V16 (2) - closed.

(c) Backwash inlet vale V15 (3) - open.

(d) Backwash outlet valve V17 (4) - open.

(e) Media filter outlet valve V35 (5) - closed.

(f) Media filter flush valve V36 (6) - closed.

(g) Air backwash valve V22 (7) - closed. (This is the only valve that changes position.)

NOTE
Remember to adjust feed flow to proper amount per Table 2-25 using the feed control valve.

(4) Backwash step 4, clean water backwash (two minutes).

(a) Clean/flush outlet valve V5 (1) - open. (This is the only valve that changes position.)

(b) Media filter inlet valve V16 (2) - closed.

(c) Backwash inlet valve V15 (3) - open.

(d) Backwash outlet valve V17 (4) - open.

(e) Media filter outlet valve V35 (5) - closed.

(f) Media filter flush valve V36 (6) - closed.

(g) Air backwash valve V22 (7) - closed.

(5) Backwash step 5, media flush (after completion of backwash).

(a) Clean/flush outlet valve V5 (1) - closed.

(b) Media filter inlet valve V16 (2) - open.

(c) Backwash inlet valve V15 (3) - closed.

(d) Backwash outlet valve V17 (4) - closed.

(e) Media filter outlet valve V35 (5) - open.

(f) Media filter flush valve V36 (6) - open.

(g) Air backwash valve V22 (7) - closed.

c. Compete Manual Media Filter Backwash (Figure 2-77). This situation can occur if the backwash timing or control circuits fail Shut down to standby and leave the OPERATION MODE switch (1) set to FILTER NORMAL. Use following procedure.

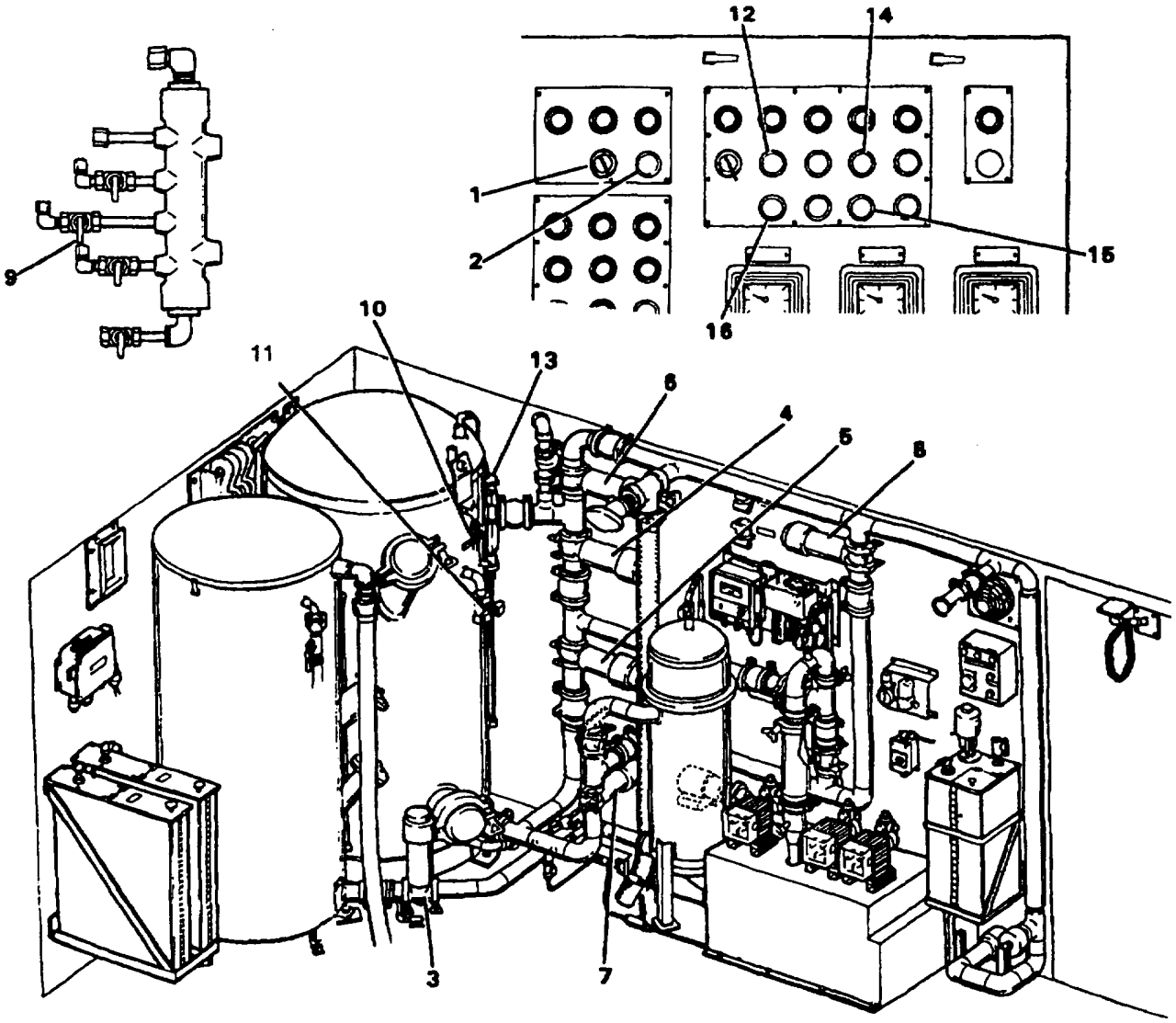


Figure 2-77. Complete Manual Media Filter Backwash

(1) Backwash step 1, drain down after pushing INITIATE (2) on main control panel (approximately one minute).

(a) Clean/flush outlet valve V5 (3) - closed.

(b) Media filter inlet valve V16 (4) - open.

(c) Backwash inlet valve V15 (5) - closed.

(d) Backwash outlet valve V17 (6) - closed.

(e) Media filter outlet valve V35 (7) - open.

(f) Media filter flush valve V36 (8) - open.

(g) Air backwash valve V22 (9) - closed.

(h) Open media filter upper drain valve V25 (11).

(i) Open media filter vent valve V19 (10) if draining stops.

(j) Close vent and drain valve (10 and 11) when no longer draining.

CAUTION
Do not switch valve positions until media filter pressure drops below 3 psig (21 kPa).

(2) Backwash step 2, air/water backwash (approximately 1 minute).
- (a) Clean/flush outlet valve V5 (3) - closed.
- (b) Media filter inlet valve V16 (4) - closed.
- (c) Backwash inlet valve V15 (5) - open.
- (d) Backwash outlet valve V17 (6) - open.
- (e) Media filter outlet valve V35 (7) - closed.
- (f) Media filter flush valve V36 (8) - closed.
- (g) Air backwash valve V22 (9) - partially open. Do not let air system pressure drop below 150 psig (1034 kPa).
- (h) Push RAW WATER PUMP START (12).

NOTE
Remember to adjust feed flow to 30 gpm using the feed control valve.

- (i) Watch air blanket level indicator (13).
- (j) When level (red flags) reaches 3 inches from top, close air backwash block valve (9).

(3) Backwash step 3, water backwash (10 minutes).
- (a) Clean/flush outlet valve V5 (3) - closed.
- (b) Media filter inlet valve V16 (4) - closed.
- (c) Backwash inlet valve V15 (5) - open.
- (d) Backwash outlet valve V17 (6) - open.
- (e) Media filter outlet valve V35 (7) - closed.
- (f) Media filter flush valve V36 (8) - closed.
- (g) Air backwash valve V22 (9) - closed. (This is the only valve that changes position.)
- (h) Push BOOSTER PUMP START (14).

NOTE
Remember to adjust feed flow to proper amount per Table 2-25 using the feed control valve.

- (i) After 10 minutes, push BOOSTER PUMP STOP(15) and RAW WATER PUMP STOP (16).

(4) Backwash step 4, clean water backwash (two minutes).
- (a) Clean/flush outlet valve V5 (3) - open. (This is the only valve that changes position.)
- (b) Media filter inlet valve V16 (4) - closed.
- (c) Backwash inlet valve V15 (5) - open.
- (d) Backwash outlet valve V17 (6) - open.
- (e) Media filter outlet valve V35 (7) - closed.
- (f) Media filter flush valve V36 (8) - closed.
- (g) Air backwash valve V22 (9) - closed.
- (h) Set OPERATION MODE switch (1) to SYSTEM CLEAN position and push INITIATE (2).
- (i) Push BOOSTER PUMP START (14).

NOTE
Remember to adjust feed flow to proper amount per Table 2-25 using the feed control valve.

(j) When tank empties, push BOOSTER PUMP STOP (15).

(5) Backwash step 5, media flush (after completion of backwash).

(a) Clean/flush outlet valve V5 (3) - closed.

(b) Media filter inlet valve V16 (4) - open.

(c) Backwash inlet valve V15 (5) - closed.

(d) Backwash outlet valve V17 (6) - closed.

(e) Media filter outlet valve V35 (7) - open.

(f) Media filter flush valve V36 (8) - open.

(g) Air backwash valve V22 (9) - closed.

(h) Set OPERATION MODE switch (1) to FILTER NORMAL position and push INITIATE (2).

(i) Push RAW WATER PUMP START (12).

(j) Push BOOSTER PUMP START (14).

NOTE
Remember to adjust feed flow to 100 gpm (690 kPa).

(k) Proceed with normal start-up after media filter backwash (para. 2-21).

2-35. EMERGENCY PROCEDURES.

a. Emergency Thaw Out (Figure 2-78). Use this procedure if a high pressure drop is indicated on the media filter pressure gage during the media flush at start-up, following a freeze up (see para. 2-31f (2)(f)).

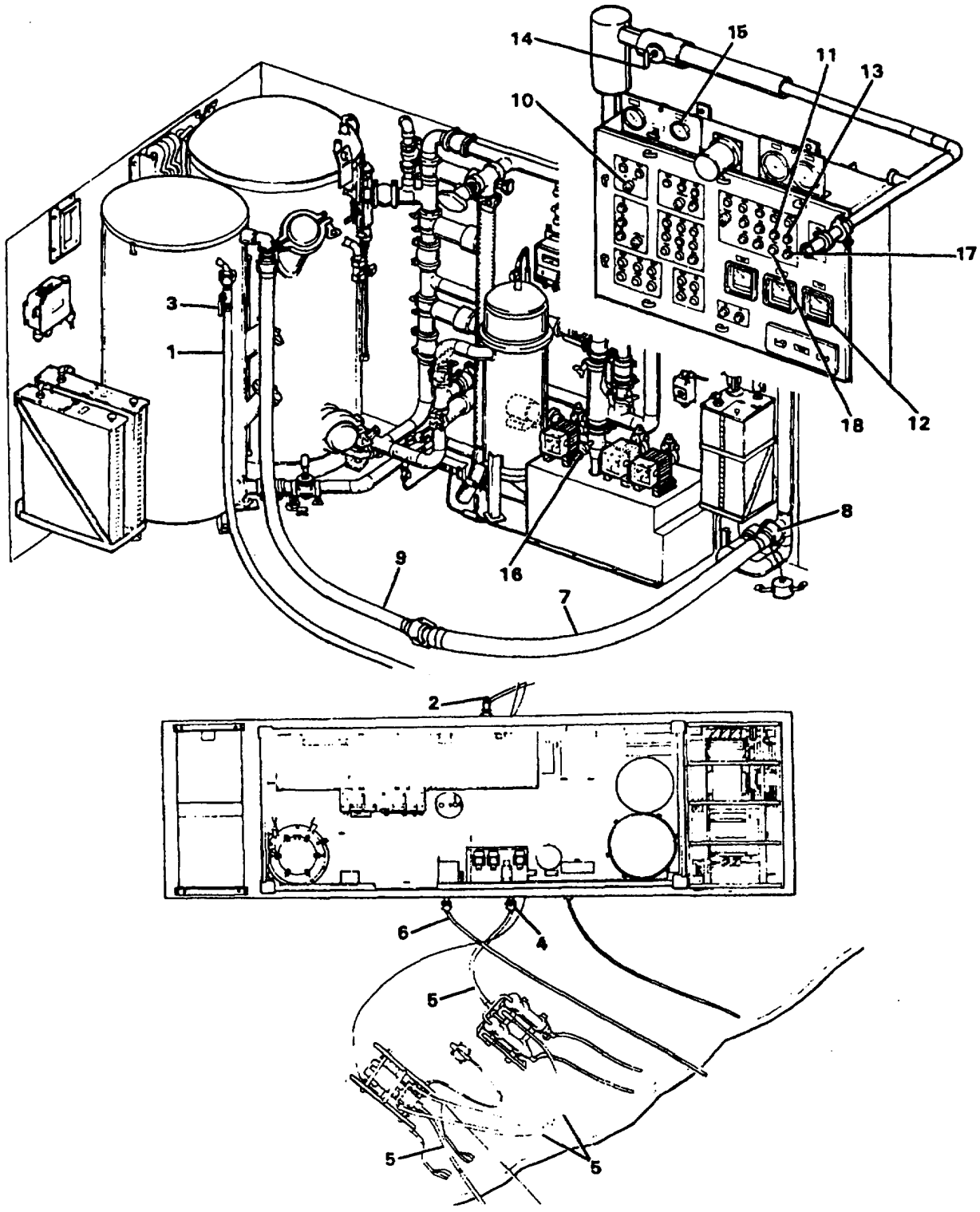


Figure 2-78. Emergency Thaw Out

(1) Continue normal start-up except leave chemical pumps off.

(2) Connect product utility hose (1) to clean/flush tank inlet. Partially close the product shut-off valve (2). Open the utility hose valve (3) and fill the clean/flush tank.

(3) Shut down to standby (para. 2-18).

(4) Remove raw water discharge hose (4) and cap connection.

(5) Disconnect and drain raw water hoses (5).

(6) Remove outside waste out hose (6) and cap connection.

(7) Connect cleaning heat-up jumper hose (7) between waste out connection (8) and clean/flush tank overflow hose (9).

(8) Turn system switch to shutdown (10).

(9) Fully close product shut-off valve (2).

(10) Push BOOSTER PUMP START (11).

(11) When WASTE FLOW flowmeter (12) reads steady, push HIGH PRESSURE PUMP START (13).

(12) Close system pressure control valve (14) until pressure gage (15) reads 20 psig.

NOTE

Water will now circulate the same as during cleaning heat-up except that it also circulates through the media filter.

(13) Continue to circulate until the water temperature gage (16) reads at least 45°F (7°C).

(14) Push HIGH PRESSURE PUMP STOP (17).

(15) Wait 1 minute. Push BOOSTER PUMP STOP (18).

(16) Turn system switch to SYSTEM ON (10).

(17) Remove heat-up jumper hose (7). Cap connection (8).

(18) Reconnect raw water (5) and waste (6) hoses.

(19) Close product utility hose valve (3) and disconnect hose (1) from clean/flush tank.

(20) Open product shut-off valve (2).

(21) Complete normal start-up.

(22) Backwash media filter as soon as possible.

b. *Procedures following EMP Exposure.*

NOTE

A low yield, high altitude nuclear detonation will produce an electro-magnetic pulse (EMP) which may disrupt ROWPU operation and damage certain electronic devices.

NOTE

The portable instruments will be protected if inside the grounded storage box (42, Figure 2-24) if the cover is closed and latched. Keep inside the box when not in use.

NOTE

The immediate result of EMP will be a ROWPU shutdown, probably with a feed pressure low alarm condition. The generator circuit breaker may trip in which case the ROWPU will stop and there will be no power. Follow the procedures presented by this section to restore and continue operation.

(1) Restore power. Follow this procedure even if the ROWPU is still powered (Figure 2-79).

(a) Open MAIN circuit breaker (1).

(b) Check all circuit breaker resets (2) to be sure they are reset and in the ON position.

(c) Check the GROUND FAULT resets (3) to be sure they are reset and ON.

(d) Push all MOTOR STARTER resets (4).

(e) Turn COMPRESSOR switch (5) to OFF.

(f) Check diesel generator operation. Check the DC control breaker button (6). It should be pushed in. If the PANEL ENERGIZED light (7) is off, turn generator circuit breaker toggle switch (8) to ON.

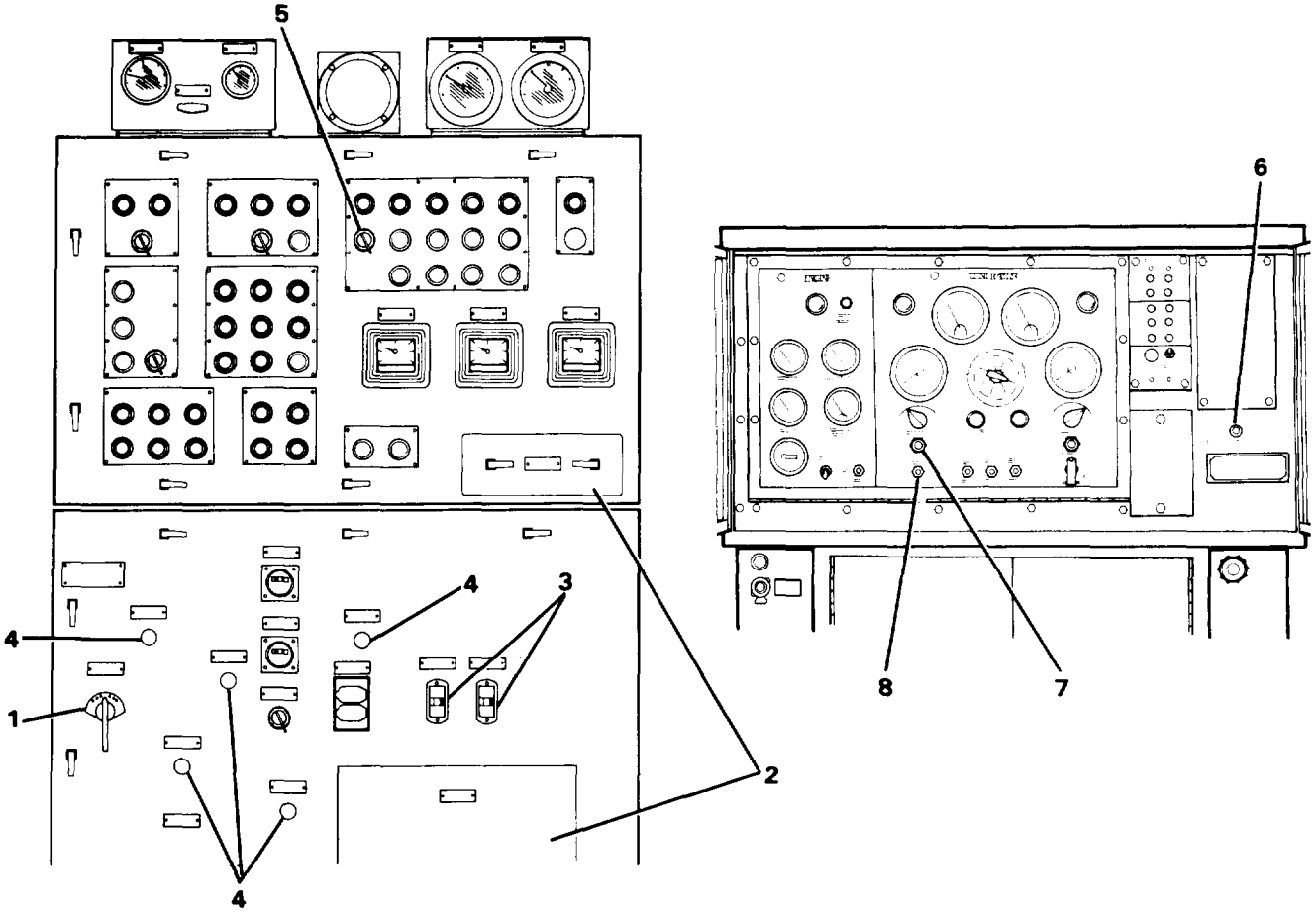


Figure 2-79. Restore Power to ROWPU

(2) Start-up.

(a) Follow normal start-up procedures.

(b) Make sure automatic valves cycle properly. If not, refer to para. 2-34a, b and c.

(c) Make sure all motors start. If not, notify unit maintenance.

(3) Operation. The flow meters and the TDS meter may have been damaged. The in-line turbidity meter may also be damaged. Use the following alternate methods to continue operation:

(a) TDS can be monitored using the portable TDS meter. Measure the TDS at the combined sample valve (20, Figure 2-6). Be sure to place the meter back into the grounded storage box after use.

(b) Turbidity can be monitored using the portable turbidity meter. Obtain the media filter outlet sample (4, Figure 2-6).

(c) A portable flowrate indicator (1, Figure 2-80) is provided as a replacement for the panel flowmeters. This portable flowrate indicator is stored in the special tools and indicators storage box no. 4 (Figure 2-24). Simply connect the flowrate indicator to the end of the product to storage hose (2, Figure 2-80). Holding the flowrate indicator in a horizontal position with the indicator on top, read the flowrate directly in gallons per minute. Make necessary adjustments in the ROWPU to attain the desired performance.

NOTE

There must be full pipe flow at the end of the indicator. If not, elevate the end of the pipe to remove air and then return to the horizontal position and read flowrate. If, after this procedure, full flow is not maintained, submerge the flowrate indicator in the storage tank in a horizontal position with the indicator extending above the water surface.

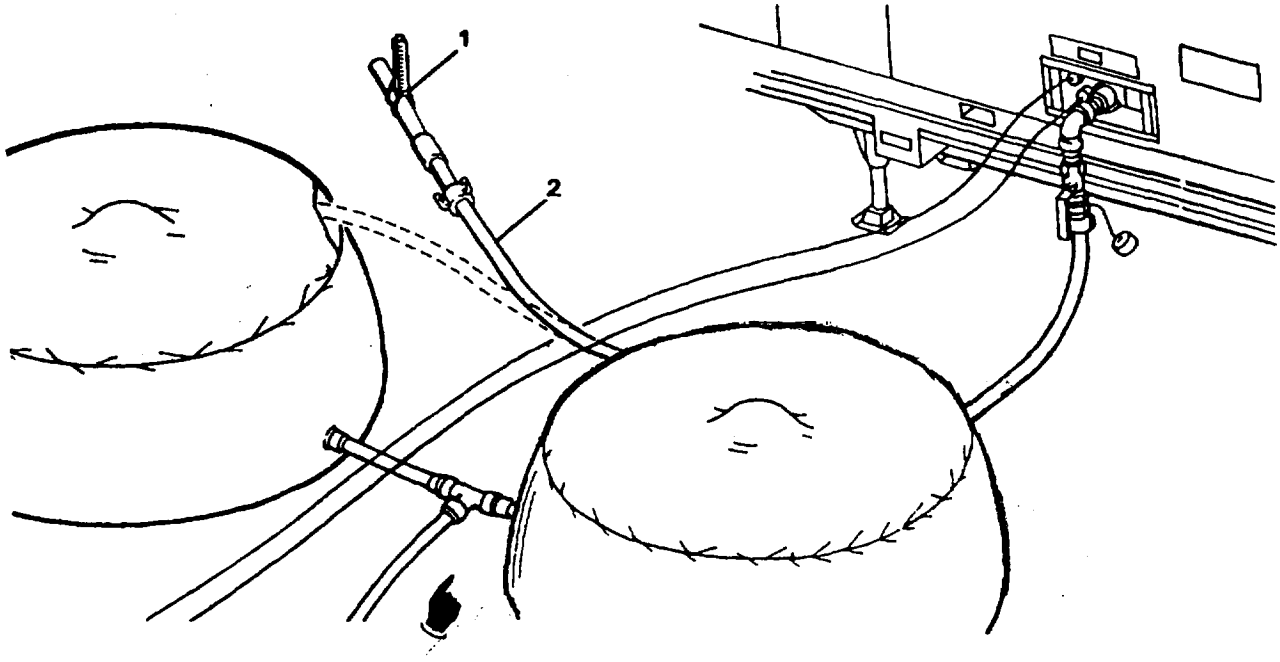


Figure 2-80. Use of Portable Flowrate Indicator

c. Emergency Hasty Decon Preparation for Movement.

WARNING

Wear protective gear when performing emergency decon. Failure to do so may lead to death.

CAUTION

Do not use DS-2 dawn solution.

(1) Hasty decon. In an emergency, limited hasty decon, can be accomplished by mixing a solution of 8 gallons product water, one pound RO element cleaning detergent, and 6.5 pounds calcium hypochlorite (six and one half packets).

(a) Use solution to decon specific surfaces. Let stand for 15 minutes, then flush off with clean water.

WARNING
Areas must be tested before removing protective gear.

(b) Avoid tracking mud into ROWPU.

(2) Preparation for movement. After NBC agent exposure while deployed, the ROWPU will require detailed decon. Use the following procedure to prepare to move to the detailed decon operations site.

(a) Secure ROWPU to temporary secured status as described in para. 2-22.

(b) Do not pack-up deployed pumps and hoses. Use a separate truck or other vehicle to pack-up all deployed items for transport to the decon site.

CAUTION
Packing these items inside the ROWPU will severely increase the agent contamination of surfaces inside the ROWPU van.

(c) Do not drain potable water storage tanks. Leave for later decon or decon by weathering.

CHAPTER 3. OPERATOR MAINTENANCE INSTRUCTIONS

SECTION I. LUBRICATION INSTRUCTIONS.

3-1. LUBRICATION. Lubrication instructions for the ROWPU are given in the tube order LO 10-4610-232-12. The instructions contained in the lube order must be followed.

SECTION II. TROUBLESHOOTING PROCEDURES.

3-2. GENERAL. This section covers the Troubleshooting Procedures and are for the most frequent problems encountered in operation of the ROWPU.

3-3. TROUBLESHOOTING TABLE.

a. *Use of Table*. Table 3-1 lists common malfunctions during operation or maintenance of the ROWPU or its parts. Tests, inspections, and corrective actions should be made or taken in the order listed.

b. *Limitation*. This manual cannot list all the problems that may occur, or all tests, inspections, and corrective actions. If a problem is not listed, or is not corrected after corrective actions are taken, notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
RAW WATER PUMP.
1. Raw water pump won't start with OPERATION MODE switch in FILTER NORMAL position and FILTER NORMAL light on.
Step 1. Check RAW WATER PUMP circuit breaker. Push on.
Step 2. Check RAW WATER PUMP STARTER RESET button. Push in.
Step 3. Check main control panel set-up. SYSTEM MODE switch ON. FILTER NORMAL light on. Press SYSTEM RESET pushbutton. Air system regulating gage should read 85 to 95 psig (586 to 655 kPa). Press INITIATE pushbutton. Press RAW WATER PUMP START pushbutton.
Step 4. Check RAW WATER GROUND FAULT RESET. Push up.
WARNING **Make sure the circuit breaker for the raw water pump is turned off. Failure to do so could result in electrocution.**
Step 5. Check raw water power cables and connections. Tighten if loose. Clean and dry, if dirty or wet. Notify unit maintenance if damaged.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 6. Check warning lights.
PRODUCT HIGH PRESSURE light on. Clear alarm light by pressing SYSTEM RESET pushbutton. If light does not go out, refer to product high pressure troubleshooting.
HIGH PRESSURE PUMP PRESSURE HIGH alarm light on. Clear by pressing SYSTEM RESET pushbutton. If light does not go out, notify unit maintenance.

Step 7. Notify unit maintenance.

2. Raw water pump won't start with OPERATION MODE switch in FILTER BACKWASH position and FILTER BACKWASH light on.

Step 1. Check media filter pressure.
If pressure is greater than 5 psig (34 kPa), open drain valve until pressure drops.

Step 2. Check media filter level gage.
If flags are not white down to about the last 2-3 inches of column, open drain valve until white flags appear.

Step 3. Check RAW WATER PUMP circuit breaker.
Push on.

Step 4. Check RAW WATER PUMP STARTER RESET button.
Push in.

Step 5. Check main control panel set-up.
SYSTEM MODE switch ON.
FILTER BACKWASH light on.
Press SYSTEM RESET pushbutton.
Air supply gage should read 85 to 95 psig (586 to 655 kPa).
Press INITIATE pushbutton.
Press RAW WATER PUMP START pushbutton.

Step 6. Check RAW WATER GROUND FAULT RESET.
Push up.

WARNING

Make sure the circuit breaker for the raw water pump is turned off. Failure to do so could result in electrocution.

Step 7. Check electrical connections to pump.
Tighten if loose. Clean and dry, if dirty or wet.

Step 8. Notify unit maintenance.

3. Raw water pump won't start with OPERATION MODE switch in FILTER NORMAL position and FILTER NORMAL light off.

Step 1. Check EMERGENCY STOP pushbutton.
Pull out.

Step 2. Check all 120 volt circuit breakers.
Push on.

Step 3. Check RAW WATER PUMP STARTER RESET.
Push in.

Step 4. Check RAW WATER GROUND FAULT RESET.
Push in.

Step 5. Check main control panel set-up.
SYSTEM MODE switch ON.
OPERATION MODE switch in FILTER NORMAL position.
FILTER NORMAL light on.
Press SYSTEM RESET pushbutton.
Air supply gage should read 85 to 95 psig (586 to 655 kPa).

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Press INITIATE pushbutton.
Press RAW WATER PUMP START pushbutton.

Step 6. Check warning lights.
PRODUCT PRESSURE HIGH light on. Clear alarm light by pressing SYSTEM RESET pushbutton. If light does not go out, refer to product high pressure troubleshooting.
HIGH PRESSURE PUMP PRESSURE HIGH alarm light on. Clear by pressing SYSTEM RESET pushbutton. If light does not go out, notify unit maintenance.

Step 7. Notify unit maintenance.

4. Raw water pump starts but stops when RAW WATER PUMP START pushbutton is released.
Step 1. Notify unit maintenance.

5. Raw water pump motor hums but won't turn with ambient temperature above 32°F (0°C).
Step 1. Immediately push RAW WATER PUMP STOP.
Step 2. Notify unit maintenance.

6. Raw water pump motor hums but won't turn with ambient temperature below 32°F (0°C).
Step 1. Immediately push RAW WATER PUMP STOP.
Step 2. Check pump heat lamp (winter kit item).
With pump stopped, pump heat lamp should be on. If not, refer to pump heat lamp troubleshooting.
Step 3. Check for icing.
Disconnect suction and discharge hoses. Open drain and priming valves. Allow pump heat lamp to heat pump for one hour and then start pump.
Step 4. Notify unit maintenance.

7. RAW WATER PUMP circuit breaker opens whenever RAW WATER PUMP START pushbutton is pushed.

WARNING

Make sure the circuit breaker for the raw water pump is turned off. Failure to do so could result in electrocution.

Step 1. Check raw water pump power cable.
Clean and dry power cable electrical connector
Step 2. Notify unit maintenance.

8. RAW WATER PUMP circuit breaker trips open repeatedly
Step 1. Notify unit maintenance.

9. RAW WATER PUMP GROUND FAULT trips repeatedly.
Step 1. Check raw water pump power cable.

WARNING

Turn off RAW WATER PUMP circuit breaker before proceeding. Failure to do so could result in electrocution.

Clean and dry electrical connectors
Step 2. Notify unit maintenance.

10. Raw water pump/motor is noisy.
Step 1. Notify unit maintenance.

11. Raw water pump assembly leaks.
Step 1. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

12. Raw water pump needs to be primed whenever it is stopped.
    - *Step* 1. Check raw water suction hoses that are out of water.
      Clean and tighten connections. Replace missing or damaged gaskets.
    - *Step* 2. Check raw water pump drain valve.
      Notify unit maintenance if it leaks.
    - *Step* 3. Inspect check valve for proper operation.
      Notify unit maintenance if inoperative.
    - *Step* 4. Notify unit maintenance.

13. Raw water pump runs but wont prime.
    - *Step* 1. Check raw water pump drain valve.
      Close, if open. Install manual priming pump and, while working handle, put finger over outlet of drain valve. Notify unit maintenance that drain valve needs replacing if suction is felt on finger.
    - *Step* 2. Check raw water suction hoses that are out of water.
      Clean and tighten connections. Replace missing or damaged gaskets.
    - *Step* 3. Check that raw water pump is filled with water.
      Use priming pitcher to fill pump.
    - *Step* 4. Check height of pump above water level.
      Move pump to a lower level if it is more than 15 ft. (4.6 m) above water level.
    - *Step* 5. Check length of suction hose out of water.
      Move pump closer to water if more than 3 sections are exposed.
    - *Step* 6. Check raw water intake strainer.
      Clean off debris.
    - *Step* 7. Inspect check valve for proper operation.
      Notify unit maintenance if inoperative.
    - *Step* 8. Notify unit maintenance.

14. Raw water pump does not deliver sufficient flow or pressure to operate the ROWPU.
    - 100 gpm (378 lpm) cannot be obtained when starting with media flush valve open.
    - FEED PRESSURE LOW alarm light remains on after media flush valve is closed.
    - 40 psig (345 kPa) cannot be obtained at the cartridge filter pressure gage before starting high pressure pump (red needle).
    - The FEED PRESSURE LOW light and alert horn come on shortly after starting the high pressure pump.
    - *Step* 1. Check raw water pump discharge hoses
      Remove any kinks, sharp bends, or pluggings.
    - *Step* 2. Check manual valve positions.
      Set valves correctly (para. 2-17b).
    - *Step* 3. Check filter pressure differentials. Start-up system, including high pressure pump, and watch filter gages.
      If the media filter differential is 20 psi (136 kPa) or greater, backwash media filter.
      If the cartridge filter differential is 15 psi (102 kPa) or greater change cartridge filters
    - *Step* 4. Check height of ROWPU Water Purification System (van) above raw water pump.
      Relocate equipment if ROWPU Water Purification System van is more than 30 ft (9.2 m) above the height of the raw water pump and no more than 200 ft. (61 m) from the ROWPU Water Purification System.
    - *Step* 5. Check raw water suction hoses out of water.
      Clean and tighten connections. Replace missing or damaged gaskets.
    - *Step* 6. Check raw water intake strainer
      Clean off debris.
    - *Step* 7. Check basket strainer
      Clean basket strainer
    - *Step* 8. Check automatic valve positions.
      Refer to automatic valve troubleshooting if they am not positioned properly.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 9. Check separators. (MODEL WTrA60 ONLY) I

(Normal waste flow is about 1-2 gpm (4-8 Ipm) when the high pressure pump is running.) If little or no flow comes out of the waste flow hoses when the high pressure pump is running, recheck height of pump above water level, distance to the ROWPU van, and height of van above pump. If any distance is greater than limits, reposition equipment accordingly. Check that separator waste hoses are not plugged with sand or dirt. Notify unit maintenance that raw water pump should be tested for correct operation.

CAUTION

Operation can continue by removing the separators and pumping direct to the van. If operating at a beach site with surf and sand or if operating at site with a lot of seaweed and organic debris, the in-line strainer will plug frequently. Do not overstress the ROWPU electrical gear by starting and stopping too often.

If there is a heavy stream of water coming from the separator waste hoses, check for plugged, collapsed hoses or blockage in the piping.

Step 9. 1. **Check Separator (MODEL ROWPu-1 ONLY)**

NOTE

(Normal waste flow is about 14-15 gpm (51.8-55.5 Ipm) when the high pressure pump is running.

If little or no flow comes out of the waste flow hose when the high pressure pump is running, recheck height of pump above water level, distance to the ROWPU van, and height of van above pump. If any distance is greater than limits, reposition equipment accordingly. Check that separator waste hose is not plugged with sand or dirt. Tap the bottom of the separator to loosen any clogging debris.

If there is a heavy stream of water coming from the separator waste hoses, check for plugged or collapsed hoses or blockage in the piping.

CAUTION

If operation at a beach site with surf and sand or if operating at a site with a lot of seaweed or organic debris, the In-line basket strainers will be need to be cleaned more often.

Step 10. Notify unit maintenance.

15. Raw water pump heat lamp does not work.

NOTE

Heat lamp only works when raw water pump is off.

Step 1. Check SUMP HEAT/PUMP HEAT OFF/ON switch on main control panel.
Turn ON.

WARNING

Position SUMP HEAT/PUMP HEAT OFF/ON switch to OFF before proceeding. Failure to do so could result in electrocution.

Step 2. Check heat bulb.
Replace if broken or burned out.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check power cable connections.
Tighten if loose. Clean and dry if dirty or wet.
Step 4. Notify unit maintenance.

SEPARATORS AND PIPING.

1. Separator assembly leaks at flanges.
Step 1. Notify unit maintenance.

2. No waste water flow from separators.
Step 1. Check waste water hoses.
a. Remove kinks and sharp bends. Remove hose and dislodge any sand or debris in hose or underflow outlet on separators.
b. To remove sand from the separator(s), remove discharge hoses(s) from separator(s) and turn on raw water pump until all sand is removed from the separator then turn off raw water pump. Install discharge hose(s) back on separator(s).

NOTE
If waste water comes out of separators with hoses off, but not with them on, leave hoses off.

Step 2. Check height of raw water pump above water, height of van from pump, and distance to van from pump.
Reposition any equipment that is not within limits.
Step 3. Notify unit maintenance to test raw water pump.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

3. No raw water discharge flow through separators.
   Step 1. Check raw water pump.
   Disconnect inlet hoses to separators and start raw water pump.
   a. If no flow from raw water pump, refer to raw water pump troubleshooting.
   b. Notify unit maintenance.

NOTE

The ROWPU may be operated without separators, but the in-line strainer will plug rapidly, especially when operating on beach sites with a lot of sand or on sites with a lot of organic weeds and debris. Site improvement per FM10-52 will help to ease the loading on the In-line strainer. Do not overstress the ROWPU motors with frequent stops and starts due to In-line basket strainer cleanings.

4. Water leaks through separator waste water hoses when ROWPU is shut down.
   Step 1. Notify unit maintenance.

FEED WATER BOOSTER PUMP.

1. Booster pump won't start with OPERATION MODE switch in FILTER NORMAL position and FILTER NORMAL light on.
   Step 1. Check BOOSTER PUMP circuit breaker.
   Push on.
   Step 2. Check BOOSTER PUMP RESET switch.
   Push in.
   Step 3. Check main control panel set-up.
   SYSTEM MODE switch ON.
   FILTER NORMAL light on.
   Press SYSTEM RESET pushbutton.
   Air system regulating gage should read 85 to 95 psig (586 to 655 kPa).
   Press INITIATE pushbutton.
   Press RAW WATER PUMP START pushbutton.
   Press BOOSTER PUMP START pushbutton.
   Step 4. Check raw water pump.
   Start pump.
   Step 5. Check FEED PRESSURE LOW alarm light on.
   Push SYSTEM RESET. If light does not go out:
   a. Check valve positions (refer to para. 2-19).
   b. Refer to raw water pump troubleshooting malfunction no. 14.
   Step 6. Notify unit maintenance.
2. Booster pump won; start with OPERATION MODE switch in SYSTEM CLEAN position and SYSTEM CLEAN light on.

   Step 1. Check BOOSTER PUMP circuit breaker.
   Push on.
   Step 2. Check BOOSTER PUMP RESET.
   Push in.
   Step 3. Check CLEAN/FLUSH TANK LOW LEVEL alarm light.
   Push SYSTEM RESET if light does not go out:
   a. Fill clean flush tank.
   b. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 4. Check main control panel set-up.
SYSTEM MODE switch ON.
FILTER CLEAN light on.
Press SYSTEM RESET pushbutton.
Air system regulating gage should read 85 to 95 psig (586 to 655 kPa).
Press INTIATE pushbutton.
Press BOOSTER PUMP START pushbutton.
Step 5. Notify unit maintenance.

3. Booster pump won't start with OPERATION MODE switch in the FILTER BACKWASH position and the FILTER BACKWASH light on.
Step 1. Check BOOSTER PUMP circuit breaker.
Switch on.
Step 2. Check BOOSTER PUMP RESET.
Push in.
Step 3. Check clean/flush tank.
Fill tank.
Step 4. Notify unit maintenance.

4. Booster pump motor hums but won't turn.
Step 1. Notify unit maintenance.

5. Booster pump and/or motor is noisy.
Step 1. Notify unit maintenance.

6. BOOSTER PUMP circuit breaker opens whenever pump is started.

WARNING

Turn off booster circuit breaker before proceeding. Failure to do so could result in electrocution.

Step 1. Check booster pump electrical connectors.
Clean and dry pump electrical connectors.
Step 2. Notify unit maintenance.

7. BOOSTER PUMP circuit breaker trips open repeatedly.
Step 1. Notify unit maintenance.

8. Booster pump assembly leaks.
Step 1. Notify unit maintenance.

9. Booster pump is started, but 50 psig (345 kPa) cannot be obtained on the cartridge filter pressure gage (red needle).
Step 1. Check position of auto valves and manual valves.
Place valves in proper position.
Refer to auto valve troubleshooting if a valve is not in the correct position after setting up the control panel properly.
Step 2. Check booster pump.
Use hand to feel that air is moving out of the pump enclosure. If pump is not running, refer to malfunctions 1 thru 4 above.
Step 3. Check media filter differential.
Backwash media filter if differential is 20 psid (138 kPa) or greater.
Step 4. Check cartridge filter differential.
Change cartridge filters if differential is 15 psid (103 kPa) or greater.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 5. Check raw water pump.
Refer to raw water pump troubleshooting malfunction no. 14.
Step 6. Notify unit maintenance.

10 Booster pump is started in clean mode, but pressure is not observed at the cartridge filter pressure gage
Step 7. Check clean/flush tank.
Make sure tank is full and the clean flush outlet valve is open.
Step 2. Check manual valve positions.
Refer to para. 2-19.
Step 3. Check automatic valve positions.
Refer to automatic valve troubleshooting.
Step 4. Check cartridge filters.
If plugged, change filters.
Step 5. Check booster pump.
Use hand to feel that air is moving out of the pump enclosure.
If pump is not running refer to malfunctions 1 thru 3 above.
Step 6. Check for plugged basket strainer.
Step 7. Notify unit maintenance.

11. Booster pump does not stop when clean flush tank is empty.
Step 1. Press booster pump stop pushbutton.
Notify unit maintenance to check level switch in clean flush tank for sticking or operational problem and to check low feed pressure switch for operation.

NOTE

Operation can continue by manually starting and stopping the booster pump and high pressure pump during system clean operations.

12. Booster pump does not stop when there is no feed water to the ROWPU.

NOTE

This situation can occur if the forward flush valve is open. Close forward flush valve to check if problem is still occurring.

Step 1. Notify unit maintenance to check feed low pressure switch.

BASKET STRAINER

1. Strainer plugs frequently with sand.
Step 1. Check separators.
Clean out separator waste water hoses.
Step 2. Check separator waste water flow (on Model WTA-060 normal flow is 1-2 gpm (3.7-7.6 lpm) and on Model ROWPU-1 normal flow is 14-15 gpm (51.8-55.5 lpm) with high pressure pump running).
If there is little or no flow from the separator waste hoses, remove hoses and continue operation.
If there is still no flow from the separator waste hoses, check the pump height above water, van height above the pump, and distance from pump to van. Reposition equipment if not within limits.
If the above steps do not clear the problem, notify unit maintenance to test raw water pump.

NOTE

Site improvement per FM10-52 may be required to reduce sand input to equipment.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. Strainer plugs frequently with debris or large organic matter.

Step 1. Check intake strainer.
Replace intake strainer if damage has occured.

NOTE

Site improvement per FM10-52 may be required to reduce sand input to equipment.

Step *2.* Site improvement per FM10-52 will be required to reduce debris input to the equipment. If site improvement cannot be accomplished there is no repair for the problem and frequent shutdowns to clean the in-line strainer will have to be tolerated.

CAUTION

Frequent stop/starts of the ROWPU pumps can cause motor starter contact arcing and burnout.

3. Strainer alarm light stays on.

Step 1. Check strainer.
Clean strainer basket (para. 2-24 b(3)).

Step 2. Notify unit maintenance.

4. Basket strainer plugged alarm light is on and basket strainer is clean or not very dirty or basket strainer light is not on and basket strainer is plugged (filter normal system only).

Step 1. Check feed valve.
Open feed valve. Press SYSTEM RESET.

Step 2. Notify unit maintenance.

MEDIA FILTER.

1. Media filter loses media during backwash (waste water hose).

NOTE

If media has been changed within the last 24 hours, this situation is normal. Maintain lower backwash flow rates until the media has been in use for 24 hours.

Step 1. Check feed flow during backwash.
Slowly close the feed control valve until prescribed flow rate is reached.

NOTE

If media continues to flow out of waste hose during backwash, close the feed control valve until media stays in filter. Troubleshoot feed flowmeter.

2. MEDIA FILTER PLUGGED light stays on.

Step 1. Check SYSTEM RESET pushbutton.
Push in.

Step 2. Check media filter inlet/outlet gage.
Backwash media filter if differential pressure is greater than 25 psig (172 kPa).

Step 3. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

3. Media filter won't go into backwash cycle.
   Step 1. Check control panel set-up.
   Press SYSTEM RESET pushbutton.
   Turn OPERATION MODE switch to BACKWASH.
   Press INITIATE pushbutton.
   Step 2. Check media filter water level.
   Open media filter upper drain valve and drain water until backwash cycle starts. Close drain valve.
   Step 3. Notify unit maintenance.

4. Clean/flush tank runs out of water before backwash cycle is over
   Step 1. Check clean/flush tank level.
   Tank must be full before starting backwash cycle.
   Step 2. Notify unit maintenance.

5. Media filter air blanket won't come on or level indicator does not turn white.
   Step 1. Check AIR BLANKET V20 light.
   Press LIGHT TEST, if light does not come on change pilot light.
   Step 2. Check air blanket block valve at air manifold.
   Open valve.
   Step 3. Check media filter inlet pressure and check air pressure.
   If air pressure is equal to or just greater than media filter pressure during normal operation, adjust system air regulator until the air pressure is 10 psi (69 kPa) greater than water pressure.
   Step 4. Notify unit maintenance.

6. Media filter AIR BLANKET V20 light won't turn off.
   Step 1. Notify unit maintenance.

NOTE

Unit can be operated by using the air blanket block valve to manually control the air level in filter. Open and close the valve to keep the air blanket level between the middle stop switch on the level indicator.

7. Media filter air level chamber is plugged (flags always stay the same color).
   Step 1. Open drain valve on bottom of air chamber.
   Step 2. Shut down ROWPU and vent all pressure from the media filter.
   Remove bottom cover from chamber and clean out media. Do not drop float when it slides out of chamber. Clean out water line that goes from chamber to media filter. Install float with arrow pointing up. Reinstall cover on chamber.

8. Media filter won't drain.
   Step 1. Check for a plugged line.
   Slowly open drain valve while media filter has water pressure in it.
   Step 2. Notify unit maintenance.

9. No air goes into media filter during backwash.
   Step 1. Check backwash air block valve at air manifold.
   Step 2. Refer to manual operation of backwash air valve, para. 2-33.
   Step 3. Notify unit maintenance.

10. Valves do not cycle correctly during backwash.
   Step 1. Refer to automatic valve troubleshooting.
   Step 2. Use manual procedures (para. 2-33).
   Step 3. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

11. Media filter output turbidity is greater than 5 NTU.
    Step 1. Check turbidity monitor.
    Refer to para. 2-5 for adjustment and crosscheck using the hand held turbidity meter para. 2-6.
    Step 2. Check polyelectrolyte flow.
    Watch that level in polyelectrolyte tank drops consistently.
    Step 3. Vigorously stir the polytank to ensure mixing.
    Step 4. Repeat polyelectrolyte optimization.
    Refer to para. 2-17f.
    Step 5. Backwash media filter.
    Refer to para. 2-21.
    Step 6. Check filter media depth.
    a. Shut down to temporary shutdown condition.
    b. Open media filter vent and both drains.
    c. When water no longer is observed at upper drain, close drain valves and open filter access port.
    d. Use steel rule and measure down to media level. If more than 14 inches (356 mm) but less than 17" (432 mm), contact unit maintenance to add media.
    Step 7. Recondition media.

NOTE
Media can become fouled with organic material which will lead to channeling and poor filtration. Make sure that chlorine is being pumped into filter during backwash.

a. Backwash and allow automatic steps to proceed up to taking water from the clean/flush tank. Switch the OPERATION MODE switch to FILTER NORMAL and push INITIATE.
b. Repeat step a. after air pressure has built up.
c. Allow filter to soak for 2 hours.

NOTE
Diesel generator may be secured if the feed valve and cartridge filter block valve are first closed.

d. Backwash again (step a) and repeat 2 hour soak.
e. Backwash normally, allowing a complete backwash sequence (para. 2-21).
f. Return to normal operation.

    Step 8. Contact unit maintenance to replace media.
12. Media filter pressure drop exceeds 15 psig (69 kPa) after backwashing.
    Step 1. Repeat backwash.
    Step 2. Recondition media.
    Refer to malfunction 11, step 7 above.
    Step 3. Contact unit maintenance to replace media.
13. Media filter inlet and outlet pressure are equal during normal operation.
    Step 1. Ensure cleaning bypass valve (V13) is closed.
14. Drain sump has media in it (or sump hose has media coming out).

NOTE
This situation is typical when the media filter has been manually drained to initiate a backwash. The media ends up in the sump because the upper drain valve has not been closed fast enough when the raw water pump is turned on at the start of backwash.

    Step 1. Refer to air blanket troubleshooting, problems 5, 6, and 7 and also backwashing, problems 3 and 15.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

15. Media filter air blanket is working properly and all valves are in correct position, but media filter has to be drained manually to start the backwash.
Step 1. Check waste out hoses.
Remove any kinks or plugs in the hoses. Too much back pressure will not allow the backwash to start automatically.

16. Media filter pressure is less than 5 psig (34 kPa) and no water comes out the upper drain valve and backwash will not start.
Step 1. Troubleshoot plugged air chamber.
Step 2. Loosen the clamp on the lower switch on the air chamber. Slide switch slightly upward until the backwash starts.
Tighten clamp.
Step 3. Notify unit maintenance.

17. Media filter plugged alarm is on at less than 22 psi (152 kPa) differential (Model ROWPU-1) or 25 psi (172 kPa) differential (Model WTA-060) or is not on at 22 psi (152 kPa) differential (Model ROWPU-1) or 25 psi (172 kPa) differential (Model WTA-060) (system normal only).
Step 1. Check manual valves.
Position valves correctly.
Step 2. Check auto valves position.
Refer to auto valve troubleshooting if valves are not positioned correctly.
Step 3. Notify unit maintenance.

CARTRIDGE FILTER.

1. Cartridge filter cover leaks.
Step 1. Shut down to standby.
Step 2. Retighten clamp.
a. Loosen both T-bolt nuts several turns.
b. Retighten, bringing both nuts up evenly and tight.
Step 3. Check preformed packing.
Clean preformed packing and sealing area of all sand or dirt.
Replace preformed packing if it is damaged or if leak cannot be stopped.
Step 4. Notify unit maintenance.

2. Cartridge filter vessel won't drain or drains very slow.
Step 1. Notify unit maintenance.

3. CARTRIDGE FILTER PLUGGED alarm light stays on.
Step 1. Press SYSTEM RESET pushbutton.
Step 2. Change cartridge filter elements (para. 2-24b) if cartridge filter inlet/outlet gage reads between 13-18 psi (90-124 kPa) differential (Model ROWPU-1) or greater than 15 psi (103 kPa) differential (Model WTA-060).
Step 3. Notify unit maintenance.

4. Cartridge filter outlet turbidity is the same as the inlet turbidity.

NOTE
If the media filter is putting out very low NTU (0.5-2.0) water, it is possible that the particles coming through are so small that the cartridge filter cannot stop them. Check that both turbidity monitors are accurate, para. 2-5 and 2-6.

Step 1. Check filter elements (para. 2-24 b).
Check that there is a circular indent on each end of filter element to indicate sealing.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Check filter seals and springs (para. 2-24b).
Replace missing seals or springs.
Step 3. Check wing nut.
Tighten.
Step 4. Change cartridge filers.
Step 5. Notify unit maintenance.

5. Cartridge filter elements plug faster than normal.
Step 1. Refer to media filter troubleshooting.

6. Media filter sand in cartridge filter housing.

NOTE

A small buildup over an extended time is normal as small pieces of media manage to slip through the media filter headers during backwash. If there is a larger or sudden amount of sand in the cartridge filter, notify unit maintenance.

7. FEED PRESSURE LOW alarm light stays on.
Step 1. Check SYSTEM RESET pushbutton.
Push SYSTEM RESET pushbutton.
Step 2. Troubleshoot raw water pump, malfunction 14.
Step 3. Check cartridge inlet/outlet pressure gage (red needle).
Pressure must be greater than 5 to 7 psig (34 to 48 kPa). If not, check the other warning lights to find where the pressure is blocked. Troubleshoot the device causing the high pressure drop.
Step 4. Notify unit maintenance.

8. Cartridge filter plugged light comes on at less than 12 psi (83 kPa) differential or is not on at 18 psi (124 kPa) differential (system normal only).
Step 1. Check manual valve position.
Position valves correctly.
Step 2. Check auto valve position.
Refer to auto valve troubleshooting if valves are not positioned correctly.
Step 3. Notify unit maintenance.

9. Feed pressure low alarm is not on at 3 psig (21 kPa) or comes on at greater than 9 psig (62 kPa).
Step 1. Check manual valve position.
Position valves correctly.
Step 2. Check auto valve position.
Refer to auto valve troubleshooting if valves are not positioned properly.
Step 3. Notify unit maintenance.

CLEAN/FLUSH TANK.

1. Clean/flush tank assembly leaks.
Step 1. Notify unit maintenance.

2. CLEAN/FLUSH TANK LOW LEVEL light stays on when tank is full.
Step 1. Check SYSTEM RESET pushbutton.
Push in.
Step 2. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. CLEAN/FLUSH TANK LOW LEVEL light stays off when tank is empty.
   Step 1. Check LIGHT TEST pushbutton.
   Push in, if light comes on, light works but switch is burned out or sticking.
   Step 2. Notify unit maintenance.

4. Clean/flush tank automatic valve won't open.
   Step 1. Check tank fluid level.
   Fill tank as required.

NOTE
If valve does not operate correctly, refer to para. 2-34 for manual operation

   Step 2. Notify unit maintenance.

5. Clean/flush tank automatic valve won't close.
   Step 1. Check air block valves.
   Open valves.

NOTE
Refer to para. 2-34 for manual valve operation.

   Step 2. Notify unit maintenance.

6. Clean/flush tank won't fill or fills very slowly with product water.
   Step 1. Check drain valve.
   Close valve.
   Step 2. Check product block valve.
   Slowly close valve until product water pressure gage reads 10 psig (69 kPa).

7. Clean/flush tank valve leaks (tank fills up or overflows when outlet valve is closed).
   Step 1. Notify unit maintenance to adjust valve.

8. Chemical cleaning solution levels keep dropping during membrane cleaning cycles.
   Step 1. Check feed valve.
   Make sure it is completely closed.
   Step 2. Notify unit maintenance to adjust either the filter flush valve or the media filter outlet valve. One of them is not completely closed.

9. Chemical cleaning solution levels drop during shutdown.
   Step 1. Refer to separator troubleshooting.

CHEMICAL TANKS.

1. Chemical tank leak.
   Step 1. Notify unit maintenance.

2. TANK LOW LEVEL light stays on when tank is full.
   Step 1. Check SYSTEM RESET pushbutton.
   Push in.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CAUTION

Turn off hypochlorite mixer if problem is in the hypochlorite tank before proceeding.

Step 2. Check for float sticking.
Use the chemical mixing paddle to move the float up and down on its stem. TANK LOW LEVEL light should go out when the float is raised and come on when the float is lowered.

NOTE

In most cases the SYSTEM RESET pushbutton also needs to be pushed to turn the light off when the float is raised.

Step 3. Notify unit maintenance.

3. TANK LOW LEVEL light stays off when tank is empty.
Step 1. Check LIGHT TEST pushbutton.
Push in. If light comes on, light works and switch is sticking or burned out.
Step 2. Check for float sticking.

CAUTION

Turn off hypochlorite mixer if problem is in the hypochlorite tank before proceeding.

Use the chemical mixing paddle to move the float up and down on its stem. TANK LOW LEVEL light should go out when the float is raised and come on when the float is lowered.

NOTE

In most cases the SYSTEM RESET pushbutton also needs to be pushed to turn the light off when the float is raised.

Step 3. Notify unit maintenance.

4. Hypochlorite tank mixer won't start
Step 1. Check MIXER switch.
Turn ON.
Step 2. Notify unit maintenance.

5. Hypochlorite tank (or mixer) vibrates strongly.
Step 1. Turn off MIXER switch.
Step 2. Use mixing paddle to keep tank contents from settling. Mix tank every 15 minutes.
Step 3. Notify unit maintenance.

6. Chemical tank(s) won't drain.
Step 1. Notify unit maintenance.

CHEMICAL PUMPS.

1. Chemical pump(s) do not operate.
Step 1. Check chemical pump circuit breaker on main control panel.
Push on.
Step 2. Check CHEMICAL PUMP START pushbutton on main control panel
Press in.
Step 3. Check individual CHEMICAL PUMP START switch (on each pump).
Switch on.
Step 4. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. Low or no flow from chemical pump(s).
   Step 1. Check that pump is operating.
   A pulse can be felt in the pump discharge line when it is operating.
   Step *2.* Check chemical level in chemical tank.
   Fill tank if low.
   Step 3. Check that pump is not air locked.
   Pull out pressure release knobs on liquid handling assembly until chemical solution flows.
   Step 4. Check setting of capacity control knobs.
   Adjust knobs to proper setting (see Chemical Pump Set-Up, para. 2-17c).
   Step 5. Adjust pump speed and stroke until correct flow is obtained.
   Step 6. Check for leaks in pump assembly or chemical lines.
   Tighten fittings (hand tighen only).
   Step 7. Notify unit maintenance.

3. Hypochlorite backwash pump does not operate during media filter backwash (hypochlorite doesn't drop).
   Step 1. Check that pump is primed.
   Open prime valve above hypochlorite tank until flow is seen. Close valve.
   Step 2. Notify unit maintenance.

4. Hypochlorite backwash pump has low or no output flow.
   Step 1. Notify unit maintenance.

5. Chemical pump(s) or lines leak.
   Step 1. Notify unit maintenance.

RO ELEMENTS.

1. The product water TDS is greater than the maximum calculated using Table 2-23.
   Step 1. Check TDS meter.
   Use portable TDS meter and verify that the combined product TDS is high. If TDS is within limits, troubleshoot in-line TDS meter. Use hand held portable TDS meter until in-line meter is repaired.

NOTE

New elements sometimes take a while to settle down. Monitor TDS and if it continues to come down, continue operation until it bottoms out and is stable.

   Step 2. Check the vessel product TDS readings.
   a. Using the portable TDS meter, measure the TDS at the four RO vessel sample valves (16 thru 19, Figure 2-6) and at the combined product sample valve (20).
   b. Compare the TDS readings for the top two vessels (16 and 17). If they vary from each other by more then the allowed amount (Table 2-26), internal preformed packing leakage is indicated. Check preformed packings (para. 3-28).
   c. Repeat step b for the bottom two vessels (18 and 19).
   d. If preformed packing leakage is not indicated, clean the RO elements (para. 2-25).
   Step 3. Check water quality.
   a. Contact medical team to check product water quality characteristics.
   b. If water quality is not acceptable, replace RO elements (para. 3-28).

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. Mission normal product flow (Table 2-18 and 2-20) cannot be obtained.

Step 1. Check product flowmeter.

a. Install the auxiliary flowmeter on the product hose (para. 2-35) and check accuracy of the panel mounted meter.
b. If the auxiliary flowmeter shows that the panel meter is inaccurate, operate the unit using the auxiliary flowmeter reading and notify unit maintenance of the problem.
c. If the auxiliary flowmeter also indicates a low product flow, go to Step 2.

NOTE
For new elements, skip Step 2.

Step 2. Clean the RO elements.

a. Conduct routine cleaning (para. 2-25) and extend the detergent soak to 6 hours.
b. Conduct sodium bisulfite sanitization (para. 2-26) except double the amount of bisulfite and after the 30 minute circulation, soak for 30 minutes. Repeat alternating 30 minute circulation and 30 minute soak for four hours.
c. Repeat routine cleaning (para. 2-25) without the extended soak.
d. Return to normal operation.

Step 3. Check element lip seals.

Check all element lip seals (para. 3-28) for possible backwards installation. (All seals should be installed with open end facing the chemical tanks.)

Step 4. Replace RO elements.

TURBIDITY METER. Deleted

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
PORTABLE TURBIDITY METER.
1. Display will not stabilize. *Step* 1. Check light shield. Place correctly over sample well. *Step* 2. Check battery. If low battery light is on, recharge battery. *Step* 3. Check sample cuvette. If sample is cold, water will form on the outside. Wipe off cuvette. *Step* 4. Check instrument. If instrument has been moved from a different temperature, it needs time to stabilize at new temperature.
2. Reference adjust knob does not have enough travel to adjust for the reference standard value. *Step* 1. Check standard cuvette. If cuvette is scratched or rubbed or can not be cleaned, replace standard. If cuvette is aged, replace standard.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Notify unit maintenance.

3. Meter does not respond when a sample is set in well.
   Step 1. Check battery.
   If battery low light is on, recharge battery.
   Step 2. Notify unit maintenance.

4. Battery low light does not go out when using charge adapter.
   Step 1. Check 120 VAC outlet.
   Use a different outlet or plug something else into outlet to check if it is working.
   Step 2. Notify unit maintenance.

FEED FLOWMETER.

1. Feed flowmeter does not show any flow.
   Step 1. Ensure that cleaning bypass valve (V13) is closed.
   Step 2. Check feed flow sensor to ensure wheel spins freely.
   Step 3. Notify unit maintenance,

2. Feed flowmeter shows less than 100 gpm when high pressure pump is running.
   Step 1. Check generator output.
   Adjust voltage to 440V and frequency to 60 cps.
   Step 2. Check product and waste stream flow rates.
   Product gpm and waste gpm added together equal feed gpm.

NOTE

The auxiliary flowmeter can be attached to the product hose and waste hose and the readings added together equal the feed flow gpm.

   Step 3. Notify unit maintenance.

3. Feed flowmeter inaccurate.
   Step 1. Notify unit maintenance

4. Feed flowmeter shows an initial flow when pumps are started but drops off to no flow before starting the high pressure pump.
   Step 1. Check pressure control valve.
   Open valve.
   Step 2. Check waste hoses.
   Remove dust cap from hose and remove any kinks in hose. Make sure water is flowing out of waste hose.

PRODUCT FLOWMETER.

1. Product flowmeter shows no flow or is inaccurate.
   Step 1. Check product relief valve.
   If it is leaking notify unit maintenance.
   Step 2. Use the portable flowmeter (para. 2-35 b).
   Step 3. Check product feed flow sensor to ensure wheel spins freely.
   Step 4. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
WASTE FLOWMETER.
1. Waste flowmeter shows no flow or is inaccurate. *Step* 1. Check waste flow sensor to ensure wheel spins freely. *Step* 2. Notify unit maintenance.
PRODUCT RELIEF VALVE.
1. Product relief valve leaks. *Step* 1. Notify unit maintenance.
HIGH PRESSURE RELIEF VALVE.
1. High pressure relief valve leaks. *Step* 1. Notify unit maintenance.
PRODUCT VENT VALVE.
1. Leaks. *Step* 1. Tap lightly with wrench. If it continues leaking notify unit maintenance.
MAIN CONTROL PANEL.
1. Control panel does not power up. *Step* 1. Check diesel generator. Start diesel generator. *Step* 2. Check generator circuit breaker. Switch on. *Step* 3. Check generator DC circuit breaker. Push in. *Step* 4. Check diesel generator voltage cycles. Adjust to 440V on all 3 phases. Adjust RPM to obtain 60 cycles. *Step* 5. Check control panel MAIN circuit breaker. Turn on. *Step* 6. Check control panel EMERGENCY STOP pushbutton. Pull out. *Step* 7. Check control panel 120V circuit breakers. Switch on. *Step* 8. Notify unit maintenance. 2. Control panel light(s) do not come on when LIGHT TEST is pushed. *Step* 1. Replace unlit lights. *Step* 2. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. Alarm warning/bell does not come on when ALARM TEST is pushed.
   Step 1. Notify unit maintenance.

4. ALARM light does not go out when SYSTEM RESET is pushed.
   Step 1. Check conditions for the light.
   Refer to individual alarm switch and corresponding light to isolate problems.
   Step 2. Notify unit maintenance.

5. Alarm does not sound on alarm conditions, but alarm light is on.
   Step 1. Check for other alarm lights.
   ALARM SILENCE may have been pushed and is causing the alarm not to sound.
   Step 2. Check SYSTEM RESET.
   Step 3. Check ALARM TEST.
   Step 4. Notify unit maintenance.

6. ROWPU starts normally until high pressure pump is started and then all pumps shut down.
   Step 1. Check generator voltage and cycles.
   Adjust generator to 440V on all phases.
   Adjust RPM until 60 cycles are obtained.
   Step 2. Check alarm lights.
   Red alarm lights cause the ROWPU to shut down. Refer to individual alarm troubleshooting.
   Step 3. Notify unit maintenance.

AUTOMATIC VALVES.

1. Valve light fails to show proper position, on control panel, after an operational procedure has been selected (FILTER NORMAL, FILTER BACKWASH, SYSTEM CLEAN, para. 2-34).
   Step 1. Check ALARM RESET.
   Push in.
   Step 2. Check INITIATE switch.
   Push in.
   Step 3. Check LIGHT TEST.
   Push in. All lights must light up.
   Replace unlit lights.
   Step 4. Check air block valve.
   Open vale.
   Step 5. If a light has failed, physically check the valve position.
   Remove orange actuator cap.
   The central stem is in when the valve is open. Compare the actual position of the valve to the valve charts (para. 2-34) to see if valve is in wrong position and go to Step 6.
   Step 6. Manually operate failed automatic valve (para. 2-34) if valve is in wrong position.
   Step 7. Notify unit maintenance.

AIR SUPPLY SYSTEM.

NOTE

If, at any time, the air system will not supply enough pressure to operate the ROWPU, switch to manual valve operation. Refer to para. 2-34 and notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. Outlet air filter leaks air.
   - *Step* 1. Check filter element access plug.
     Tighten.
   - *Step* 2. Notify unit maintenance.

2. Low pressure air manifolds, lines, or valves leak air.
   - *Step* 1. Isolate air leak.
     Close the block valves on each air manifold one by one. If results a obtained, operate with that part of the system on manual. Refer to para. 2-34 and notify unit maintenance.
   - *Step* 2. Notify unit maintenance.

3. Outlet air filter chamber is loaded with a white oily substance.
   - *Step* 1. Notify unit maintenance.

4. Air lines have water in them.
   - *Step* 1. Check low pressure air dryer.
     Open drain valve and blow out water.
   - *Step* 2. Check outlet air filter.
     Change filter.
   - *Step* 3. Check outlet air filter automatic blowdown.
     The automatic blowdown valve should automatically open and blow down air and water once every 15 minutes of air compressor operating time. Notify unit maintenance if valve does not cycle properly.
   - *Step* 4. Check air manifolds.
     Open drain valves and let air blow out any water in them.
   - *Step* 5. Notify unit maintenance.

AIR COMPRESSOR.

NOTE

If, at anytime, the air compressor will not supply enough air to operate the ROWPU, switch to manual valve operation. Refer to para. 2-34 and notify unit maintenance.

1. Air compressor chatters rapidly when started (see also malfunction 2).
   - *Step* 1. Check that compressor has oil in it.
     Check dipstick and add oil as necessary.
   - *Step* 2. Check length of time compressor chatters.
     This is a normal sound if compressor has not run for a while and is cold. If noise persists for more than two (2) minutes notify unit maintenance. Do not operate air compressor.

2. Air compressor makes sharp knocking noise.
   - *Step* 1. Check that compressor has oil in it.
     Check dipstick and add oil as necessary.
   - *Step* 2. Check dipstick.
     If dipstick has scratches on it, reinstall and start compressor. Rotate dipstick in its holder until noise goes away.
   - *Step* 3. Notify unit maintenance. Do not operate air compressor.

3. COMPRESSOR ON light comes on but compressor does not start.
   - *Step* 1. Check AIR COMPRESSOR circuit breaker.
     Switch on.
   - *Step* 2. Check AIR COMPRESSOR STARTER RESET button.
     Push in.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check air system pressure.
Compressor will not start if pressure is between 1500 and 1800 psig (10342 and 12410 kPa).
Step 4. Switch to manual valve operation. Refer to para. 2-34.
Step 5. Notify unit maintenance.

4. Noisy or burning smell from compressor belts.
Step 1. Notify unit maintenance.

5. Air pressure cycles rapidly between 1500 and 1800 psig (10342 and 12410 kPa).
Step 1. Check air reservoir tank block valve.
Open valve.
Step 2. Notify unit maintenance.

6. Air compressor runs continually but does not reach 1700 to 1800 psig (11721 to 12410 kPa).
Step 1. Close high pressure auto blow down block valve.
Open valve for 30 seconds every 15 minutes if compressor now runs correctly. Notify unit maintenance.
Step 2. Check inlet air filter.
Change if dirty or plugged.
Step 3. Notify unit maintenance.

7. AIR COMPRESSOR circuit breaker opens whenever air compressor is started.
Step 1. Notify unit maintenance.

8. Air compressor overloads trip open repeatedly.
Step 1. Notify unit maintenance.

9. Air compressor/motor is noisy.
Step 1. Notify unit maintenance.

10. Air compressor assembly leaks air.
Step 1. Notify unit maintenance.

11. Air compressor does not start.
Step 1. Check COMPRESSOR ON/OFF switch.
Turn on.
Step 2. Check air compressor circuit breaker.
Switch on.
Step 3. Check air compressor starter reset button.
Push in.
Step 4. Check air system pressure.
Compressor will not star if pressure is between 1500-1800 psig (10342-12410 kPa).
Step 5. Switch to manual valve operation.
Refer to para. 2-34.
Step 6. Notify unit maintenance.

12. Air compressor runs but does not build up any pressure.
Step 1. Check for open air drain valve.
Close any open valves.
Step 2. Check vent valve on top of air filter chamber.
Close if open.
Step 3. Check high pressure auto air blowdown.
Close block valve. If compressor builds up pressure, open block valve for 30 seconds, every 15 minutes during operation. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Check inlet air filter.
Change if plugged or dirty.
Step 5. Isolate air leak.
Close the air block valves on both air manifolds, one by one. If results are obtained, operate with that part of the system on manual.
Step 6. Switch to manual valve operation.
Refer to para. 2-34.
Step 7. Notify unit maintenance.

13. Air compressor overheats. Air compressor fan does not turn.
Step 1. Switch to manual valve operation. Refer to para. 2-34.
Step 2. Notify unit maintenance. Do not operate air compressor.

14. Air compressor oil looks milky.
Step 1. Notify unit maintenance.

15. Air compressor motor runs but air compressor does not.
Step 1. Notify unit maintenance.

AIR SUPPLY.

NOTE
If, at anytime, the air supply is not enough to operate the ROWPU, switch to manual valve operation. Refer to para. 2-34 and notify unit maintenance.

1. System air pressure is less than 85 psig (586 kPa).
Step 1. Check air COMPRESSOR OFF/ON switch.
Turn ON.
Step 2. Check for open air drain valves.
Close valves.
Step 3. Check air system low pressure regulator.
Adjust pressure up to 85 to 90 psig (586 to 620 kPa).
Step 4. Isolate leak.
Close block valves on both air manifolds, one by one. If results are obtained, operate with that part of system on manual. Refer to para. 2-34 and notify unit maintenance.
Step 5. Notify unit maintenance.

2. System air pressure is greater than 95 psig (655 kPa).
Step 1. Check air system low pressure regulator.
Adjust pressure to 85 to 90 psig (586 to 620 kPa).

NOTE
System air pressure goes down very slowly. The process can be sped up by opening and closing an air manifold drain valve until the pressure drops.

Step 2. Notify unit maintenance.

3. Air system low pressure relief valve leaks air.
Step 1. Check to see that air pressure is not more than 85 to 90 psig (586 to 620 kPa).
Step 2. Notify unit maintenance.

4. Air system high pressure relief valve leaks air.
Step 1. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

5. Air panel high pressure gage indicates pressure over 1850 psig (12755 kPa) and the air compressor is still running.
   Step 1. Turn COMPRESSOR OFF/ON to OFF.
   Step 2. When pressure reading drops to 1000 psig (6895 kPa) turn COMPRESSOR OFF/ON to ON. Normally control by turning OFF at 1750 psig (12066 kPa) and ON at 1000 psig (6895 kPa).
   Step 3. Notify unit maintenance.

6. Air panel high pressure gage indicates pressure below 1500 psig (10342 kPa) and the air compressor has not started.
   Step 1. Check COMPRESSOR ON/OFF switch.
   Turn on.
   Step 2. Check air compressor 440 VAC circuit breaker.
   Turn on.
   Step 3. Check air compressor starter reset.
   Push in.
   Step 4. Notify unit maintenance.

HIGH PRESSURE PUMP.

1. High pressure pump won't start with OPERATION MODE switch in FILTER NORMAL or SYSTEM CLEAN position.
   Step 1. Check HIGH PRESSURE PUMP circuit breaker.
   Switch on.
   Step 2. Check HIGH PRESSURE PUMP STARTER RESET.
   Push in.
   Step 3. Check feed water pressure.
   If feed pressure is below 5-7 psig (34-48 kPa) at the cartridge filter pressure gage (red needle), the pump won't start. Refer to operation procedures and set valves to their proper position.
   Step 4. Notify unit maintenance.

2. High pressure pump motor hums but won't turn with ambient temperature above 32°F (0°C).
   Step 1. Notify unit maintenance.

3. High pressure pump motor hums but won't turn with ambient temperature below 32°F (0°C).
   Step 1. Check for icing of pump.
   Step 2. Check to assure pump electric heater is delivering hot air.
   Step 3. Notify unit maintenance.

4. High pressure pump starts but shuts down on product high pressure.
   Step 1. Check product piping and valves.
   Open product shut off valve and remove dust caps from product hose.
   Step 2. Check for ice at the block valve and connection (cold weather operation only).
   Step 3. Notify unit maintenance.

5. High pressure pump starts but shuts down on feed high pressure.
   Step 1. Check pressure control valve.
   Open valve.
   Step 2. Notify unit maintenance.

6. High pressure pump starts but shuts down on feed low pressure.
   Step 1. Check feed valves.
   Refer to operational procedure and position valves correctly.
   Step 2. Check caution lights.
   Service the filters or strainer if a caution light is lit.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check pressure gages when starting.
A rapid drop on one of the gages indicates which filter may be plugging.
Step 4. Troubleshoot raw water pump and booster pump.
Step 5. Shutdown ROWPU to check media level.
Step 6. Notify unit maintenance.

7. High pressure pump starts but lights go dim and remain dim.
Step 1. Check pressure control valve.
Open valve.
Step 2. Check generator voltage.
Adjust voltage to 440 volts and RPM to 60 cycles.
Step 3. Notify unit maintenance.

8. High pressure pump overloads trip open repeatedly.
Step 1. Notify unit maintenance.

9. HIGH PRESSURE PUMP circuit breaker opens whenever pump is started.
Step 1. Notify unit maintenance.

10. High pressure pump starts but stops when HIGH PRESSURE PUMP START switch is released.
Step 1. Notify unit maintenance.

11. High pressure pump/motor is noisy.
Step 1. Refer to high pressure pump problem malfunction 19.
Step 2. Check high pressure pump assembly stable levels.
Release air from pump assembly stable levels until noise disappears. If noise does not go away, slowly inflate stable levels until noise goes away.
Step 3. Notify unit maintenance.

12. High pressure alarm light stays on.
Step 1. Notify unit maintenance.

13. HIGH PRESSURE PUMP PRESSURE HIGH alarm light comes on below 930 psig (6412 kPa) or is not on at 960 psig (6619 kPa).
Step 1. Notify unit maintenance.

14. High pressure pump and/or piping leaks water.
Step 1. Notify unit maintenance.

15. High pressure pump leaks oil or oil looks milky.
Step 1. Notify unit maintenance.

16. High pressure pump has excess water flowing out of pump drain cavity.

NOTE
A small stream or drips are normal.

Step 1. Notify unit maintenance.

17. High pressure pump discharge pressure is low (won't go to 900 psig (6205 kPa)).
Step 1. Check pressure control valve.
Adjust to correct pressure.
Step 2. Check high pressure relief valve.
Notify unit maintenance if leaking.
Step 3. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

18. High pressure pump belts are noisy or smell like burned rubber.
Step 1. Notify unit maintenance.

19. High pressure pump and feed piping vibrates. Pump makes sharp hammering sounds (see also problem #20).

CAUTION
Shut down high pressure pump.

NOTE
The piping and the pumps all vibrate to some extent due to the high pressure pump. This vibration is very steady and of a low frequency. Piping does not usually move about unless something is wrong.

Step 1. Check media filter air blanket level indicator. If all the flags on the level indicator are white, there is a possibility that the air blanket is working improperly, troubleshoot media filter air system.
Step 2. Check for air in system. Open drain valves on pump until water comes out. Run raw water and booster pumps until air is out of system. Restart high pressure pump.
Step 3. Notify unit maintenance.

20. Piping pulses (vibrates) moderately to severely (see also problems #11 and #19).

CAUTION
Shut down high pressure pump.

Step 1. Check valve positions. Refer to operation procedures and adjust valves accordingly.
Step 2. Notify unit maintenance.

21. High pressure pump starts, but generator loads down and won't let the pump come up to full speed. Lights may dim. Generator may shut down electrical output. Generator exhaust is thick and black.
Step 1. Shut down high pressure pump. Push pump stop button.
Step 2. Check high pressure control valve. Fully open valve.
Step 3. Check generator voltage cycles. Adjust voltage to 440 VAC on all three legs. Adjust RPM to get 60 cycles.
Step 4. Notify unit maintenance.

22. High pressure pump starts but does not shift into high gear. Generator is unaffected. Feed flow is low.
Step 1. Notify unit maintenance.

23. High pressure pump motor runs, but pump does not.
Step 1. Notify unit maintenance.

24. High pressure pump does not respond to jog switch.
Step 1. Check HIGH PRESSURE PUMP circuit breaker switch on.
Step 2. Notify unit maintenance.

HIGH PRESSURE PUMP ASSEMBLY.

1. Air mounts leak air or are damaged.
Step 1. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

UNUSUAL NOISE.

Step 1. Check media filter air blanket level indicator.
If all the flags on the level indicator are white or orange there is a possibility that the air blanket is working improperly, troubleshoot media filter air system. Refer to high pressure pump start-up (para. 2-17 (3)) to restart pump.
Step 2. Check for air in system.
Run raw water and booster pumps, without the high pressure pump on, until air is out of system.
Step 3. Check all components of unit to locate noise.
Step 4. Notify unit maintenance.

PRODUCT HIGH PRESSURE SWITCH.

1. PRODUCT PRESSURE HIGH alarm light and horn stay on.
Step 1. Check product shut-off valve.
Open valve.
Step 2. Check SYSTEM RESET.
Push reset
Step 3. Check product out hoses for bends.
Straighten hose.
Step 4. Check that product out hose dust plug is removed.
Remove plug.
Step 5. Notify unit maintenance.

2. Product high pressure alarm comes on below 35 psig(138 kPa) or is not on at 45 psig(172 kPa).
Step 1. Notify unit maintenance.

NBC FILTER.

1. NBC filter assembly leaks.
Step 1. Check cover seal.
Clean seal and seal area.
Step 2. Notify unit maintenance.

2. Product water from NBC filter is greater than 2 ppm (feedwater 1500 ppm max.)
Step 1. Replace NBC media.
Refer to para. 2-33.

3. NBC media in distribution water tanks.
Step 1. Do not dispense water.
Notify unit maintenance.
Step 2. Notify medical personnel.
Tanks and water will have to be cleared before dispensing.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

HEATERS AND HEAT TRACES.

1. Diesel heaters fail to operate with generator operating and all other systems operating okay (motor fails to run).
   Step 1. Check 120V circuit breakers.
   Switch on.
   Step 2. Check HEATER POWER SUPPLY OFF/ON switch on main control panel.
   Turn on.
   Step 3. Check HEATER circuit breaker (on heater).
   Push in.
   Step 4. Check thermostats.
   Adjust to temperature greater than ambient temperature.
   Step 5. Check fuel pumps.
   Fuel pump bowls should have fuel in them.
   Step 6. Start heaters.
   Follow procedures for starting heaters (para 2-31 e).
   Step 7. Notify unit maintenance.

2. Diesel heaters fail to operate with generator not working (motor fails to run).
   Step 1. Check jumper cable from generator batteries.
   Install cable.
   Step 2. Check HEATER circuit breaker (on heater).
   Push in.
   Step 3. Check thermostats.
   Adjust to temperature greater than ambient temperature.
   Step 4. Check fuel pumps.
   Fuel pump bowls should have fuel in them.
   Step 5. Start heaters.
   Follow procedure for starting heaters (para. 2-31 e).
   Step 6. Notify unit maintenance.

3. Diesel heaters fail to operate off of auxiliary power (motor fails to run).
   Step 1. Check 120V circuit breakers.
   Switch on.
   Step 2. Check HEATER POWER SUPPLY OFF/ON switch on main control panel.
   Turn on.
   Step 3. Check HEATER circuit breaker (on heater).
   Push in.
   Step 4. Check thermostats
   Adjust to temperature greater than ambient temperature.
   Step 5. Check fuel pumps.
   Fuel pump bowls should have fuel in them.
   Step 6. Start heaters.
   Follow procedures for starting heaters (para 2-31 e).
   Step 7. Notify unit maintenance.

4. Diesel heater exhaust pipe drips fuel when starting heater.
   Step 1. Heater is flooded. Wait 15 minutes and start again.
   Step 2. Notify unit maintenance.

5. Diesel heater exhaust smokes heavily while operating.
   Step 1. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. Diesel heater operates normally after started, but shuts down instead of going to standby after container is heated Heater requires restarting to operate.
   Step 1. Notify unit maintenance.
7. High pressure pump package heater does not operate.
   Step 1. Check PUMP SKID HEATER circuit breaker. Switch on.
   Step 2. Check thermostat. Adjust thermostat to a temperature higher than ambient temperature.
   Step 3. Notify unit maintenance. 8 Electric or diesel heater keeps on operating after thermostat setting has been reached.
   Step 1.. Notify unit maintenance.
9. Drain sumps freeze up.
   Step 1. Check 120V circuit breaker. Switch on.
   Step 2. Check SUMP HEAT/PUMP HEAT OFF/ON switch. Turn on.
   Step 3. Notify unit maintenance.

NOTE

The drain sump under the media filter does not have a heat trace.

10. Diesel heater motor runs, but there is no combustion.
    Step 1. Check fuel pump bowl for fuel. Check fuel pump screen. Fill fuel bowls. Clean screen, if dirty.
    Step 2. Notify unit maintenance.
11. Diesel heater has excessive back firing or popping.
    Step 1. Notify unit maintenance.
12. Diesel heater fan falls to go to high speed during burning cycle.
    Step 1. Notify unit maintenance.
13. Noxious fumes in ROWPU van (diesel fuel smell) or carbon monoxide (CO) monitor alarms go on.

WARNING

Carbon monoxide can be lethal. Do not sleep in ROWPU van. Do not stay in van if CO monitor audio alarm is sounding and/or red "ALARM 2" light is on and level of CO on display is above 50 ppm.

Step 1. Isolate fume source. Close doors if fumes are coming from outside.
Step 2. Check heater exhaust pipes.

CAUTION

Heater exhaust pipes are very hot(6000F, 316°C). Do not touch exhaust pipes unless heat protective gloves are worn on hands.

If pipes are plugged, clean out pipes. If pipes are filled with water, drain water from pipes and check that drain hole in outside exhaust pipe elbow is not clogged and that drain hole is pointing down. (Model ROWPU1 only).

If extensions have been added to the exhaust pipes, they may be too long. The diesel heaters can only push exhaust fumes through about 7 feet (2.1 m) of pipe before fumes back up into the van (any elbows in the pipe are equal to 1 foot (.3 m) of pipe a piece).

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CARBON MONOXIDE (CO) MONITOR.

WARNING

Inhalation of carbon monoxide can cause serious illness or death.

1. Green SYSTEM OK light is off and neither ALARM 1, ALARM 2, or audio alarm are on.
   Step 1. Check HEATER POWER SUPPLY ON/OFF switch.
   Turn ON.
   Step 2. Check monitor POWER switch and CIRCUIT BREAKER.
   Open monitor front panel and turn POWER toggle switch ON. Press monitor CIRCUIT BREAKER.
   Step 3. Notify unit manitenance.

NOTE

CO monitor is set to alarm at 25 ppm for Alarm 1 and 50 ppm for Alarm 2. The OSHA maximum safe level for an 8 hour shift is 50 ppm.

2. Monitor reading is erratic.
   Step 2. Notify unit maintenance.
3. Monitor audio alarm keeps sounding.
   Step 1. Press RESET button on bottom of monitor.
4. Monitor display indicates “EEE” or “E” or is blank and the alarm is sounding.
   Step 1. Press RESET on bottom of monitor.
   Step 2. Notify unit maintenance.
5. Monitor alarms at wrong set points.
   Step 1. Notify unit maintenance.

DISTRIBUTION PUMP.

1. Distribution pump won’t start.
   Step 1. Check DISTRIBUTION PUMP circuit breaker.
   Switch on.
   Step 2. Check DISTRIBUTION PUMP GROUND FAULT RESET.
   Push Up.
   Step 3. Check DISTRIBUTION PUMP STARTER RESET.
   Turn on.
   Step 4 Check DISTRIBUTION PUMP ON pushbutton.
   Push on.
   Step 5 Check DISTRIBUTION PUMP selector switch (on pump).
   Turn on.

WARNING

Turn off DISTRIBUTION PUMP circuit breaker and make certain DISTRIBUTION PUMP OFF pushbutton is pressed and DISTRIBUTION PUMP POWER ON light is not lit before proceeding. Failure to do so could result in electrocution.

   Step 6 Check electrical cables.
   Clean if dirty, dry if wet.
   Step 7 Notify unit maintenance.
2. Distribution pump motor hums but won’t turn with ambient temperature above 32°F (0°C).
   Step 1. Notify unit maintenance.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. Distribution pump motor hums but won't turn with ambient temperature below 32°F (0°C).
   Step 1. Check for icing.
   Allow pump heater to warm pump for 1 hour.
   Step 2. Notify unit maintenance.

4. DISTRIBUTION PUMP circuit breaker opens whenever pump is started.

WARNING

Turn off DISTRIBUTION PUMP circuit breaker and make certain DISTRIBUTION PUMP OFF pushbutton is pressed and DISTRIBUTION PUMP POWER ON light is not lit before proceeding. Failure to do so could result in electrocution.

   Step 1. Check pump power cable. Clean and dry electrical connectors.
   Step 2. Notify unit maintenance.

5. DISTRIBUTION PUMP GROUND FAULT RESET trips repeatedly.

WARNING

Turn off DISTRIBUTION PUMP circuit breaker and make certain DISTRIBUTION PUMP OFF pushbutton is pressed and DISTRIBUTION PUMP POWER ON light is not lit before proceeding. Failure to do so could result in electrocution.

   Step 1. Check pump power cable. Clean if dirty, dry if wet.
   Step 2. Notify unit maintenance.

6. Distribution pump overloads trip repeatedly.
   Step 1. Notify unit maintenance.

7. Distribution pump assembly leaks.
   Step 1. Notify unit maintenance.

8. Distribution pump/motor assembly is noisy.
   Step 1. Notify unit maintenance.

9. Distribution pump runs but does not pump water with ambient temperature above 32°F (0°C).
   Step 1. Check storage tanks.
   Water must be above suction hose connections.
   Step 2. Check for pump air lock.
   Remove discharge hoses from pump until water flows out of pump. If water does not come out of pump discharge do step 3 and also check for plugged suction hoses.
   Step 3. Check tank outlet,
   [f the tank sidewall hangs over the connection, it maybe blocked by tank fabric. Drain tank out second connection and check.
   Step 4. Notify unit maintenance.

10. Distribution pump runs but does not pump water with ambient temperature below 32°F (0°C).
   Step 1. Refer to steps 1, 2, and 3 of problem #9.
   Step 2. Check dispensing hoses for freezing.
   If the hoses are hard or there is ice in the end connections, take hoses inside ROWPU van to thaw out. Make sure dispensing nozzle is thawed.
   Step 3. Check for ice plugging the suction hoses or inlet of pump.
   Remove suction hoses from the pump back to the tanks. Remove any ice plugs found or move hoses inside ROWPU van to thaw out.
   Step 4. Notify unit maintenance.

11. Distribution pump runs but water discharge pulses.
   Step 1. Check storage tanks.
   Water must be above level of suction hoses.

Table 3-1, Operator Troubleshooting Guide (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Check hose connections.
Clean if dirty.
Replace missing gaskets.

12. Distribution pump heater does not work.

NOTE

Heater only works when pump is off.

Step 1. Check control panel SUMP HEAT/PUMP HEAD OFF/ON switch. Turn on.

WARNING

Turn off pump heat/sump heater switch before proceeding. Failure to do so could result in electrocution.

Step 2. Check heat bulb. Replace if broken or burned out.
Step 3. Check electrical connectors. Clean and tighten connectors.
Step 4. Notify unit maintenance.

13. Dispensing nozzles leak or are plugged.
Step 1. Notify unit maintenance.

PRESSURE GAGES.

1. Leak.
Step 1. Notify unit maintenance.
2. Do not zero or are inaccurate.
Step 1. Notify unit maintenance.
3. Show no pressure.

NOTE

Some gauges are inoperative in different modes of operation. Make sure gauge works in system "normal".

Step 1. Check manual valves for position. Place valves in correct position.
Step 2. Check auto valves for position. Refer to auto valve troubleshooting if a valve will not operate correctly.
Step 3. Check pressure gage drain valve positions. Make sure drain valves are closed.
Step 4. Notify unit maintenance.

4. System pressure gauge fluctuates.

NOTE

Do not operate if fluctuations are moderate to severe.

Step 1. Notify unit maintenance.

5. Media filter or cartridge filter gauges fluctuate.

NOTE

Do not operate if fluctuations are moderate to severe.

Step 1. Check media filter air blanket indicator. Refer to media filter troubleshooting if air blanket is not present in filter or all air chamber flags are all red or all white. Refer to high pressure pump vibration troubleshooting.

Table 3-1. Operator Troubleshooting Guide (Continued).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Check air blanket in cartridge filter.
Shut down ROWPU and drain cartridge filter. Restart ROWPU and vent cartridge filter until water comes out vent.
Step 3. Notify unit maintenance.

PORTABLE TDS METER.

1. Meter does not read the correct 's' value.
Step 1. Adjust meter.
Open bottom of motor and adjust to value shown on instrument back.
2. Meter needle won't stabilize.
Step 1. Water has leaked into instrument.
Dry out.
Step 2. Replace meter.
3. Meter does not respond when button is pushed.
Step 1. Replace battery.
4. Meter is inaccurate.
Step 1. Adjust meter.
Obtain water/salt standards and adjust different scale ranges to correct reading.
Step 2. Replace meter.

WASTE RELIEF AND PRESSURE VALVES.

1. Relief valve leaks a little.
Step 1. Check waste out hoses.
Too much back pressure will cause this.
Straighten out any kinks in the hoses.
Step 2. Notify unit maintenance.
2. Relief valve leaks a lot.
Step 1. Check waste out hoses.
Remove dust caps or plugs.
Straighten out any kinks in hoses.
In cold weather operation, make sure hoses are not frozen.
Step 2. Notify unit maintenance.

SAFETY VALVE.

1. Valve leaks.
Step 1. Notify unit maintenance.

HIGH PRESSURE PUMP STABLE LEVELS.

1. Leaks air or won't pump up.
Step 1. Notify unit maintenance.

SECTION III. MAINTENANCE PROCEDURES

3-4. GENERAL. This section contains instructions for the operator and follows the Maintenance Allocation Chart. These tasks have been determined to be essential to the operator in proper maintenance of the ROWPU.

3-5. TASK SUMMARY. The operator maintenance tasks are as follows:

Task **Para.**

3-6. REPAIR ANCHOR AND ANCHOR ROPE. This task covers:

a. Removal. b. Replace. c. Repair.

INITIAL SETUP.

Materials/Parts:
Replacement anchor pulley.
Replacement anchor rope.

Equipment Condition:
Raw water pump shut down (para. 2-18).

General Safety Instruction:
Observe specific Warning and Caution in text.

WARNING

Turn off the raw water pump (para. 2-18) before removing the anchor. Failure to do so could result in injury and could damage the raw water pump.

CAUTION

Do not lose control of free end of anchor rope while pulling in anchor and strainer. Failure to do so will result in loss of anchor.

NOTE

Inspect anchor rope and anchor at start-up and pack-up.

REMOVAL.

a. Check the exposed rope (1, Figure 3-1) for cuts or fraying.

b. Use the anchor rope to pull in the anchor. Check the rope and pulley (2) for damage or clogging of the pulley with debris. Check anchor for damage.

REPLACE.

a. Remove and replace rope if cut or frayed.

b. Remove and replace anchor assembly if damage will not allow it to operate properly.

REPAIR.

a. Clean debris from rope, pulley, retaining link (3) and anchor (4).

b. Replace pulley if damaged by loosening the nut on the retaining ring, removing damaged pulley, installing new pulley, and tightening nut on retaining ring.

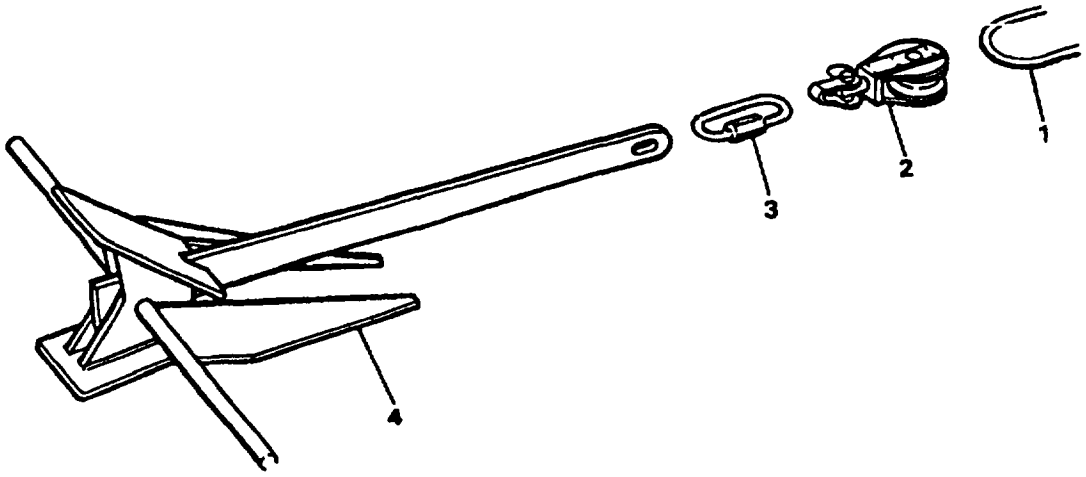


Figure 3-1. Repair Anchor and Anchor Rope

3-7. REPAIR INTAKE STRAINER ASSEMBLY. This task covers:

a. Removal. b. Inspection. c. Cleaning. d. Repair. e. Installation.

INITIAL SETUP.

Tools:
Plater's brush from ROWPU storage box no. 3

Materials/Parts:
Wiping Rag (Appx E, Sec II, Item 58)
Replacement gasket from storage box no. 3.

Equipment Condition:
ROWPU shutdown to standby (para. 2-1 8).

Personnel Required: 3

General Safety Instructions

WARNING

- Observe specific Warning and Caution in text.
- Do not wear loose clothing or jewelry while working on equipment.

WARNING

Turn off the raw water pump (para. 2-18) before removing the intake strainer. Failure to do so could result in injury and could damage the raw water pump.

CAUTION

All three crew members are required to pull in the intake strainer. Do not lose control of free end of anchor rope while pulling in strainer. Failure to do so will result in loss of anchor.

NOTE

Both the standard intake strainer (shown) and the ice hole strainer (part of winter kit) are serviced and replaced in the same way.

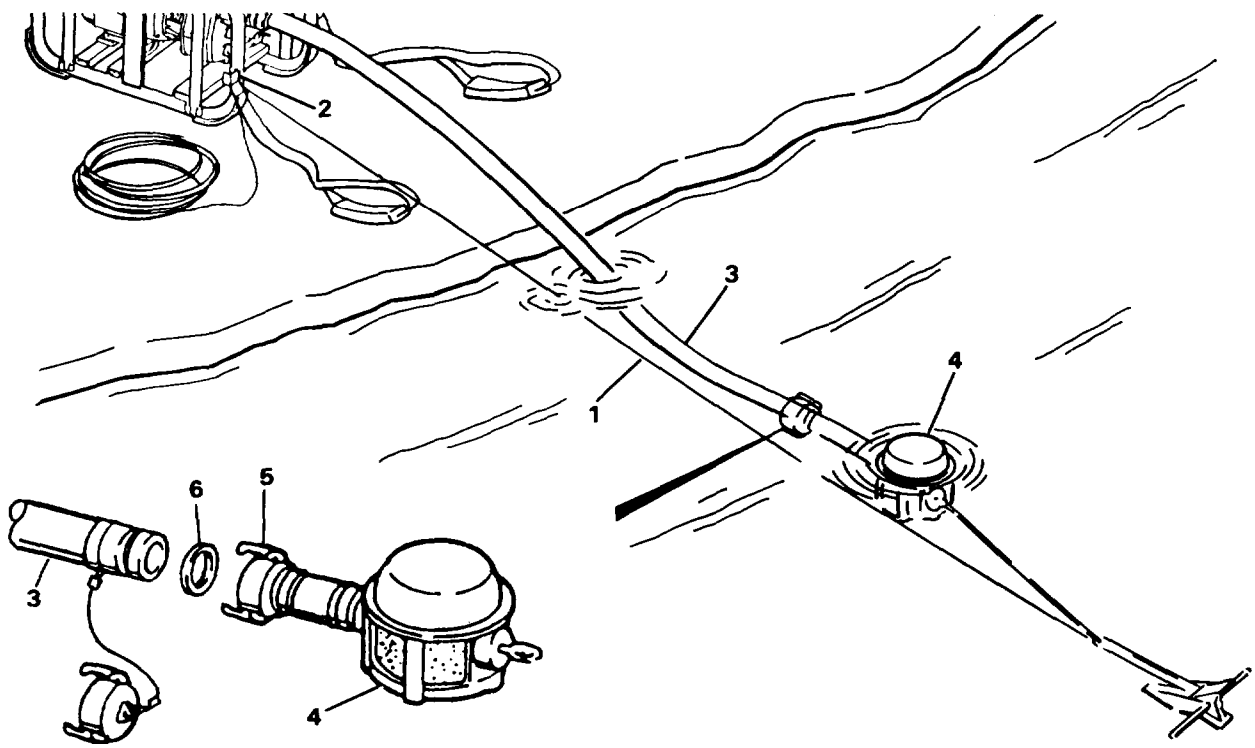


Figure 3-2. Intake Strainer

REMOVAL.

a. Keep the anchor rope (1, Figure 3-2) tied to the raw water pump frame (2).

b. One crew member pulls on the anchor rope while the other two pull on the suction hose (3) to retrieve the strainer (4).

NOTE

For inspection and cleaning, it is not necessary to remove the intake strainer from the suction hose.

INSPECTION.

Visually check the intake strainer for clogging from debris or possible punctures or tears.

CLEANING.

a. Use plater's brush to remove foreign matter from the holes in the strainer screen.

b. Wipe screen clean.

REPAIR.

Repair of the intake strainer assembly is limited to replacement of gasket (6). Replace gasket if cut or worn.

INSTALLATION.

NOTE

If the strainer has been damaged, notify unit maintenance for replacement.

a. Open cam locks (5) on new strainer.

b. Make certain gasket(6) is seated in strainer connector, attach strainer connector to suction hose (3) and close cam locks.

3-8. REPAIR RAW WATER HOSES. This task covers.

a. Removal. b. Inspection. c. Replace. d. Repair. e. Inslallalion.

INITIAL SETUP.

Materials/Parts:
Replacement gaskets from storage box no. 3.

Equipment Condition:
ROWPU shutdown to standby.

General Safety Instructions:
Observe specific Caution In text.

CAUTION

Turn off the raw water pump (para. 2-18) before removing the raw water hoses. Failure to do so could result in equipment damage.

NOTE

This task is limited to replacement of cut or worn gaskets at the raw water hose cam and groove connection points and hose replacement.

REMOVAL.

Open the cams as shown in Figure 3-3. Extract gaskets

INSPECTION.

Check the gaskets for cuts, sand and dirt. Inspect hoses for damage or cuts. Inspect suction hoses for flattening due to being driven over. Inspect suction hoses for inner liner collapsing by holding hose to light and visually looking down the inside of the hose.

REPLACE.

If hoses are damaged or cut, replace hose.

REPAIR.

Discard old gaskets and replace with new gaskets from storage box no. 3.

INSTALLATION.

a. Carefully check gasket seating in protective caps and/or female connectors for sand or dirt. Install gaskets.

b. Reconnect hoses and close cam levers.

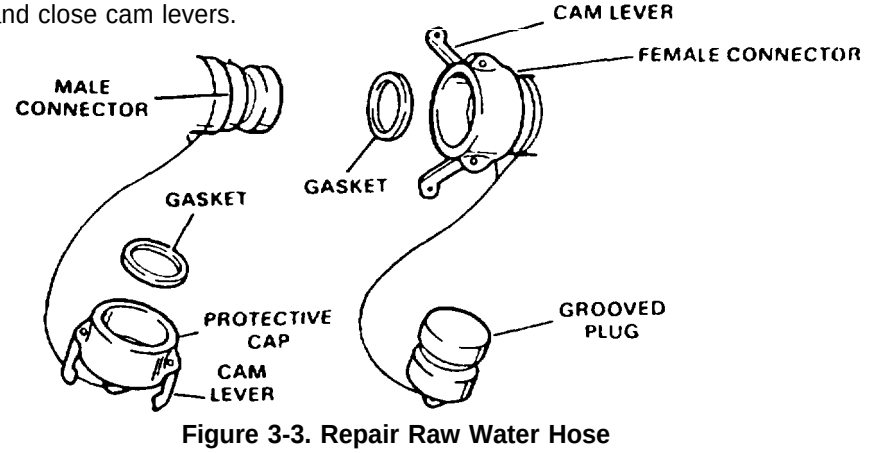


Figure 3-3. Repair Raw Water Hose

3-9. SERVICE RAW WATER PUMP POWER CABLES. This task covers:

a. Removal. b. Inspection. c. Service.

INITIAL SETUP.

Materials/Parts:
Wipes (Appx E, Sec II, Item 76)

Equipment Condition:
ROWPU shutdown to standby (para. 2-18).

General Safety Instructions:

WARNING

Make sure the circuit breaker for the raw water pump is turned off Failure to do so could result in electrocution.

NOTE

This task is limited to cleaning and drying the connectors.

REMOVAL.

Unscrew the threaded electrical connector (1, Figure 3-4) and separate from connector (2).

INSPECTION.

Look for any dirt, sand, or water in the connector,

SERVICE.

a. Clean out all dirt and/or sand.

b. Soak up and wipe dry any water in the connector using the kimwipes.

INSTALLATION.

Plug the connector halves (1 and 2) together and tighten the threaded connector (1).

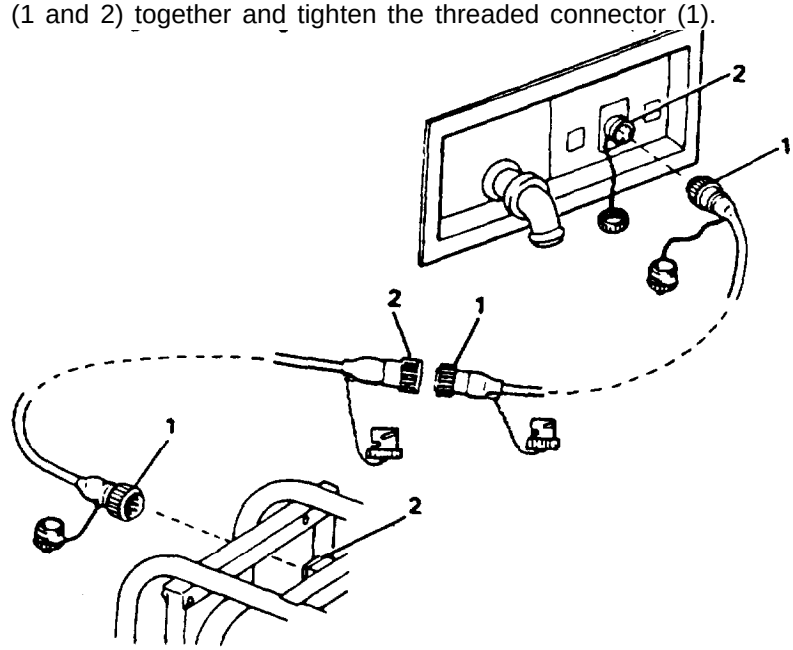


Figure 3-4. Service Raw Water Pump Power Cable

3-10. REPAIR RAW WATER PUMP ASSEMBLY. This task covers replacement of connector gaskets as described in para. 3-8.

3-11. REPAIR RAW WATER PIPING AND VALVES. This task covers replacement of connector gaskets as described in para. 3-8.

3-12. REPAIR RAW WATER PRIME ASSIST PUMP. This task covers replacement of connector gaskets as described in para. 3-8.

3-13. REPAIR SEPARATOR PIPING. This task covers replacement of connector gaskets as described in para. 3-8.

3-14. REPAIR SEPARATORS. This task covers replacement of connector gaskets as described in para. 3-8.

3-15. SERVICE EYEWASH STATION. This task covers:

a. Inspection. b. Service.

INITIAL SETUP.

Materials/Parts:
Bacteriostatic Additive (Appx E, Sec II, Item 11)

Equipment Condition:
Normal operation of ROWPU; no shutdown required.

General Safety Instructions:
Be careful to keep dirt and other foreign matter out of eyewash solution container.

INSPECTION.

Remove dust caps (1, Figure 3-5) and push down on valve handle (2) and visually check operation. Flow should be equal from both nozzles, Turn balancing screw (7) to adjust.

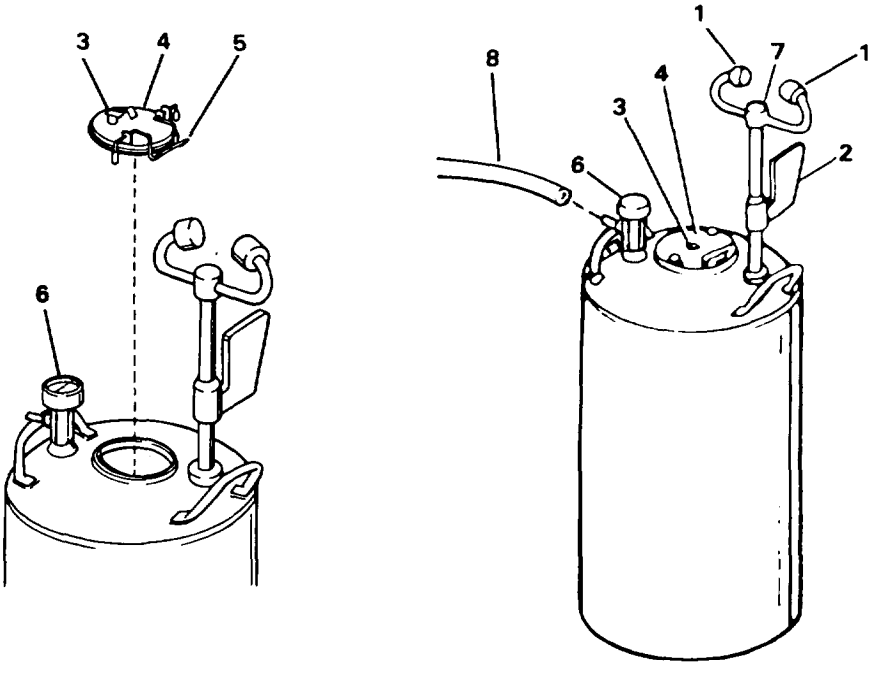


Figure 3-5. Service Eyewash Station

SERVICE.

a. Open pressure release valve (3).

CAUTION

Pressure gage (6) must read 0 before removing tank cover (4).

b. Remove tank cover(4) by opening bail (5), straps must be removed and tank tipped to drain it and add product water to fill mark.

c. Add one 4 ounce packagee of fungicide additive.

d. Replace tank cover (4) and lock in place with bail (5).

e. Connect utility air line (8) and charge to 85 psig (586 kPa)

f. Push lever (2) and adjust eyewash flow by turning balancing screw (7) to right or left until flow is equal from both nozzles.

g. Install dust caps on eyewash nozzles.

3-16. REPLACE INTERIOR LIGHT BULBS. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Materials/Parts:
100 watt light bulb (Appx E, Sec II, Item 48)

Equipment Condition:
ROWPU in normal operation or shutdown to standby (para. 2-18).

General Safety Instructions:
Observe specific Warning in the text.

REMOVAL.

WARNING

A light bulb or bulb guard that has been on can be hot. Use a glove or suitable cloth when performing maintenance to avoid getting burned.

a. Use step stool if needed.

b. Unscrew light bulb guard (1, Figure 3-6),

c. Grasp defective bulb (2) and turn it counterclockwise to remove from base socket (3).

INSTALLATION.

a. Screw in a new bulb (2). Turn new bulb clockwise to install into socket (3).

b. Screw in light bulb guard(1).

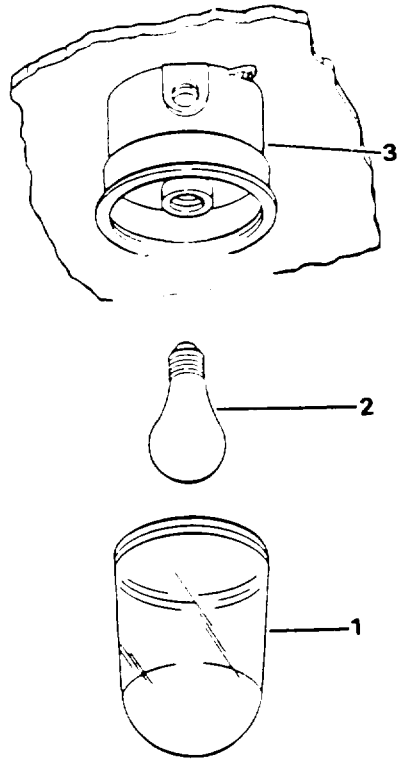


Figure 3-6. Replace Interior Light Bulbs

3-17. REPLACE INDICATOR LIGHT BULBS. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Materials/Parts:
Light bulb (Appx E, Sec II, Item 49)

Equipment Condition:
ROWPU operating or shutdown.

General Safety Instructions:

WARNING

Do not try to remove lights with metal pliers or any non-electrical tools.

NOTE

This task is limited to replacing the pilot light bulbs.

REMOVAL.

a. Unscrew colored light lens (1, Figure 3-7)

b. Twist bulb (2) slightly to left and remove.

INSTALLATION.

a. Align tabs on new bulb with slots in the receptacle.

b. Gently push in and twist to the right slightly. Bulb will lock in place.

c. Screw colored light lens on.

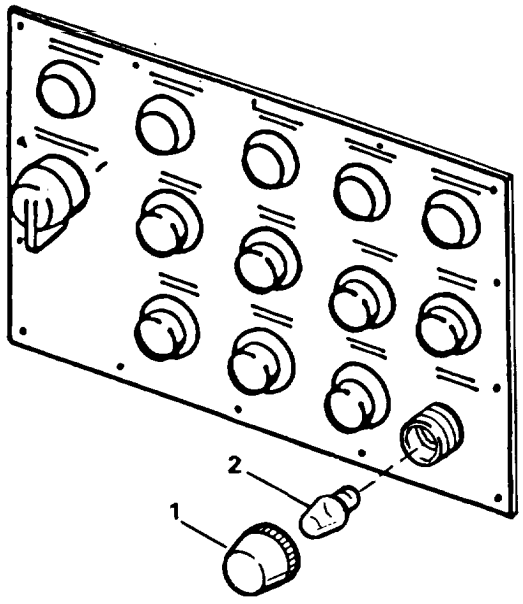


Figure 3-7. Replace Indicator Light Bulbs

3-18. REPLACE SWITCH PANEL NO. 1 INDICATOR LIGHT BULBS. This task covers replacement of the indicator light bulbs as described in para. 3-17.

3-19. REPAIR HYPOCHLORITE TANK COMPONENTS AND COVERS. This task covers replacement of connector gaskets as described in para. 3-8.

3-20. REPAIR CARTRIDGE FILTERS. This task covers:

a. Removal. b. Inspection. c. Repair. d. Installation.

INITIAL SETUP.

Materials/Parts:
Cartridge filter elements (Appx E, Sec II. hem 35)
Replacement gaskets from storage box no. 3.

Equipment Condition:
ROWPU shutdown to standby (para. 2-1 8) or shutdown to extent described in a below.

General Safety Instructions:
Do not wear loose clothing or jewelry while working on equipment.

REMOVAL.

NOTE

When cartridge filters are dirty, the cartridge filter pressure drop sensor will turn on warning horn and yellow CARTRIDGE FILTER PLUGGED light (1, Figure 3-8).

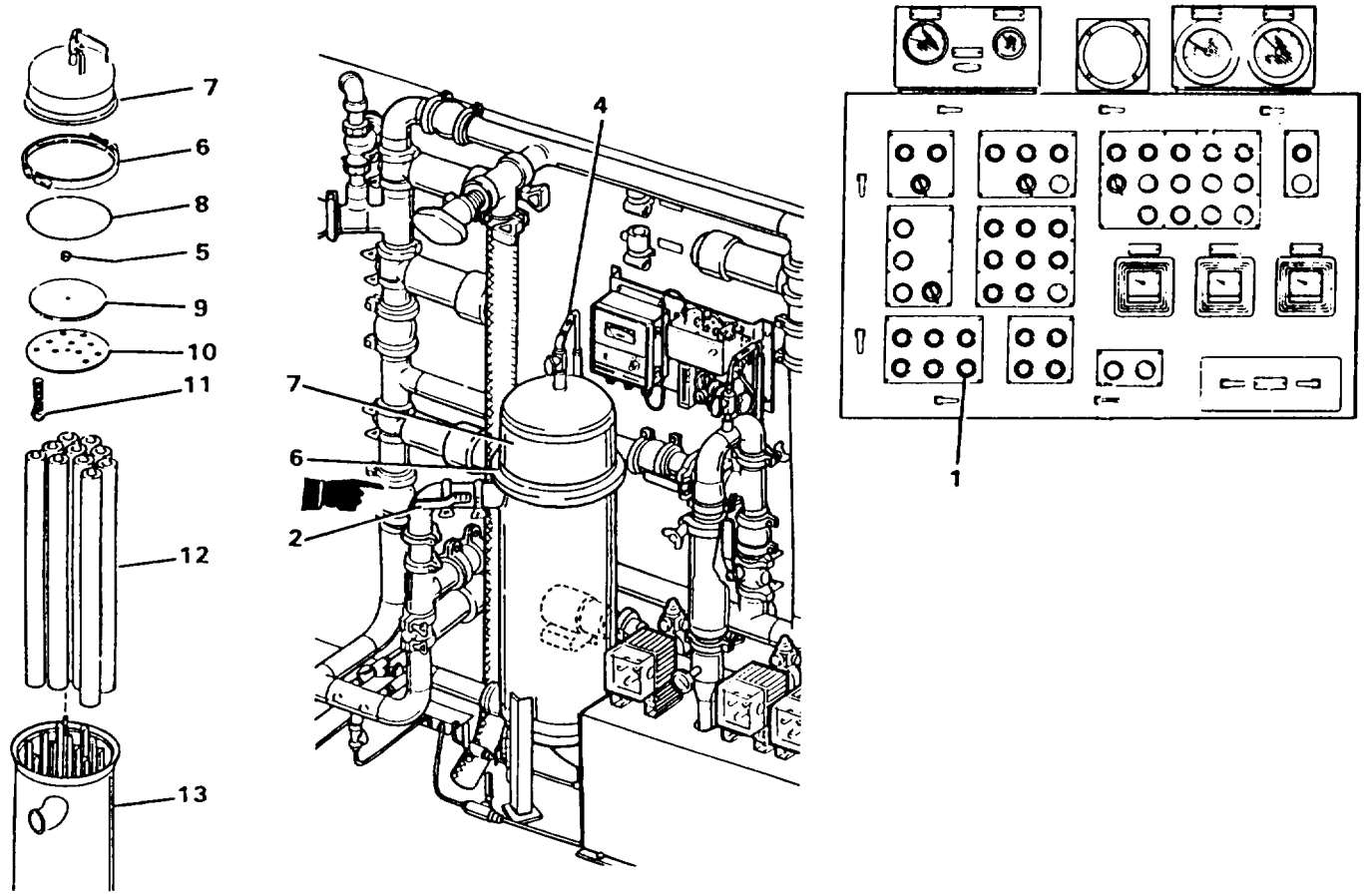


Figure 3-8. Replace Cartridge Filters

a. Close cartridge filter block valve (2).

b. Open cartridge drain valve (3) and filter vent (4).

NOTE

Wait until filter has fully drained before removing nut and washer (5).

c. Loosen clamp (6) using ratchet wrench. Remove clamp (6), cover (7) and gasket (8). Use crescent wrench to remove nut and washer (5). Remove plate (9), retainer (10), 10 spring and seal assemblies (11), and 10 filter elements (12) from filter housing (13). Discard filter elements.

INSPECTION.

Check gasket (8) for cuts and other damage, Check gasket seating area for sand or other debris.

REPAIR.

a. Replace gasket (8) if cut or damaged.

b. Install 10 new elements (12).

c. Clean gasket sealing areas.

INSTALLATION.

a. Install 10 spring and seal assemblies(11), retainer (10), and plate (9).

b. Install nut and washer (5) and tighter, leaving approximately 1 inch between plate (9) and retainer (10).

c. Install gasket (8), cover (7), and clamp (6). Tighten with ratchet wrench.

d. Close drain (3) and vent (4).

3-21. REPAIR WATER PURIFICATION FILL AND DRAIN HOSES, REPAIR CLEAN RETURN LINE, AND HEATER JUMPER HOSE. This task covers repair of hoses by replacement of gaskets as described in paragraph 3-8.

3-22. REPAIR BASKET STRAINER. This task covers: (MODEL WTA-060 ONLY)

a. Inspection b. Service c. Repair d. Installation

INITIAL SETUP.

Tools:
Plater's brush from storage box no. 3
Materials/Parts:
Replacement basket strainer from storage box no. 2
Replacement gaskets from storage box no. 3

Equipment Condition:
ROWPU shutdown to standby (para. 2-18) or shutdown to extent described in a below.
General Safety Instructions:
Do not wear loose clothing or jewelry while working on equipment.

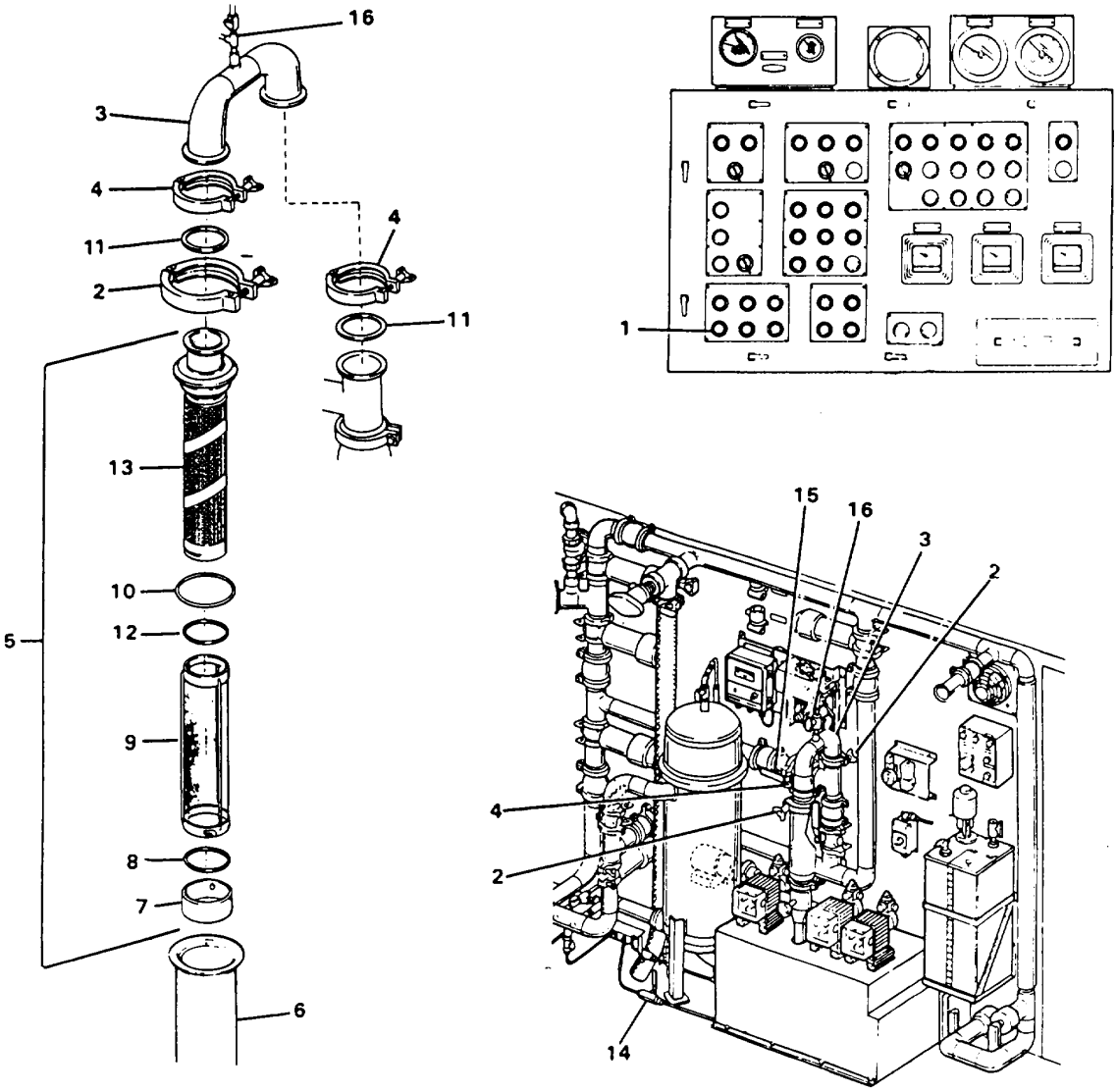


Figure 3-9. Repair Basket Strainer.
(MODEL WTA-O60 ONLY)

REMOVAL.

NOTE

When basket strainer is blocked or needs cleaning, the basket strainer pressure drop sensor will turn on warning horn and yellow STRAINER PLUGGED light (1, Figure 3-9).

a. Close feed valve (15).

b. Open vent valve (16).

c. Open drain valve (14).

d. After draining is complete, disconnect clamps (4).

e. Remove pipe section (3).

f. Remove clamp (2).

g. Lift out basket strainer assembly (5) from strainer vessel (6).

h. Twist off cap (7) and remove seal (8). Remove outer strainer (9).

INSPECTION.

a. Check condition of seal (10).

b. Check condition of gaskets(11, 8, and 12).

REPAIR.

a. Replace gaskets (11, 8 and 12) if cut or damaged.

b. Replace seal (10) if cut or damaged.

INSTALLATION.

a. install spare outer strainer(9), seal (10), gaskets (8 and 12)on inner strainer (13) and secure with cap (7). Insert the assembly into the basket strainer vessel (6).

b. Install clamp (2).

c. Install pipe section (3) with clamps (4) and gaskets (11).

d. Close drain valve (14).

e. Close vent valve (16).

f. Open feed valve (15).

g. Clean dirty outer strainer with plater's brush for next change-over. If strainer is torn or otherwise damaged, notify unit maintenance for replacement.

3-22.1. REPAIR BASKET STRAINER. This task covers: (MODEL ROWPU-1 ONLY)

a. Inspection b. Service c. Repair d. Installation

INITIAL SETUP.

Tools:
Plater's brush from storage box no. 3
Materials/Parts:
Replacement basket strainer from storage box no. 2
Replacement gaskets from storage box no. 3

Equipment Condition:
Basket strainer isolated from system by manual valve selection (para. 2-24a(3.1)).
General Safety Instructions:
Do not wear loose clothing or jewelry while working on equipment.

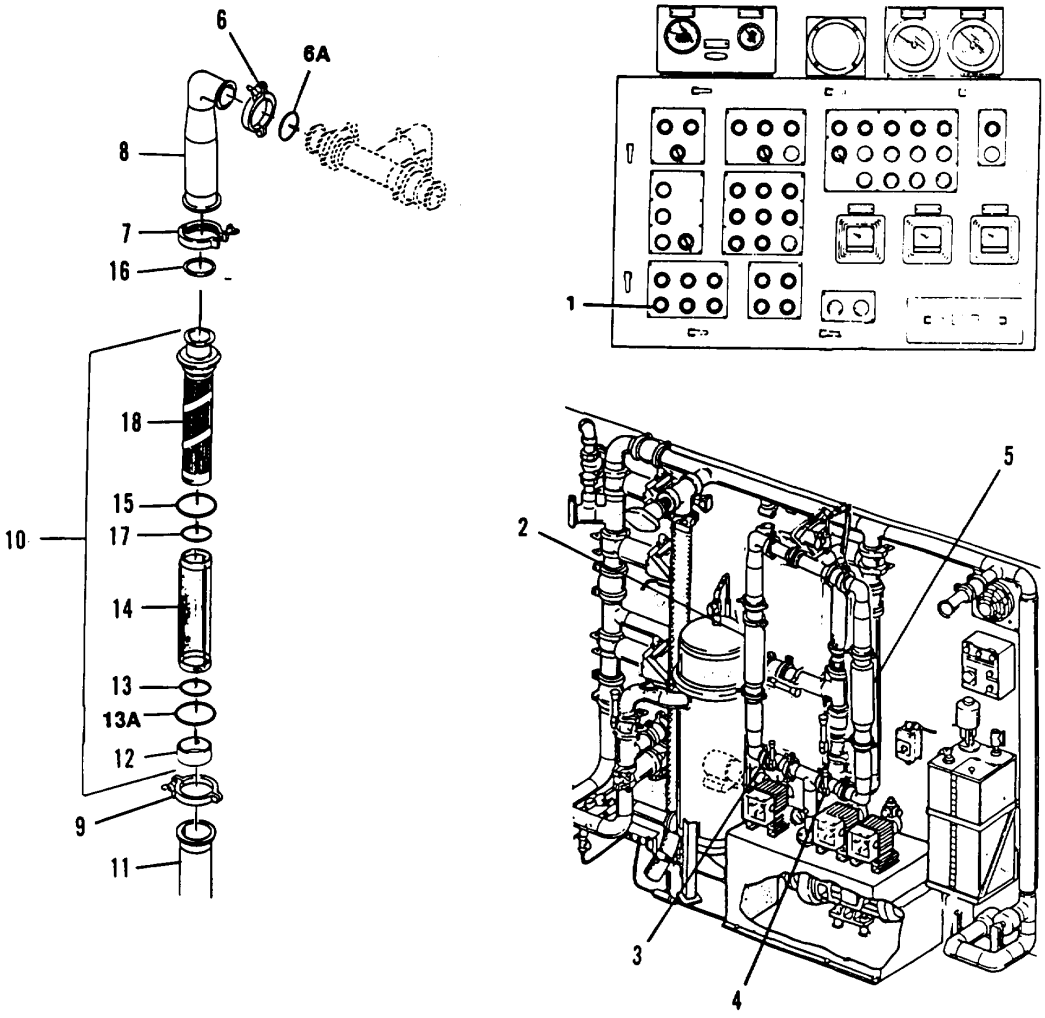


Figure 3-9.1. Repair Basket Strainer.
(MODEL ROWPU-1 ONLY)

REMOVAL.

NOTE

When basket strainer is blocked or needs cleaning, the basket strainer pressure drop sensor will turn on warning horn and yellow STRAINER PLUGGED light (1, Figure 3-9.1).

NOTE

Model ROWPU-1 of the ROWPU is equipped with a dual strainer system to allow one strainer to be replaced without shutting down the system. The following procedure describes the replacement of one strainer. The procedure for removing the strainers are similar.

a. If strainer (2) is being replaced, open manual valve (4) and close manual valve (3). If strainer (5) is being replaced, open manual valve (3) and close manual valve (4).
b. Remove clamp (6), gasket (6A), clamp (7), pipe section (8), gasket (16), and clamp (9).
c. Lift out basket strainer assembly (10) from strainer vessel (11).
d. Twist off cap (12) and remove seal (13A) and gasket (13).
e. Remove outer strainer (14).

INSPECTION.

a. Check condition of O-ring (15) and seal (13A).
b. Check condition of gaskets (6A), (13), (16), and (17).

REPAIR.

a. Replace gasket (6A), (13), (16), and (17) if cut or damaged.
b. Replace seal (13A) or O-ring (15) if cut or damaged.

INSTALLATION.

a. Install O-ring (15), gasket (17), outer strainer (14), gasket (13), and seal (13A) on inner strainer (18) and secure with cap (12).
b. Insert strainer assembly (10) into the basket strainer vessel (11) and install clamp (9).
c. Install pipe section (8), gasket (16), clamp (7), gasket (6A), and clamp (6).
d. Clean dirty outer strainer with plater's brush for next change-over. If strainer is torn or otherwise damaged, notify unit maintenance for replacement.

3-23. SERVICE MEDIA FILTER. This task covers:

a. Testing. b. Service.

INITIAL SETUP.

Tools:
Steel rule from storage box no. 2

Materials/Parts:
Coarse media (Appx E, Sec II, Item 55)
Fine media (Appx E, Sec II, Item 56)
Wiping rags (Appx E, Sec II, Item 58)

Equipment Condition:
ROWPU shutdown to standby (para. 2-18).

General Safety Instructions:
Clean up any spilled media from floor of ROWPU after test and filling.

TESTING.

a. Close CARTRIDGE FILTER BLOCK valve (1, Figure 3-10).
b. Open MEDIA FILTER VENT valve (2).
c. Open MEDIA FILTER DRAIN valve (3).
d. Remove clamp (4).
e. Remove cap (5) and gasket (6).
f. Measure from top of access hole to top of media bed, using steel rule (7).

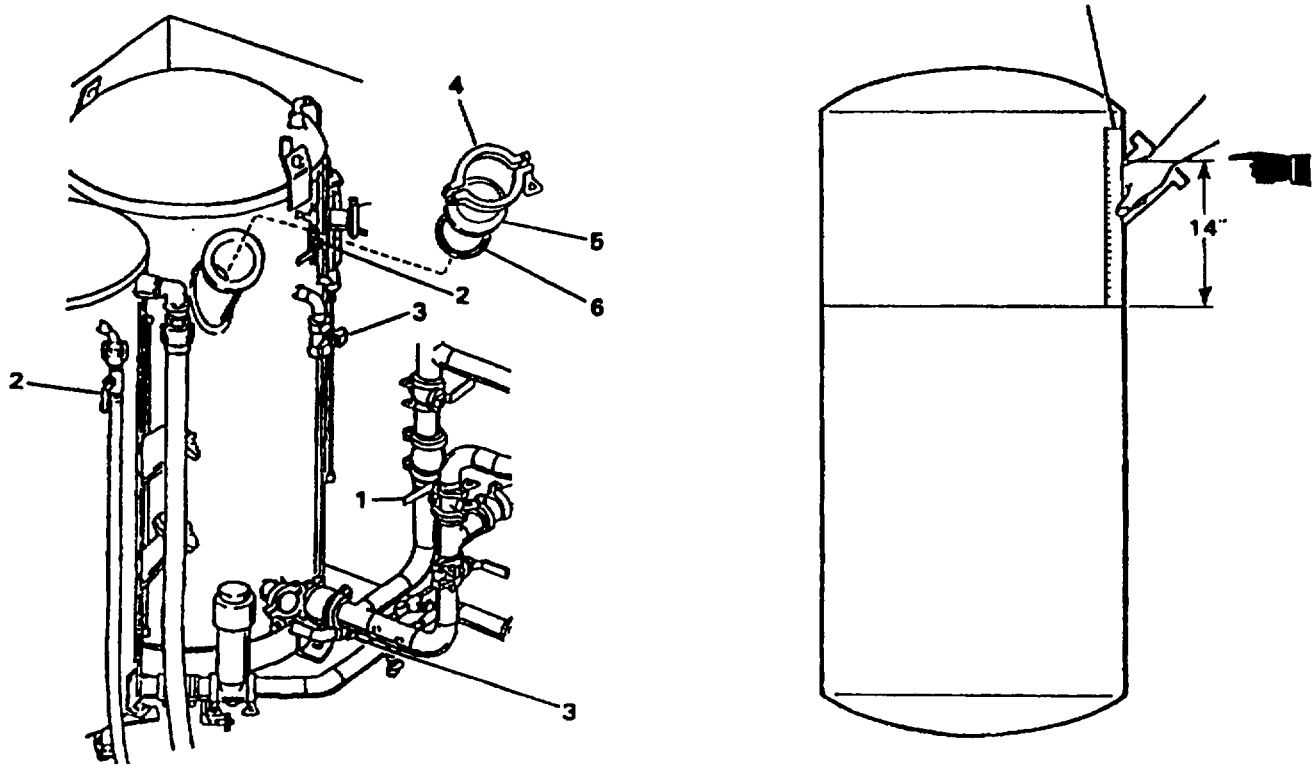


Figure 3-10. Service Media Filter

SERVICE.

a. If measurement is more than 14 inches but less than 18 inches, add media at next scheduled shutdown. If more than 18 inches do not operate ROWPU until media level has been corrected. Correct media level is 14 to 18 inches.

b. Install cap (5), gasket (6), and clamp (4) and return steel rule (7) to storage box no. 2. Clean gasket area before installing cap (5) and clamp (4).

3-24. REPAIR CLEAN FLUSH TANK ASSEMBLY. This task covers replacement of connector gaskets as described in paragraph 3-8.

3-25. REPAIR POLYELECTROLYTE TANK COMPONENTS AND COVERS. This task covers replacement of connector gaskets as described in paragraph 3-8.

3-26. REPAIR SEQUESTRANT TANK COMPONENTS AND COVERS. This task covers replacement of connector gaskets as described in paragraph 3-8.

All data on pages 3-51 and 3-52 deleted.

3-27. SERVICE TURBIDITY METER AIR DRYER. This task covers: (MODEL WTAO60ONLY) I
a. Inspection b. Service

INITIAL SETUP.

Materials/Parts:
Desiccant (Appx E, Sec II, Item 31)
Solvent (Appx E, Sec II, Item 32)

Equipment Condition:
ROWPU operating BUT air supply to turbidity meter air dryer shut-off.

INSPECTION.

Check condition of desiccant through sight glass window (1, Figure 3-11). If desiccant material color is pink, the desiccant must be changed.

SERVICE.

a. Shut off air supply by closing the turbidity meter block valve (2). With turbidity meter air control (3) open, wait approximately 4 minutes until pressure gage (4) and air flow indicator (5) read zero.
b. Unscrew clamp ring (6). Remove seal (7) and bowl (8) from air dryer head (13).

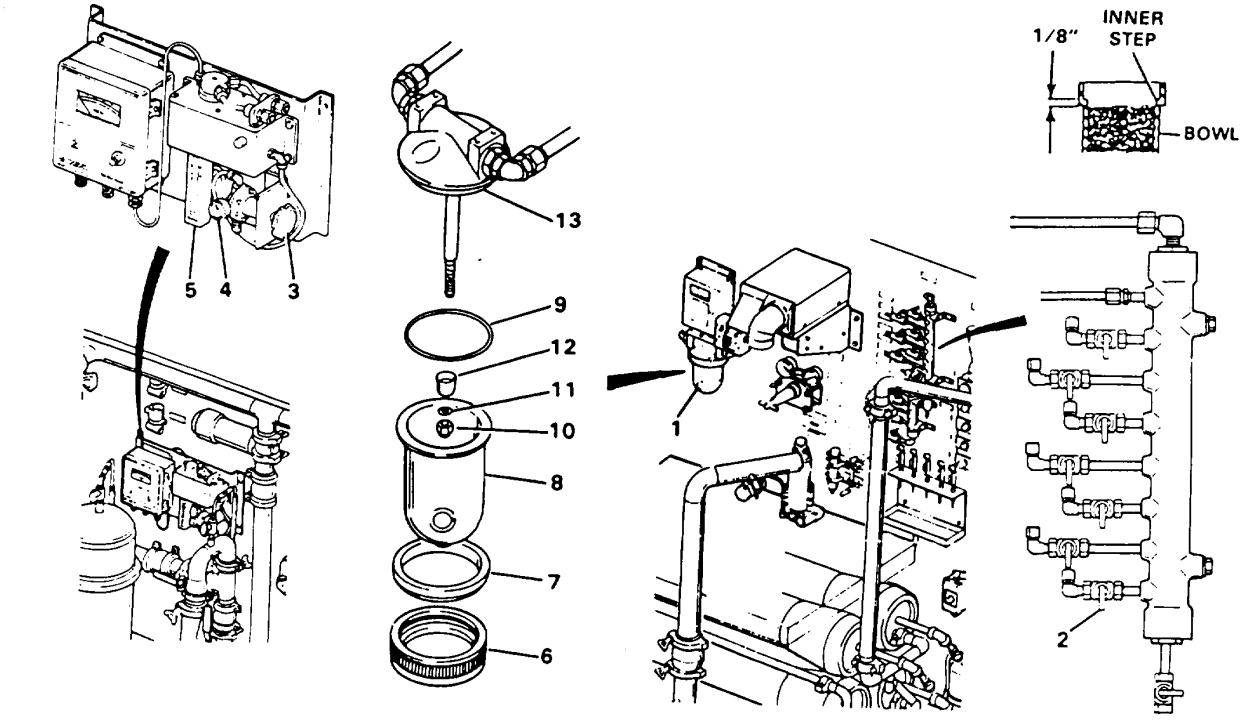


Figure 3-11. Service Turbidity Meter Air Dryer
(MODEL WT4A-06 ONLY)

c. Remove preformed packing (9).

d. Remove bowl with saturated desiccant and pour desiccant into suitable container and discard.

e. Unscrew acorn nut (10), preformed packing (11) and filter (12). Clean filter in solvent and dry.

f. Install filter (12), preformed packing(11) and acorn nut (10).

g. Fill bowl assembly(8) with new desiccant. Shake or tap bowl assembly (8) to settle desiccant. Add or remove until desiccant level is 1/8” below inner shoulder of bowl.

NOTE

Make certain window (1) in bowl (8) faces outward as shown.

h. Install new preformed packing (9) and bowl (8) to air dryer head (13) using clamp ring (6) and seal (7).

i. Open turbidity meter block valve (2).

j. Refer to paragraph 2-5 for procedures to return to normal operation.

3-28. REPLACE RO ELEMENTS. This task covers:

a. Removal. b. Repair. c. Installation.

INITIAL SETUP.

Tools, see Appx C, Sec Ill, Ref Code (No):
- Flat Tipped Screwdriver (51)
- 7/8 in. Socket (54)
- Wrench, Hex Key 1/4 in. (59)
- 9/16 in. Open End Wrench (60)
- 3/8 in. Ratchet Wrench (61)
- RO Element Pusher (Appx B, Sec Ill, Ref Code No. 14)

Materials/Parts:
- RO Elements (Appx E, Sec II, Item 36)
- Glycerin (Appx E, Sec II, Item 16)
- Suitable Tags
- Gloves (Appx E, Sec II, Item 43)
- Wood Block

Equipment Condition:
- ROWPU shutdown.
- Water drained from high pressure system.

Personnel Required: 2

General Safety Instructions:

WARNING

Observe specific Warnings and Cautions in the text.

WARNING

Before working on the RO elements, make certain that in-line pressure is relieved and drain valves (3 thru 9, Figure 3-12) are opened to drain the RO vessels and piping. Failure to do so could result in injury or death.

REMOVAL.

a. Make certain the valves in Figure 3-12 are in the following positions:

(1) System pressure control valve (1) — open.

(2) Product vent valve (2) — open.

(3) Product drain valves (3 thru 6) — open.

(4) Waste drain valves (7 thru 9) — open.

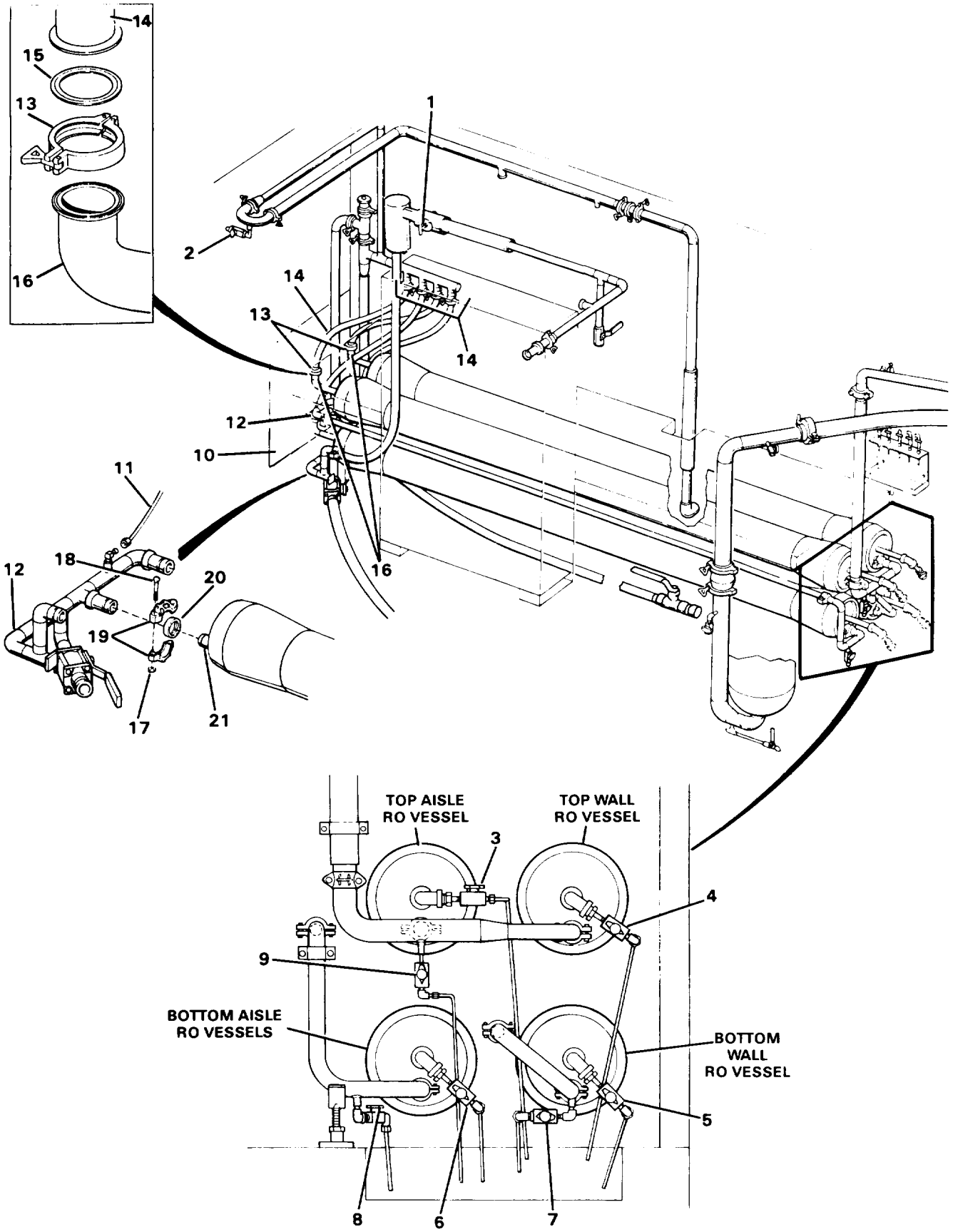


Figure 3-12. Valve and Piping Locations

NOTE

Procedures b thru p below are performed at generator end of the RO vessels starting with removal (from outside van) of access cover.

b. Remove the access cover (5, Figure 3-13) as follows:

(1) Loosen the threaded cable retainer (1) and slide the retainer and gasket (2) down the main power cable (3).

(2) Loosen the 1/4 turn latch screws (4) and remove access cover (5) while feeding the main power cable through the adapter (6).

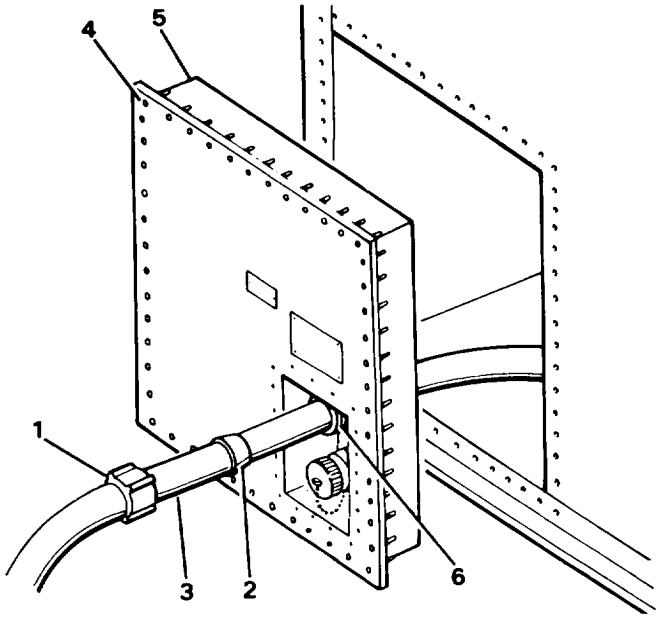


Figure 3-13. RO Access Cover (Generator End)

NOTE

If the diesel fuel line and 24 VDC cable are attached to the panel (5) they must also be removed to allow removal of the panel (4).

c. Working through the access port (10, Figure 3-1 2), disconnect the tube (11) from the piping (1 2).

NOTE

Tag hoses before removal.

d. Remove the tri-clamp(13) and move the hose (14) out of the way of the RO vessel ends.

e. Remove the gasket (15) from the end of the pipe (16).

f. Remove two nuts (17) and capscrews (18) from the clamp (19) and remove clamp and gasket (20). Reassemble clamp.

g. Repeat procedures d through f for the remaining three RO vessels

NOTE

Tag each of the eight cap head assemblies (6, Figure 3-14) to ensure installation into the same RO vessel from which it is removed.

h. Remove the three plastic screws (1, Figure 3-14) with hex key wrench.

i. Thread each of the three plastic screws (1), into securing ring (2) until finger tight. Alternately turn screws (1) with Allen wrench to remove securing ring (2).

j. Tap cap head assembly (6) gently and evenly with wood block until the locking rings are loose. Remove tapered locking ring section (3) and two square end locking ring sections (4 and 5).

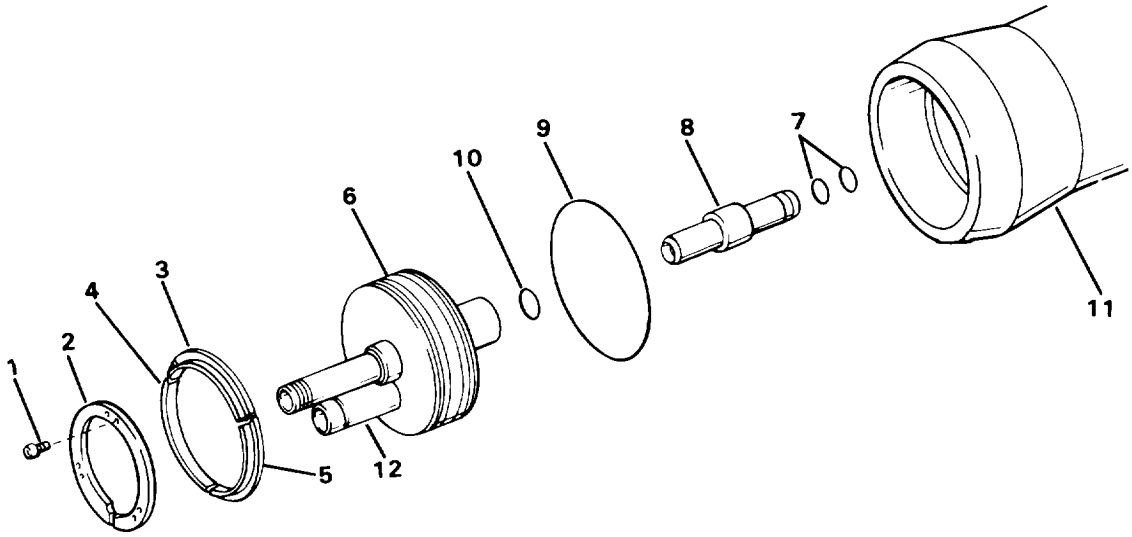


Figure 3-14. RO Cap Head

k. Pull cap head assembly (6) out of RO vessel (11) by grasping the cap head pipes and rocking the head up and down until it slides out.

NOTE

Occasionally, after a long period of service, the cap heads may be very difficult to remove. Perform step l.

l. Install clamp (6, Figure 3-15)on port (9) and use wood block as a pry bar to loosen the cap head assembly by prying against clamp and edge of vessel.

m. Remove seal (9, Figure 3-14) from cap head assembly (6).

n. Remove connector (8).

o. Remove two preformed packings (7) from connector (8).

p. Remove preformed packing (10) from inside diameter of cap head assembly (6).

q. Repeat procedure h thru p for remaining three RO vessels (11).

r. Move inside the van at chemical tank end of RO vessels. Tag piping (8, Figure 3-1 5) and drain tubes (2) to ensure proper installation.

s. Loosen nuts (1, Figure 3-15) from drain valves (3). Remove the drain tube (2).

t. Remove the four nuts (4) and capscrews (5) from two clamps (6)of upper vessel. Remove the clamps and gasket (7). Reassemble clamps.

u. Repeat step t for lower RO vessels.

v. Disconnect RO piping (8) from RO vessels and move piping out of the way of RO vessel end.

w. Remove the four cap head assemblies at this (chemical tanks) end of the RO vessels using the same procedures as described in steps h thru q above.

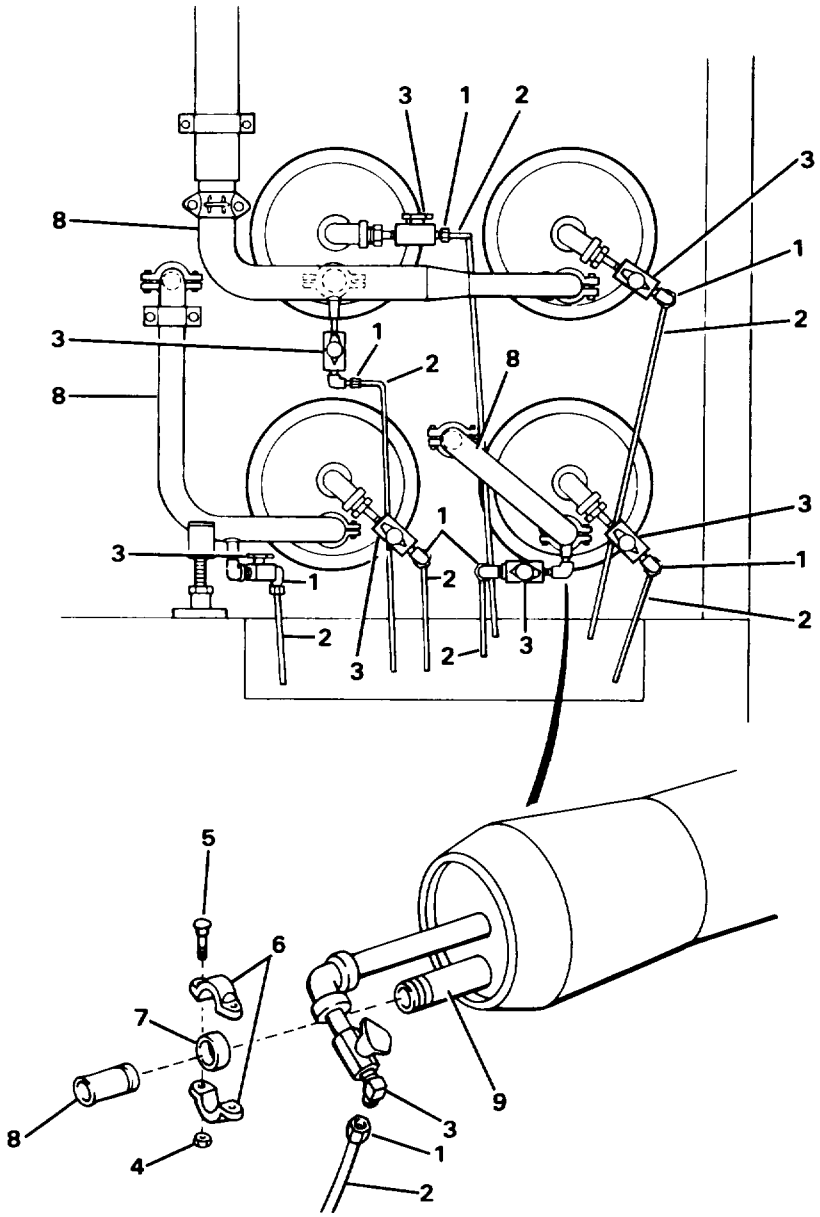


Figure 3-15. Piping and Drain Valves

WARNING

- When using RO element pusher (1, Figure 3-16) to remove RO elements, DO NOT shove elements forward with extreme force or rapid movement. It may cause serious injury to crew member at access port on generator end of RO vessels.
- Wear gloves when removing RO modules to prevent skin irritations from fiberglass.

NOTE

The following steps require two crew members, one should be positioned at access port outside the van; the other inside the van at chemical tank end of RO vessels.

NOTE

Remove all three elements from one vessel before proceeding to the next.

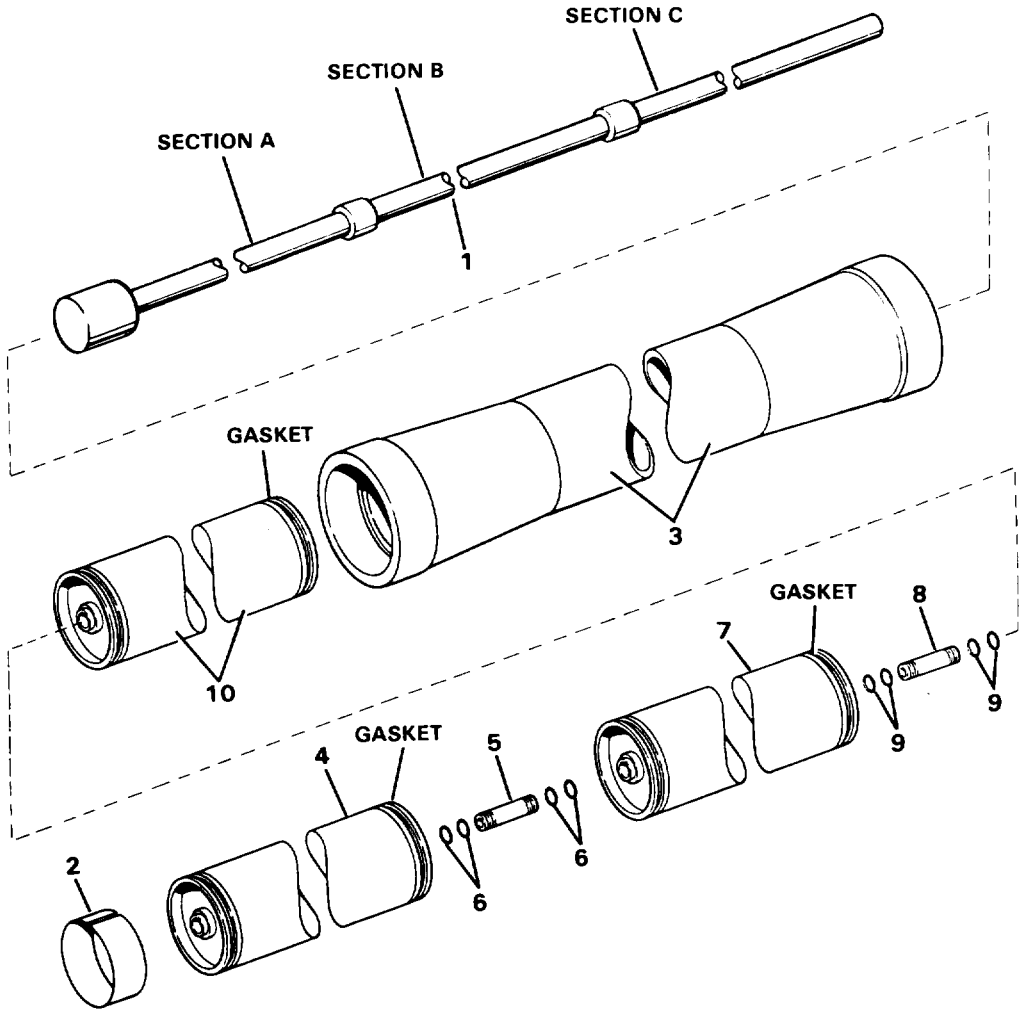


Figure 3-16. RO Element Removal

x. Using only section A of RO element pusher (1, Figure 3-1 6), slowly push RO elements toward access port. Stop pushing when spacer (2) reaches end of RO vessel (3). Remove spacer.

CAUTION

Do not allow weight of RO element to be supported by interconnections (5 and 8).

y. Continue pushing until first element (4) can be removed. Remove RO element (4).

z. Remove interconnector (5) and four preformed packings (6).

aa. Add section B to RO element pusher and remove second element (7). Remove interconnector (8) and four performed packings (9).

bb. Add section C to RO element pusher and remove third element (10).

cc. Repeat procedure x thru bb for remaining three RO vessels.

REPAIR.

a. Install new seals and replace damaged components.

b. Replace RO elements.

INSTALLATION.

NOTE
Begin this procedure at the access port at the generator end of the RO vessels.

a. Install spacer (2, Figure 3-16) into end of RO vessel (3).

CAUTION
Do not allow weight of RO elements to be supposed by interconnectors.

b. Lubricate seal (9, Figure 3-14) and preformed packing (10) with glycerin and install on cap head assembly (6). Be careful seal (9) is not twisted.

c. Install connector (8) into end of cap head assembly.

d. Lubricate preformed packings (7) and install on connector (8).

CAUTION
Pulling back on cap head assembly will damage or unseat seals.

e. Insert cap head assembly into RO vessel (11) with port (12) at 6 o'clock position. Push cap head assembly forward until it bottoms out. DO NOT pull back on cap head assembly.

f. Back plastic screws from securing ring until flush.

g. Install square end locking ring sections (4 and 5) with square ends together at 6 o'clock.

h. Install tapered end locking ring section (3). Hold in place.

NOTE
Securing ring must be positioned on inside diameter of assembled locking ring to ensure that locking ring sections stay in place.

NOTE
Plastic screws must be inserted through non-threaded holes on securing ring. Tighten with the T-bar Allen wrench until they bottom out. Do not overtighten. A "snug" fit is all that is required.

i. Place securing ring (2) into RO vessels (11) with notch at 6 o'clock Unthread screws and place into non-threaded holes

j. Fasten securing ring (2) to cap head assembly (6) with plastic screws (1).

k. Repeat procedures a thru j for each of the remaining three cap heads at access panel (generator end) of RO vessels.

l. Lubricate gasket (20, Figure 3-12) with glycerin. Position gasket (20) on port (21) with top half of clamp (19).

NOTE
Upper brine piping must be installed first.

m. Position piping (12) on port (21).

n. Place bottom half of clamp (19) over gasket (20) ensuring that clamp fits into groove and secure with two capscrews (18) and nuts (17).

NOTE

Product hoses are labeled "16" thru “19".

Connect product hoses as follows:

- **Hose “16" to RO vessel at top wall side (V54)**
- **Hose “17" to RO vessel at top aisle side (V55)**
- **Hose “18" to RO vessel at bottom wall side (V56)**
- **Hose "19" to RO vessel at bottom aisle side (V57)**

o. Lubricate gasket (15) with glycerin and position on pipe (16).

p. Position product hose (14) on product outlet pipe (16) and secure with tri-clamp (13).

q. Repeat steps l thru p for the remaining three RO vessels.

r. Connect tube (11) to piping (12).

s. Feed main power cable (3, Figure 3-13) through adapter (6) while installing access panel (5).

t. Secure access panel with 1/4 turn latch screws (4).

u. Push gasket (2) into adapter (6) and secure with threaded cable retainer (1).

NOTE

Begin the following procedures inside van at chemical tanks end.

NOTE

Sealing gaskets on RO elements must be inserted with gasket end toward chemical tanks end.

v. Making certain that RO element ends without gaskets go in first, insert first RO element (4, Figure 3-16) into RO vessel (3), leaving gasket extended from end of vessel. Lubricate gasket with glycerin.

w. Install four preformed packings (6) onto interconnector (5) and lubricate preformed packings (6) with glycerin.

x. Insert interconnector (5) into RO element (7) (at end without gasket) and push until interconnector bottoms out in RO element.

y. While holding RO element (4) in place, insert interconnector (5) into end of RO element (4). Push RO element (7) into vessel (3) leaving gasket extended from end of vessel. Lubricate gasket with glycerin.

z. Install four preformed packings (9) into interconnector (8) and lubricate preformed packings (9) with glycerin.

aa. Insert interconnector (8) into RO element (10) (at end with gasket) and push until interconnector bottoms out in RO element.

ab. While holding RO element (10) in place, insert interconnector (8) into end of RO element (7). Push RO element (10) into vessel (3), leaving gasket extended from end of vessel. Lubricate gasket with glycerin.

ac. After lubricating gasket, push RO element (10) into vessel (3) until assembled elements bottom out.

ad. Repeat steps b thru j for remaining three RO vessels to install cap head assembly.

ae. Repeat steps v thru ac for remaining three RO vessels.

af. Lubricate gasket (7, Figure 3-15) with glycerin and position gasket on lower ports (9) with top half of clamp (6).

ag. Position lower piping (8) on lower ports (9).

ah. Install bottom half of clamp (6) around gasket (7) making certain that clamp halves fit into grooves. Secure with capscrews (5) and nuts (4).

ai. Repeat steps af thru ah for upper RO vessels.

aj. Reconnect drain tubes (2) to drain valves (3, Figure 3-15), as tagged during removal procedure.

ak. Connect each drain tube to fittings on drain valves and secure with nuts (1, Figure 3-15) at end of tubing.

3-29. SERVICE NBC FILTER. This task covers:

a. Service.

INITIAL SETUP.

Materials/Parts:
Ion exchange resin (Appx E, Sec II, Item 20)
Activated carbon (Appx E, Sec II, Item 13)
Wiping rags (Appx E, Sec II, Item 58)

Equipment Condition:
ROWPU shutdown to standby (para. 2-18).
NBC filter set-up for nuclear decontamination mission (para. 2-33).

General Safety Instructions:

WARNINGS

- When deployed on an NBC decontamination mission, protective gear, appropriate MOPP level, as approved by the supervisor will be worn.
- Avoid skin contact with spent NBC filter media. Use protective gear with mask. Failure to do so could result in death.

SERVICE.

a. If empty, request ion exchange resin and activated carbon from unit maintenance.

(1) Empty eleven containers of ion exchange resin (35 Ibs. each) into the filter.

(2) Empty nine containers of activated carbon (35 Ibs. each) into the filter on top of the resin.

(3) Wipe the flange surface and gasket clean, close the filter cover (1, Figure 3- 17), and tighten the clamps (2).

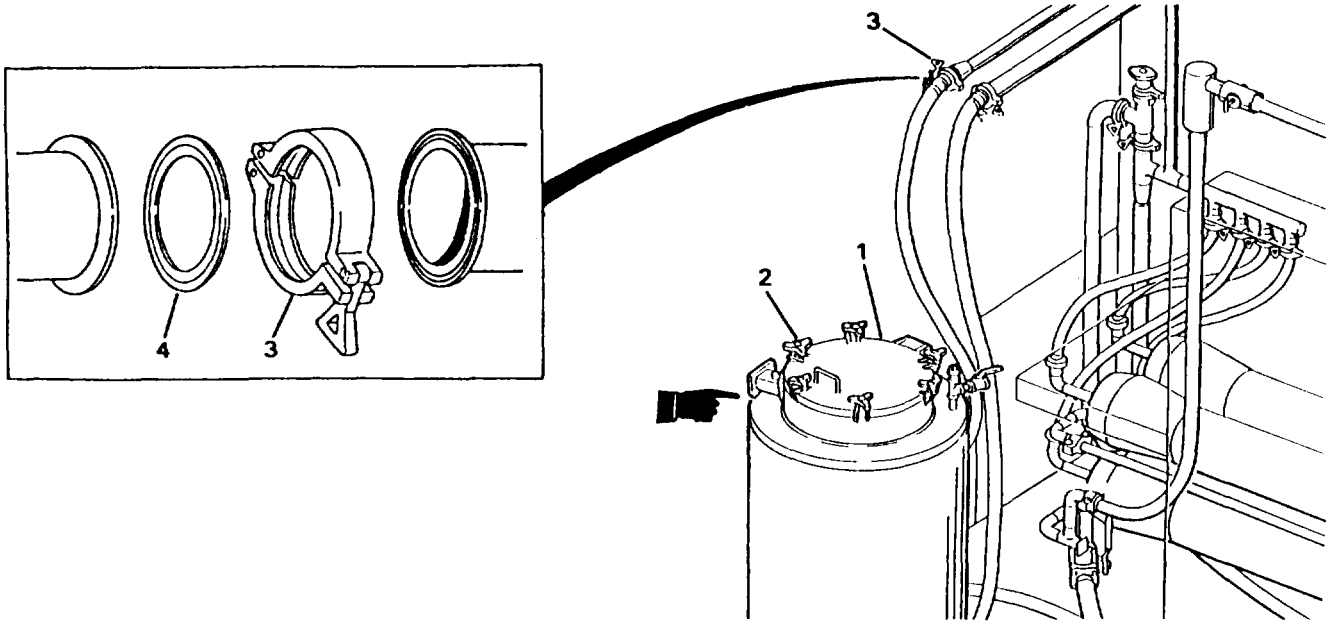


Figure 3-17. Service NBC Filter

3-30. REPAIR NBC FILTER HOSES. This task covers replacement of connector gaskets for tri-clamp connectors.

a. Unscrew tri-clamp (3, Figure 3-17) and remove clamp.

b. Separate hose from piping and remove gasket (4).

c. Wipe flange surfaces and clean gasket.

d. Install gasket (4) and position hose on piping.

e. Install and tighten tri-clamp (3).

3-31. SERVICE OUTLET AIR FILTER. This task covers service:

a. Removal. b. Installation.

INITIAL SETUP.

Tools:
Strap wrench (Appx C, Sec Ill, Item 62)

Materials/Parts:
Filter, Outlet (Appx E, Sec II, Item 40)

Equipment Condition:
COMPRESSOR ON/OFF switch in OFF position.

General Safety Instructions:
Observe specific Warning in text.

REMOVAL.

a. Be certain COMPRESSOR OFF/ON switch (3) is OFF.

WARNING

The air manual blowdown valve must be bled (opened) before removing the filter top plug. Failure to do so will result in the cap being blown off which could cause serious injury.

NOTE

Make certain air tank valve is closed.

b. Open air manual blowdown valve (1) to release air pressure. Leave open.

NOTE

Do not turn vent knob on top of plug.

c. Unscrew plug (2). Remove and throw away old filter (5).

INSTALLATION.

a. Install new filter (5) and reinstall top plug (2)

b. Close air manual blowdown valve(1).

c. Air storage valve (4) open.

d. Turn COMPRESSOR OFF/ON switch (3) ON. Notify unit maintenance if compressor malfunctions.

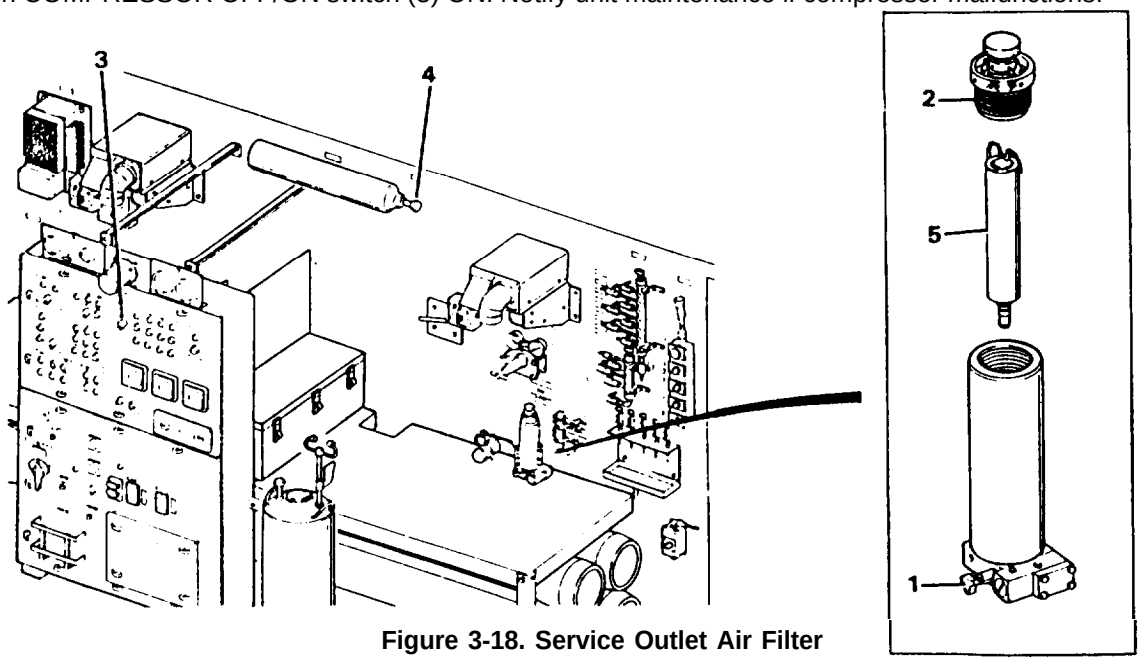


Figure 3-18. Service Outlet Air Filter

3-32. REPAIR WASTE WATER HOSES AND ADAPTERS. This task covers repair of hoses by replacement of gaskets as described in paragraph 3-8.

3-33. SERVICE AIR COMPRESSOR ASSEMBLY. This task covers:

a. Inspection. b. Service.

INITIAL SETUP.

Materials/Parts:
Filter, Inlet (Appx E, Sec II, Item 39)
Lubricating Oil (Appx E, Sec II, Item 52)

Equipment Condition:
COMPRESSOR OFF/ON switch (14, Figure 2-4) is OFF.
COMPRESSOR ON green light (9) is not lit.
HIGH PRESSURE PUMP STOP switch (22) is pressed.
HIGH PRESSURE PUMP ON (13) green light is not lit.

General Safety Instructions:

WARNING

Do not work on the inlet filter or check air compressor oil level when either the air compressor or high pressure pump are running. Noise level inside high pressure pump assembly cover could cause deafness.

INSPECTION.

a. Check condition of switches and green lights.

b. Unscrew the inlet filter cover (1, Figure 3-19) from housing (2).

c. Remove the spring (3), seal (4), filter element (5), and seal (6) from the housing (2).

d. Check condition of spring(3), and seals (4and6). If cut or damaged, request replacements from unit maintenance and replace at next filter element replacement interval.

e. Check oil level dipstick (7). Oil should be between marks at bottom of dipstick.

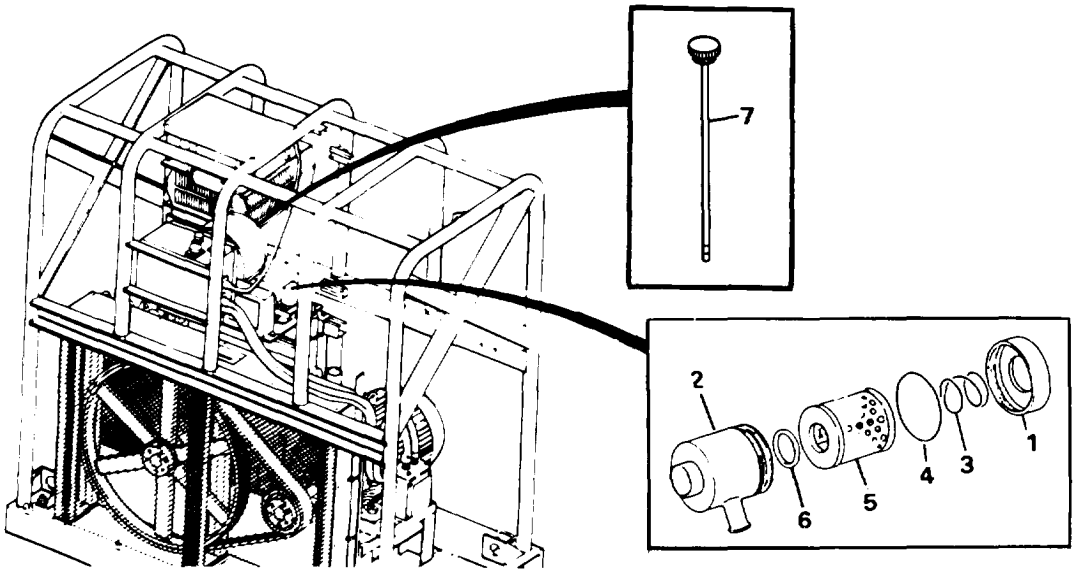


Figure 3-19. Air Compressor

SERVICE.

a. Add oil to obtain level near (but below) upper mark on dipstick.

b. Install new filter element (5).

c. If worn or damaged, replace spring (3) and seals (4 and 6), otherwise reinstall existing parts.

d. Install cover on housing, securely hand tighten.

3-34. SERVICE HIGH PRESSURE PUMP ASSEMBLY. This task covers:

a. Inspection. b. Service.

INITIAL SETUP.

Materials/Parts:
Lubricating Oil (Appx E, Sec II, Item 52)

Equipment Condition:
COMPRESSOR OFF/ON switch (14, Figure 2-4) is OFF.
COMPRESSOR ON green light (9) is not lit.
HIGH PRESSURE PUMP STOP switch (22) is pressed.
HIGH PRESSURE PUMP ON (13) green light is not lit.

General Safety Instructions:

WARNING

Do not work on the high pressure pump assembly when either the air compressor or high pressure pump are running. Noise level inside high pressure pump assembly cover could cause deafness.

INSPECTION.

a. Check oil level in high pressure pump sight gage (1, Figure 3-20).

b. Level should be at least at mid-point on gage.

c. Check for water leaks.

d. Check for milky looking oil.

SERVICE.

a. Remove oil add plug (2).

b. Add oil at plug port until sight gage (1) gives mid level reading.

c. Replace plug (2).

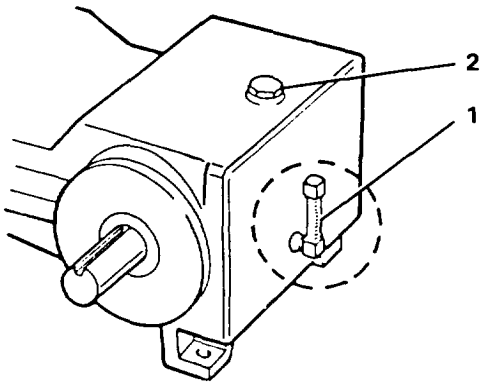


Figure 3-20. High Pressure Pump Oil Level

3-35. REPAIR DISTRIBUTION ADAPTER AND PRODUCT SHUT OFF VALVE (1, Figure 3-21). This task covers replacement of gaskets as described in paragraph 3-8.

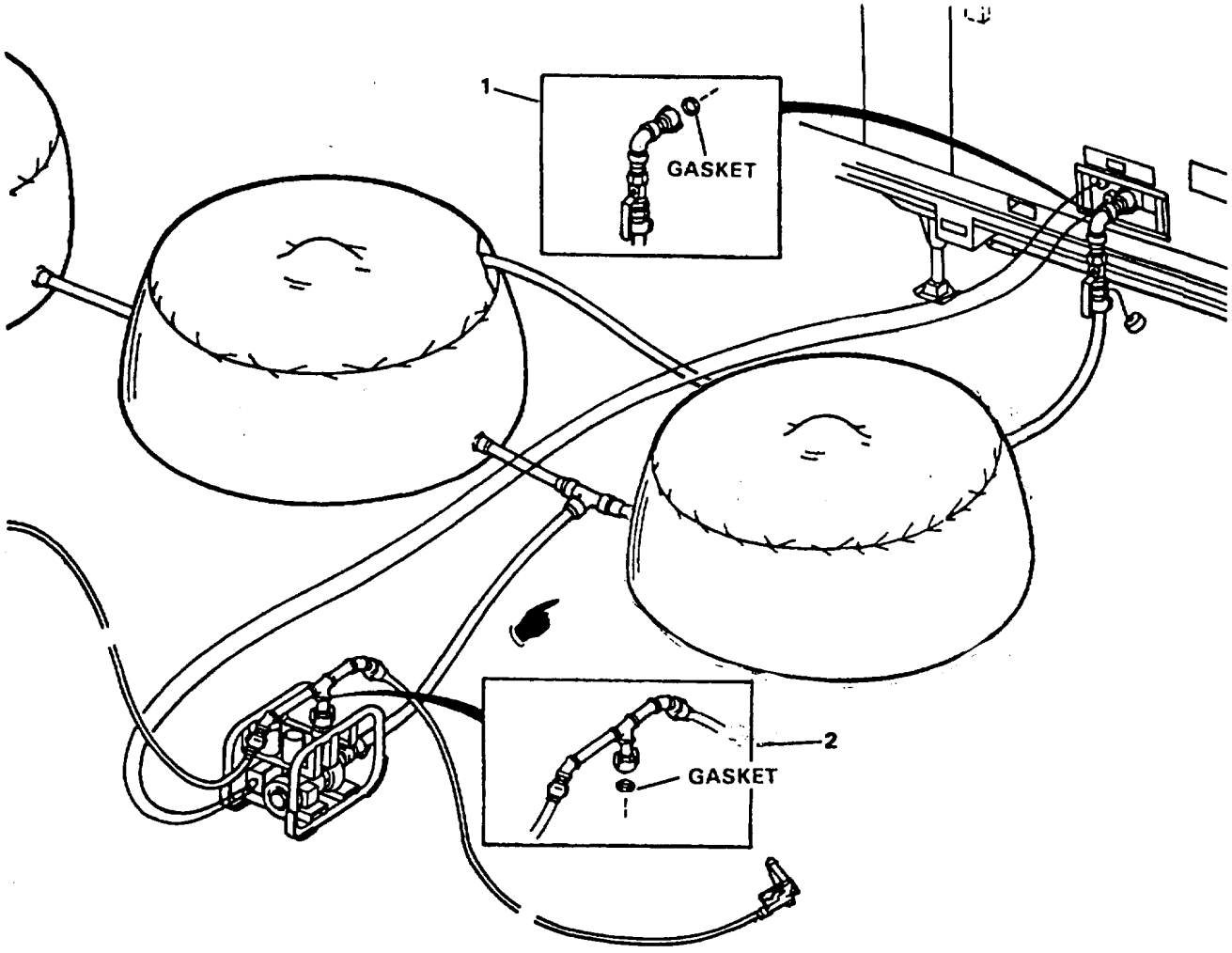


Figure 3-21. Distribution System, Piping, Hoses, Tees, and Adapters

3-36. REPAIR DISTRIBUTION HOSES, TEES, AND PIPING (2, Figure 3-21). This task covers replacement of gaskets as described in paragraph 3-8.

3-37. REPAIR DISTRIBUTION PUMP ASSEMBLY. This task covers replacement of connector gaskets and, cleaning and drying distribution pump electrical connectors in accordance with paragraph 3-9.

3-38. REPAIR HEAT LAMP ASSEMBLIES. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Tools:
Screwdriver from storage box no. 2

Materials/Parts:
Lamp 500 watt (Appx E, Sec II, Item 47)

Equipment Condition:
Heat lamp cable (1, Figure 3-22) disconnected from outlet at van.

General Safety Instructions:

WARNING

Lamp bulb that has been on will burn skin. Wait until lamp cools and use suitable cloths when performing maintenance to avoid being burned.

REMOVAL.

a. Refer to Figure 3-22 and loosen three wing nuts (2), pivot wing nuts and studs (3) off frame (10).
b. Swing cover (4) off frame (10).
c. Remove lens (5).
d. Depress clamps (6) with screwdriver and remove bulb (7) by pulling straight out of connector (8).

INSTALLATION.

a. Install bulb (7) by pressing it into connector (8).
b. Install lens (5) on positioning washer (9). Swing lens cover (4) into place, pivot studs (3) with wing nuts (2) onto frame (10) and tighten wing nuts (2).

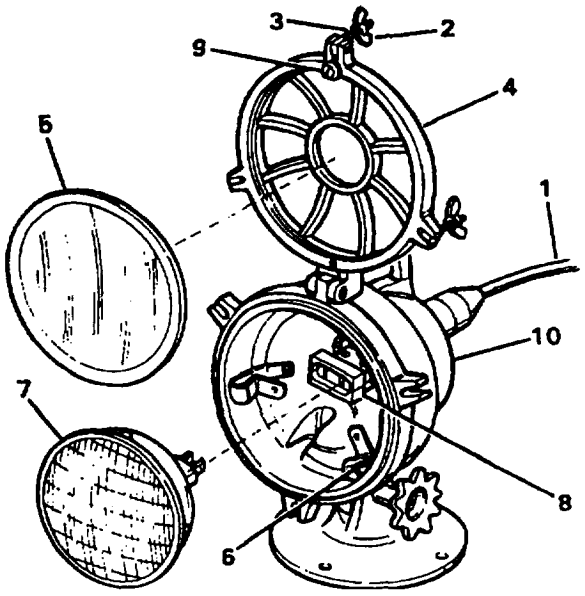


Figure 3-22. Heat Lamp

3-39. TESTING CARBON MONOXIDE MONITOR. This task covers:

a. Testing.

INITIAL SETUP.

Tools:
Test Kit, Carbon Monoxide (Appx B, Sec Ill, Item 17)

Equipment Condition:
Any powered condition

WARNING

Inhalation of carbon monoxide can cause serious illness or death.

TESTING.

a. Install the sensor zero cap (1, Figure 3-23) from the carbon monoxide monitor test kit in the sensor inlet on the CO monitor.

b. Wait approximately 1-1/2 minutes or until there is a stable reading on the display (3).

c. Display should read 0. If not, notify unit maintenance.

d. Remove sensor zero cap(1).

e. Install calibration adapter (4) on sensor inlet.

f. Install flow control (6) on calibration gas bottle (7). Connect tubing (8) between flow control (6) and calibration adapter (4).

g. Open flow control (6) by turning valve (9) counterclockwise until it stops. As CO concentration increases on display, check that alarm 1 alarms at 25 and alarm 2 alarms at 50. After 1-1 /2 minutes the value shown on the display should read 60. If it differs by more than ± 3, or if alarms do not alarm at the correct point ± 3, call unit maintenance.

WARNING

Make sure the zero or calibration plugs are not left on the sensor inlet fitting at the end of the calibration procedure, otherwise the sensor cannot sample the atmosphere for carbon monoxide.

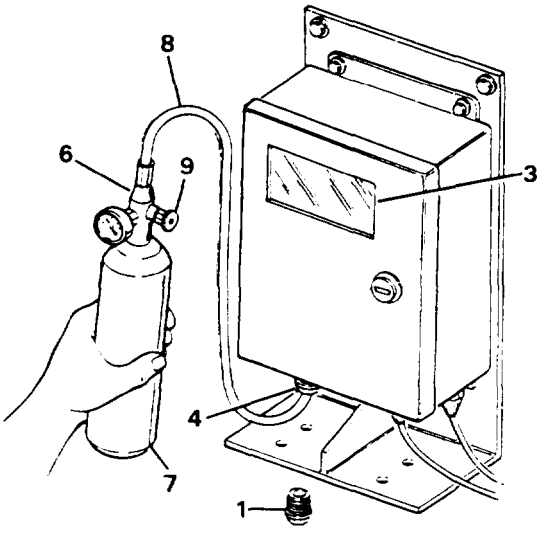


Figure 3-23. Testing Carbon Monoxide Monitor

SECTION IV. MAINTENANCE OF AUXILIARY EQUIPMENT

3-40. Complete maintenance procedures for GFE is included in manuals as follows:

Trailer TM5-6115-545-12
Generator TM9-2330-358-14
Storage Tanks . . . . . TM5-5430-225-12&P

3-41. Maintenance of the chain hoist is covered in paragraph 2-14.

CHAPTER 4. UNIT MAINTENANCE INSTRUCTIONS

SECTION I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT. Refer to Appendix B, Section II, Maintenance Allocation Chart for tool reference usage.

4-2. SPECIAL TOOLS, TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE), AND SUPPORT EQUIPMENT. Special tools are listed in Appendix B, Section Ill.

4-3. REPAIR PARTS. Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL, TM 10-4610-232-24P) covering unit maintenance for this equipment.

SECTION II. SERVICE UPON RECEIPT

4-4. SERVICE UPON RECEIPT.

a. *General.* This section contains the information necessary for unit maintenance personnel to be sure that the ROWPU is ready for use.

b. *Site and Shelter Requirements.* When not in use, the ROWPU, with the exception of temperature sensitive items, does not require special siting or shelter. If shelter is available, storing the ROWPU under cover will minimize routine maintenance. Refer to para, 1-11 for storage temperature limitations. For site and shelter requirements during operation, refer to para. 2-13.

c. *Unpacking.*

(1) Unload ROWPU (para. 2-14).

(2) Remove the sealing material from exhaust pipes on heaters and packing material from heaters.

(3) Remove any packing material from the air compressor.

(4) Remove any packing material from the electrical heater.

(5) Remove sump drain sealing material.

(6) Remove generator sealing material to include, but not limited to, the following:

(a) Transport packaging.

(b) Air cleaner sealing tape.

(c) Generator sealing tape.

(d) Any other packing material as listed in TM 5-6115-545-12.

(e) Tie down cables, if installed.

(7) Remove any installed bracing/blocking for the RO pressure vessels.

(8) Remove any blocking between the ROWPU van and high pressure pump assembly.

d. *Checking Unpacked Equipment.*

(1) Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage in accordance with DA PAM 738-750.

(2) Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA PAM 738-750.

(3) Check that NBC media is in NBC tank. Fill if empty (para. 2-33).

(4) Check that media filter has media in it and that the level is at 10-14 inches as shown in para. 3-23.

(5) Check to see whether the equipment has been modified.

e. Preliminary Servicing and Adjustment of Equipment.

(1) Check warnings at the front of this manual.
(2) Lubricate the ROWPU using lubrication order LO 10-4610-232-12.
(3) Adjust bolt tension and align motor sheaves on the high pressure pump (para. 4-81).
(4) Adjust belt tension and align motor sheave on the air compressor (para. 4-78).
(5) Check charge on fire extinguisher. Replace if necessary (para. 4-23).
(6) Service eyewash station (para. 3-15).
(7) Fill the 5 gallon water container with potable water.
(8) Open the cartridge filter top and check that filters are installed. Install filters, if missing (para. 4-44).
(9) Check that air compressor inlet filter is installed. Install if missing (para. 3-33).
(10) Check that air compressor outlet filter is installed. Install if missing (para. 3-31).
(11) Check serviceability of turbidity motor air dryer (para. 3-27). (MODEL WTA-060 ONLY)
(12) Check shelf life on chemicals in ROWPU. Replace as necessary.
(13) Check shelf life on ship loose chemicals. Replace as necessary.
(14) Install RO elements (para. 3-28).
(15) Service generator, install batteries and bolts. Refer to TM 5-6115-545-12.
(16) Service trailer. Refer to TM 9-2330-358-14 or TM 9-2330-385-14&P.

f. Deprocessing Unpacked Equipment.

(1) Check that generator support brackets are torqued to 99 ft-lbs.
(2) Check high pressure pump assembly mounting straps for tightness, wear, cracking or chafing. Replace as necessary.
(3) Remove desiccant from main control panel.
(4) Check and secure trailer/van bolster locks.
(5) Repack the ROWPU. Refer to para. 2-28 for procedures.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-5. **GENERAL.** Preventive Maintenance Checks and Services (PMCS) means systematic caring, inspecting, and servicing of equipment to keep it in good condition and to prevent breakdowns. As the ROWPU'S maintainer, your mission is to:

a. Always do your PMCS in the same order, so it gets to be a habit. Once you've had some practice, you'll quickly spot anything wrong.

b. Do your MONTHLY PMCS once a month.

c. Do your SEMI–ANNUAL PMCS every six months.

d. Do your ANNUAL PMCS one a year.

e. Do your HOURS PMCS after the number of hours of operation listed in the table.

f. Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any faults that you discover, unless you can fix them. You DO NOT need to record faults that you fix.

4-6. **PMCS PROCEDURES**

a. Your Preventive Maintenance Checks and Services, Table 4-1, lists inspections and care required to keep your ROWPU in good operating condition. It is set up so you can make your checks as you walk around the ROWPU.

b. Checks and Services are numbered in chronological order regardless of interval. This column is used as a source of item number for the "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

c. The "INTERVAL" column of Table 4-1 tells you when to do a certain check or service.

d. The "PROCEDURE" column of Table 4-1 tells you how to do required checks and services. Carefully follow these instructions. If you do not have tools, or if the procedure tells you to, notify your supervisor.

WARNING

Terms "ready/available" and "mission capable" refer to same status: Equipment is on hand and ready to perform its combat missions. (See DA Pam 738-750)

e. The "EQUIPMENT IS NOT READY/AVAILABLE IF:" column in Table 4-1 tells you when your ROWPU is nonmission capable and why the ROWPU cannot be used.

f. If the ROWPU does not perform as required, refer to Chapter 4, Section IV, Troubleshooting.

g. If anything looks wrong and you can't fix it, write it on your DA Form 2404. IMMEDIATELY, report it to your supervisor.

h. When you do your PMCS, you will always need a rag or two. Following are checks that are common to the entire ROWPU:

(1) Keep It Clean. Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed.

(2) Rust and Corrosion. Check ROWPU body and frame for rust and corrosion. If any bare metal or corrosion exists, clean, and apply a thin coat of oil. Report it to your supervisor.

(3) Bolts, Nuts, and Screws. Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, but look for chipped paint, bare metal, or rust around bolt heads. If you find a bolt, nut, or screw you think is loose, tighten it or report it to your supervisor.

(4) Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.

(5) Electric Wires and Connectors, Look for cracked, frayed, or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors. Report any damaged wires to your supervisor.

(6) Hoses and Fluid Lines. Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to your supervisor.

4-6.1 **CLEANING AGENTS**

WARNING

- DO NOT use diesel fuel, gasoline, or benzene (benzol) for cleaning.
- DO NOT SMOKE when using cleaning solvent. NEVER USE IT NEAR AN OPEN FLAME. Be sure there is a fire extinguisher nearby and use cleaning solvent only in well-ventilated places. Flash point of solvent is 138°F (60°C).
- USE CAUTION when using cleaning solvents. Cleaning solvents evaporate quickly and can irritate exposed skin if solvents contact skin. In cold weather, contact of exposed skin with cleaning solvents can cause frostbite.

a. Treating Mildewed Areas. Canvas that has mildewed can be cleaned by scrubbing with a dry brush. If it is necessary to use water to remove dirt, it should not be used until mildew has been removed. After removing mildew, examine fabric. Look for evidence of deterioration. If canvas has deteriorated, it should be replaced.

WARNING

Use only those authorized cleaning solvents or agents listed in Appendix E.

b. Cleaning Rust or Grease. When cleaning grease buildup or rusty places, use a cleaning solvent. Then apply a thin coat of light oil to affected area.

4-6.2 **LEAKAGE DEFINITIONS FOR PMCS.** It is necessary for you to know how fluid leakage affects the status of the ROWPU. Following are types/classes of leakage you need to know to be able to determine the status of the ROWPU. Learn these leakage definitions and remember-when in doubt, notify your supervisor.

WARNING

Use only those authorized cleaning solvents or agents listed in Appendix E.

- Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.
- Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

• When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

• Class Ill leaks should be reported immediately to your supervisor.

a. CLASS I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

b. CLASS II - Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

c. CLASS Ill - Leakage of fluid great enough to form drops that fall from item being checked/inspected.

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Mission Capable If:
			NOTE Ensure crew has performed operator PMCS.	
1.	Monthly	External Electrical Panels for Distribution Pump, Raw Water Pump and Utility Box.	Check desiccant (para. 4-33 to 4-35). If color has changed from pink to blue, change desiccant pack.	
2.	Monthly	Automatic Control Valves	Check all valves for signs of corrosion and water leakage by removing/replacing orange cap.	
3.	Monthly	High Pressure Pump Assembly	Check stable levels for damage, and observe for unusually high noise level in ISO Container.	Any damage to stable level is observed or excessive noise level in ISO container is present.
4.	Monthly	Air Compressor Assembly	Check belt adjustment (para. 4-78).	Cannot be adjusted between 3.7 and 5.4 pounds.
5.	Monthly	Carbon Monoxide Monitor	Check by performing test in para. 3–39, then 4-63, for proper adjustment.	Correct readings cannot be obtained.
6.	Monthly	Generator	Check that torque for generator to trailer mounting is 99 Ft Lbs.	Any mounting bolt is missing or unable to be torqued.
7.	Monthly	Air System	Check outlet air filter for white water or oil sludge buildup (para. 3-31).	

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Mission Capable If:
8.	Semi-Annual	Raw Water Pump) Frame, Cyclone Separator Frame and Distribution Pump Assembly	Check for loose and missing hardware and rigidity of assembly by manually grasping and shaking the frame. Check for unusual vibration, broken welds and bent rails.	Any component is damaged, loose, missing or broken.
9.	Semi-Annual	Van Panels, Electrical	a. Check van panel external electrical panels for water leakage and loose mountings (para. 4-33 to 4-35).	
			b. Remove threaded connectors. Check for corroded, burnt or missing pins and inserts.	Any pin or insert severely burnt, missing or corroded.
			c. Check MOVs for damage and continuity.	No continuity exists.
10.	Semi-Annual	External Cable Assemblies COEI and Bll)	a. Check for cuts, cracks, dry rot and damaged connectors.	Any cable has dry rotted insulation that will expose wires or shorting.
			b. Inspect for corroded, burnt, loose or missing cable pins and inserts.	Any cable damaged or missing and no replacement.
			c. Check connector boots for signs of looseness and water resistance in and on connector. Seal with silicone sealant as required (Appendix E).	
11.	Semi–Annual	High Pressure Pump Assembly	a. Check for missing, loose or damaged drive belt guard hardware and straight edge.	
			b. Check for loose or missing hardware and rigidity of assembly by manually shaking the frame. Check for unusual vibration, broken welds and bent rails. Check tie down straps for damage and dry rot. Replace tie down straps every two years.	Any component is broken, loose, missing or damaged
			c. Check pump and motor pulleys for wear, cracks and damage.	Any pulley damaged or missing.

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Mission Capable If:
			d. Check drive belt for cracks, rays or breaks.	Belt is broken, cracked to the belt fiber, has more than one crack (1/8th inch in depth or 50 percent of belt thickness), has frays more than 2 inches long or excessive play (stretched).
			e. Check belt adjustment (para. 4-81).	Cannot be adjusted between 8 and 13 lbs.
			f. Drain oil and check for metal particles on magnetic plug and milky condition.	Oil is milky or has metal particles.
			g. Replace oil, check that filler cover is tight and breather is not clogged.	Breather unserviceable.
			h. Check electrical connector box and cables for tightness and proper mounting. Inspect for corroded, burnt, loose or missing cable pins and inserts.	Any cable connection, pin or insert is damaged or missing.
12.	Semi–Annual	Air Compressor Assembly	a. Check drive belt and fan guards for missing, broken, loose or damaged hardware and screens.	
			b. Check for loose or missing hardware and rigidity of assembly by manually shaking the frame. Check for unusual vibration, broken welds and bent rails.	Any component is broken, loose, missing or damaged.
			c. Check fan and sheaves for wear, cracks and damage.	Any sheave or fan damaged, cracked or missing.
			d. Check drive belt for cracks, hardness, frays and breaks.	Belt is broken, cracked to the belt fiber, has more than one crack (1/8th inch in depth or 50 percent of belt thickness), has frays more than 2 inches long or excessive play (stretched).

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Mission Capable If:
			e. Check air compressor valve efficiency. Vent air pressure to 0 psi and close all vent/drain air valves. Start compressor and time it until it stops. Make sure no air is being used in the ROWPU. A run time of 1 hour indicates good operation. One to two hours indicates increasing valve wear. Over two hours indicates excessive wear and direct support should be informed to change air compressor valves.	Compressor runs over two hours.
			f. Check compressor cylinder fins for cracks, damage and cleanliness.	Any cylinder fin crack extends into cylinder housing.
			g. Drain oil and check for metal particles on magnetic plug and milky condition.	Oil is milky or has metal particles.
			h. Replace oil and check that dipstick is tight and breather is not clogged.	Breather is unserviceable.
			i. Check electrical connector box and cables for tightness and proper mounting. Inspect for corroded, burnt, loose or missing cable pins and inserts.	Any cable connection, pin or insert is damaged.
			j. Check for leaks in air lines and interstage relief valves.	Any line or valve leak or unserviceable part is found.
			k. Check fan belt for tension and wear.	Fan belt is worn or damaged.
13.	Semi–Annual	Metal Oxide Varistor (MOV) Junction Box	a. Check electrical connector box and cables for damage, tightness and proper mounting.	Any cable connection, pin or insert is damaged.
			b. Check for burnt, damaged, loose or missing cable pins, inserts and wires.	Any connector, pin, insert, screw or wire damaged, burnt or missing.
			c. Check for damage and continuity of MOVs.	No continuity exists.
14.	Semi-Annual	Electric Heater	a. Check for loose or missing mounting screws. Check for damage inserts.	Any screw missing or insert unserviceable (Cold weather operations only).

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Mission Capable If:
			b. Check cable connector, pins, inserts, wires and screws for burnt, damaged, loose or missing parts.	Connector, pin, insert, screw or wire damaged, missing or burnt (Cold weather operations only).
			c. Check inside housing for cleanliness and insects.	
15.	**Semi-** Annual	Booster Pump and Cover	**NOTE** Must perform tasks in paragraphs 4-42 and 4-43 for checks.	
			a. Check electrical connector box and cables for tightness and proper mounting.	Any cable connection, pin or insert damaged.
			b. Check cable pins, inserts and wires to screw connectors for burnt, damaged, loose or missing parts.	Any connector, pin, insert, screw or wire damaged, burnt or missing.
			c. Check for loose screws and mounts on pump motor and between pump and motor.	Any bolt loose causing excessive vibration.
			d. Check cover for damaged dampening insulation, loose or missing mounting hardware.	
16.	Semi-Annual	Media Filter Air Blanket Level Indicator	a. Check for filter media in tubings from the media filter to the indicator assembly. Clean tubes if any media is found (Para. 4-52).	
			b. Check for media in the indicator assembly. Disassemble indicator and clean if any media found.	
			c. Test the three switches for continuity after resetting all flags to white (para. 4-52).	Top switch shows continuity. Middle and bottom switches do not show continuity.
17.	Semi–Annual	Media Filter	Check for loose or damaged components and hardware. Check for leaks.	Any component damaged or leaking that will allow NBC contamination.
18.	Semi–Annual	Diesel Heaters and Thermostats	a. Check all components for loose hardware, wires and fuel lines. Check for fuel leaks.	Any fuel leaks.

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Mission Capable If:
			NOTE The electrode should be centered and not arc burnt.	
			b. Clean and inspect igniter.	
			c. Remove and clean the fuel filer float bowl screen, cover and bowl (para. 4-61).	
			d. Clean or replace the fuel romps, filters and gaskets (para. 4-61).	
			e. Check all exhaust pipes and connections for signs of leaks black powder).	
			f. Adjust the carburetors and thermostats (para. 4-60).	
19.	Semi-Annual	Control Panel and Boxes	**WARNING** **High voltages in equipment can cause serious injury or death. Be certain all power is removed before performing inspection or checks.**	
			a. Check all wiring harness connectors for damage, corrosion, and looseness. Check connector boots for sealing (para. 4-27 through 4-32).	Any connector, pin, insert or boot missing or damaged.
			b. Open the control panel and boxes and check:	
			(1) Wiring harnesses and terminal boards for damage, corrosion, pitted terminals, loose screws, broken wires, dirt and foreign matter.	Any harness or board damaged or screw missing.
			(2) Circuit breakers, control relays, switches, lamps, resistors and transformers for damage, corrosion, pitted terminals, loose screws, broken wires, dirt and foreign matter.	Any component with damage, broken wire or screw missing.
			(3) All gaskets for proper installation or damage.	

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Check Or Service	Procedure	Not Mission Capable If:
			(4) Inside compartments for signs of water leakage. (5) Latches operation, tight door closures and loose mounting hardware.	
			(6) Loose or missing doors/cabinet ground connections. c. Check for loose mounting screws on panel and boxes. d. Inspect for loose or missing ground wire and mount screw from main control panel to back wall.	Any ground strap or strap mount screw missing. Ground wire or wire mounting screw missing.
20.	Semi Annual	Generator Set, 60 Kw	Perform unit level PMCS in accordance with TM5-6115-545-12 or TM9-6115-645-10.	Any fault listed in the Not Mission Capable column of the generator TM.
21.	Semi Annual	Storage Tanks, 3,000 Gallon	Perform unit level PMCS in accordance with TM5-5430-225-12&P. **NOTE** **The following checks and services must be performed by DS maintenance personnel. They must be scheduled by Unit TAMMS clerk or maintenance supervisor and work request submitted to supporting DS or TMDE shop.**	Any fault listed in the Not Mission Capable column of the storage tank TM.
22.	Semi Annual	Trailer, 22.5 Ton	Perform unit level PMCS in accordance with TM9-2330-358-14 or TM9-2330-386-14&P.	Any fault listed in the Not Mission Capable column of the trailer TM.
23.	12,000 Hours	Butterfly Valves	Replace valve liners in the manual, automatic, cartridge filter block, feed and cleaning bypass valves (para. 4-47).	
24.	Semi Annual	Air System	Notify DS maintenance to pressure test the air storage tank.	
25.	Semi Annual	Flowmeter	Notify DS maintenance to check accuracy of flowmeters.	Any flowmeter fails accuracy.
26.	Annual	Generator	Notify DS maintenance to replace generator mount noise pads.	
27.	Annual	Pressure Gages	Notify DS to check accuracy of all pressure gages.	Any pressure gage fails accuracy test.

Table 4-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Check Or Service	Procedure	Not Mission Capable If:
28.	Annual	Control Panel	Check control panel pressure cannot switch actuation point.	Correct activation cannot be obtained.
29.	Annual	Diesel Heaters	a. Notify DS maintenance to remove excess carbon from heater burner head.	
			b. Notify DS maintenance to check heater blower motor bushes and clean blower motor assemblies with compressed air.	
30.	2,500 Hours	Raw Water Pump Assembly	Notify DS maintenance to replace mechanical seal in pump and inspect pump for internal wear.	
31.	2,500 Hours	High Pressure Pump Assembly	Notify DS maintenance to replace valve disks and check valve seat for wear.	
32.	2,500 Hours	Flowmeter Sending Units	Notify DS maintenance to check paddles and pins on the three units for damage, wear and ease of rotation.	
33.	5,000 Hours	High Pressure Pump Assembly	Notify DS maintenance to replace plunger packing and inspect plungers for wear.	
34.	5,000 Hours	Cyclone Separator Assembly	Notify DS maintenance to inspect separator lines for wear.	
35.	10,000 Hours	Air Compressor	Notify DS maintenance to replace air compressor assembly high pressure air relief valve.	
36.	10,000 Hours	Air System	Notify DS maintenance to replace air system low pressure relief valve.	
37.	20,000 Hours	Raw Water Pump Assembly	Notify DS maintenance to replace motor bearings.	
38.	20,000 Hours	Air Compressor	Notify DS maintenance to replace motor bearings.	
39.	20,000 Hours	Distribution Pump Assembly and Booster Pump	a. Notify DS maintenance to replace mechanical seals in the pumps and inspect pumps for internal wear. b. Notify DS to replace motor bearings.	

SECTION IV. TROUBLESHOOTING

4-7. INTRODUCTION. Table 4-2 lists common malfunctions during operation and maintenance which require unit maintenance level personnel to perform maintenance and checks of the ROWPU or its parts.

4-8. TROUBLESHOOTING CHART. The troubleshooting chart lists Malfunction, Test or Inspection, and Corrective Actions. Tests, inspections, and corrective action should be made or taken in the order listed.

SYMPTOM INDEX

Table 4-2. Unit Troubleshooting Guide

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ROWPU ASSEMBLY.

1. ROWPU leaks oil.
   (a) If air compressor assembly leaks oil, notify direct support maintenance.
   (b) If high pressure pump assembly leaks oil, notify direct support maintenance,
2. ROWPU leaks air.

WARNING

Make certain COMPRESSOR ON/OFF switch is turned OFF and the bleed valve at the side of the compressor has been opened to relieve pressure before changing outlet filter or working on compressor. Serious injury could result if this is not done.

NOTE

Use soapy water to detect leaks.

NOTE

The air compressor is a low volume high pressure air compressor. It does not take a big air leak to cause air system problems. Find and repair all leaks for best performance.

Isolate air leaks.

(a) If low pressure air manifolds leak, replace manifold (para. 4-68).
(b) If low pressure air valve leaks, replace valve (para. 4-68).
(c) If low pressure air tubing fittings or tubing leaks, repair (para. 4-24).
(d) Replace tubing that leaks, tighten fittings (para. 4-24).
(e) If high pressure air pipe line tubing, fittings, or piping leaks, notify direct support maintenance.
(f) If high pressure air regulator leaks, notify direct support maintenance.
(g) If air compressor relief valves leak, notify direct support maintenance.
(h) If air dryer leaks, replace air dryer (para. 4-67).
(i) If low pressure air solenoid valves leak, repair or replace (para. 4-51).
(j) If high pressure solenoid valve leaks, notify direct support maintenance.
(k) If high pressure relief valve leaks, notify direct support maintenance.
(l) If high pressure switch leaks, notify direct support maintenance.
(m) If air reservoir tank or shutoff valve leaks, notify direct support maintenance.
(n) If low pressure air relief valve leaks, notify direct support maintenance.
(o) If outlet air filter assembly leaks, notify direct support maintenance.
(p) If air compressor assembly leaks, notify direct support maintenance.
(q) If turbidity panel air system leaks, repair leaking components (paras. 4-50 and 4-58). **(MODEL WTA-060 ONLY)**
(r) If automatic valves leak at side vent fittings, replace the appropriate air solenoid valves (para.4-47).

3. ROWPU control panel will not power up.
   Step 1. Check connections between generator and ROWPU.
   Tighten loose connections.
   Step 2. Check that generator voltage is 440 VAC on all three phases.
   (a) If voltage is not present on all phases, refer to generator maintenance manual TM 5-61 15-545-12.
   (b) If voltage is present, the generator control panel is properly set up, and the control panel is properly set up, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

4. Excessive noise or vibration during ROWPU operation.

CAUTION

Make certain booster pump and raw water pump are running to avoid damage to the high pressure pump.

Locate the source of the noise or vibration by momentarily shutting down each motor and pump.
(a)I[f noise or vibration is isolated to the generator, refer to generator maintenance manual, TM 5-6115-545-12.
(b) If noise or vibration is isolated to a pump or motor, refer to the troubleshooting that covers the noisy assembly.

5. An automatic valve works properly but water (or chemical solution) leaks through it when closed.
Adjust valve/actuator positioning setscrew. (See automatic valve troubleshooting for adjustment.)
If leak cannot be stopped by adjustment, replace valve (para. 4-47).

6. Any pump is suspected of not supplying enough water or of low pressure output.
Check that the pump rotation is correct.
Rewire the pump motor if the pump rotation is wrong. Refer to electrical troubleshooting.

7. Media or debris is found in the bottom RO vessels at the generator end.
Inspect waste out check valve for proper operation or wear.
Replace check valve if defective (para. 4-45).

RAW WATER PUMP ASSEMBLY.

1. Raw water pump is noisy.
Check mounting hardware.
(a) If loose, tighten.
(b) If pump is still noisy, replace pump and motor assembly (para. 4-15).
(c) Check the inlet strainer for damage because a damaged strainer may allow foreign objects to enter the suction hoses.

2. Raw water pump assembly leaks.
Step 1. Check the motor shaft and pump casing for leaks.
Replace the pump and motor assembly if leaks are present in these areas (para. 4-15).
Step 2. Check the piping for leaks.
Repair by tightening or by removing and putting teflon tape on the threads (para. 4-14).
Step 3. Check the inlet flapper valve for leaks by filling the pump with water.
(a) If leaking, tighten the inlet flapper mount hardware (para. 4-16).
(b) Replace inlet flapper if leak cannot be stopped (para. 4-16).

3. Raw water pump runs but will not prime.
Step 1. Check the inlet flapper valve.
If it does not move freely, replace the valve (para. 4-16).
Step 2. Actuate the prime assist pump (para. 2-17b).
If air does not come out the discharge end of pump, replace the prime assist pump (para. 4-18).
Step 3. Check for leaks by filling the pump with water.
(a) If the drain valve leaks, tighten/replace drain valve (para. 4-14).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

(b) If the piping leaks, repair the leaks (para. 4-14).
(c) Replace the pump and motor assembly (para. 4-15).

4. Raw water pump requires priming after every shutdown.
Step 1. Check inlet flapper valve housing, pump valves, and piping for tightness.
Tighten/repair loose components or pipe fittings (paras. 4-14 and 4-16).
Step 2. Check for leaks by filling the pump with water.
(a) If the drain valve leaks, replace it (para.4-14).
(b) If the inlet flapper valve leaks, replace it (para.4-16).
(c) If, during inlet flapper replacement, the inlet flapper seat is found to be damaged, replace/repair the suction flange (para. 4-16).
(d) If there is a leak in the pump shaft area or in the pump casing, replace the pump and motor assembly (para. 4-15).
(e) Replace inlet flapper valve (para. 4-16).

5. Raw water pump motor hums but doesn't turn.

CAUTION

If the pump has been subjected to freezing conditions, make sure that the pump does not have ice in it. Warm it thoroughly.

Check ease of rotation of pump. Turn motor fan by hand.
(a) If the motor turns easily, refer to raw water pump electrical troubleshooting.
(b) If the motor turns hard or not at all, replace the pump/motor assembly (para. 4-15).

6. Raw water pump does not deliver sufficient flow or pressure to operate ROWPU.
Step 1. Check that operator has correctly performed troubleshooting for this problem.
Step 2. Check raw water pump rotation. It should be clockwise from the fan end.
If rotation is wrong, rewire motor by interchanging the T1 and T2 leads in the motor junction box (para. 4-15).
Step 3. Test raw water pump. Start the pump and let it run until water is flowing out of the ROWPU waste hose. Close the cartridge filter block valve and read the pressure on the media filter pressure gage.
If the pressure is less than 35 psig (276 kPa) on the black needle, replace the raw water pump and motor assembly (para. 4-15).
Step 4. Check cyclone separator performance.
If a heavy stream of water is coming from the waste hoses and the ROWPU shuts down on low pressure, check hoses and piping for plugging.
Step 5. Check raw water pump suction hoses for plugging by holding them up to the light and looking for a collapsed liner.
Replace any damaged hoses (para. 4-12).
Step 6. Check cyclone separator vortex finders for plugging.
Remove outlet flanges from separators (para. 4-20). If the gasket shows signs of being compressed and out of round, replace the gaskets (para. 4-20).
Step 7. Refer to malfunction 8 under booster pump troubleshooting for additional checks to locate the problem.
If the above checks have not isolated the problem, replace the raw water and pump/motor assembly (para. 4-15).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

SEPARATORS. **(MODEL WTA-060 ONLY)**

1. Separator leaks at inlet or outlet flange.
   Check flanges for tightness. Tighten flange capscrews evenly and in small increments until leak stops.
   (a) If the inlet flange continues to leak, replace separator (para. 4-20).
   (b) If the outlet flange continues to leak, remove the flange and replace the vortex finder gaskets (para. 4-20).
   (c) Inspect vortex finders for damage and replace as necessary.
   (d) If the leak is coming from the capscrew(s), remove capscrew and put pipe thread sealant on the threads (para. 4-20).
2. Separator leaks at piping joints.
   Isolate leaks.
   Repair leaks (para. 4-19).
3. Water leaks through separator waste hoses when ROWPU is shut down.
   Replace separator outlet check valve (para. 4-19).
4. Separator leaks at body flange joints.
   Check for hardware tightness.
   Tighten as necessary, if leaks continue, notify direct support maintenance.
5. No wastewater flow from separator hoses.
   Step 1. Check raw water pump rotation. It should be clockwise from the fan end.
   If rotation Is wrong, rewire motor by interchanging the T1 and T2 leads in the motor junction box(para. 4-15).
   Step 2. Test raw water pump. Start the pump and let it run until water is flowing out of the ROWPU waste hose.
   Close the cartridge filter block valve and read the pressure on the media filter pressure gage.
   (a) If the pressure is less than 35 psig (276 kPa), replace the raw water pump and motor assembly (para. 4-15).
   (b) If the pump is working properly, remove the bottom of the separator (para. 4-20) and clean out any sand or debris that may be clogging the separator.
6. No raw water discharge flow from separators.

CAUTION

If operating in freezing conditions, be sure separators are not filled with frozen water. Warm up the separators before assuming they are plugged.
Remove the separator discharge piping (para. 4-19) and start the raw water pump (para. 2-17).
   (a) If there Is no flow from the separator outlet, replace the separator (para. 4-20).
   (b) If there Is flow through the separator, replace the separator outlet check valve (para. 4-19).

Table 4-2. Unit Troubleshooting Guide

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

SEPARATOR. (MODEL ROWPU-1 ONLY)

1. Separator leaks at piping joints.
   Isolate leaks.
   Repair leaks (para. 4-20.1).

2. Water leaks through separator waste hoses when ROWPU is shut down.
   Replace separator outlet check valve (para. 4-20.1).

3. No wastewater flow from separator hose.
   Step 1. Check raw water pump rotation. It should be clockwise from fan end.
   If rotation is wrong, rewire motor by interchanging the T1 and T2 leads in the motor junction box (para.4- 15).
   Step 2. Test raw water pump. Start the pump and let it run until water is flowing out of the ROWPU waste water hose.
   Close the cartridge filter block valve and read the pressure on the media filter pressure gage.
   (a) If the pressure is less than 10 psig (79 kPa), replace the raw water pump and motor assembly (para 4-15).
   (b) If the pump is working properly, remove the waste hose from the bottom of the separator (para. 4-20.1) and clean out any sand or debris that may be clogging the separator.

4. No raw water discharge flow from separator.

CAUTION

If operating in freezing conditions, be sure separator is not filled with frozen water. Warm up the separator before assuming they are plugged.

Remove the separator raw water outlet hose from the separator and start the raw water pump (para 2-17).
If there is no flow from separator outlet, replace the separator (para. 4-20.1).

BOOSTER PUMP

1. Booster pump leaks.
   Isolate leak.
   (a) If the pump piping connections or drain valve leaks, repair the leak (para. 4-43).
   (b) If the pump leaks at the shaft or at case flanges, replace the pump and motor assembly (para. 4-43).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. Booster pump noisy.
Step 1. Check mounting hardware.
Tighten, if loose.
Step 2. Check the filter pressure gages.
(a) If the gages show normal operating pressures (the ROWPU is operating as if nothing was wrong), replace the booster pump and motor assembly (para. 4-43).
(b) If the gages are at or near 0 psig (0 kPa) and the system is in "NORMAL" mode, notify direct support maintenance to troubleshoot the feed low pressure switch for correct operation.
(c) If the gages are at or near 0 psig(0 kPa), the system is in "NORMAL" mode, and the forward flush valve IS open, troubleshoot the raw water pump for "low flow, low pressure" (malfunction 6).
(d) If the gages are at or near 0 psig(0 kPa)andthe system is in "CLEAN" mode, notify direct support maintenance to troubleshoot, in order, the feed low pressure switch, clean/flush tank low level switch, and the clean/flush tank valve for correct operation until the problem is found.
(e) If the gages are at or near 0 psig (0 kPa), the system is in "BACKWASH" mode, and the raw water pump is running, troubleshoot the raw water pump for "low flow/low pressure''(malfunction 6).
(f) If the gages are at or near 0 psig (0 kPa) and the system is in the last phase of backwashing, troubleshoot the clean/flush tank low level switch (malfunction 7 in level switch troubleshooting) and the clean/flush tank outlet valve (malfunction 16 in automatic valve troubleshooting.
Step 3. Remove inlet piping from booster pump and check for foreign objects (para. 4-43).
(a) Remove foreign objects, if present.
(b) Replace booster pump/motor assembly (para. 4-43).

3. Booster pump continues to run when raw water is not supplied to the ROWPU.
Check operating conditions.

NOTE

This situation can occur if the media filter has an air blanket and the raw water pump is shut down or stops running for some reason. The air blanket slowly drops in pressure and the booster pump will keep running until the pressure drops far enough to trip the feed low pressure switch. There is no problem as long as the booster pump shuts down when the pressure drops to about 7 psig (48 kPa).

If the pump does not shut down, notify direct support maintenance to troubleshoot the feed low pressure switch.

4. Booster pump is started in "CLEAN" mode, but no pressure is observed at the cartridge filter gage.
Step 1. Check that booster pump is running by opening the access panel and observing pump.
If the pump is not running, refer to booster pump electrical troubleshooting (malfunction 6).
Step 2. Operate ROWPU in "NORMAL" mode. Check pressure gages for operation.
(a) If the gages don't show pressure, notify direct support maintenance.
(b) If the gages are operating correctly, check the cleaning bypass piping and the clean/flush tank outlet piping for plugging (para. 4-45).

5. Booster pump does not shut down when running off of the clean/flush tank and the tank is empty.
Visually observe if the clean/flush tank low level light and the feed pressure low light on the control panel are lit.
(a) If the clean/flush tank low light is not lit, refer to level switch troubleshooting (malfunction 7).
(b) If the clean/flush tank low light is lit, notify direct support maintenance to troubleshoot the clean/flush tank low level control circuits.
(c) If the feed pressure light is lit, notify direct support maintenance to troubleshoot the low feed pressure shutdown circuits.
(d) If the feed pressure light is not lit, notify direct support maintenance to troubleshoot the feed low pressure switch.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. Booster pump is started in "CLEAN" mode but ROWPU shuts down on low feed pressure when the high pressure pump is started.
   Check inlet of booster pump for clogging.
   Remove object clogging pump (para. 4-43).

7. Booster pump motor hums but won't turn.

WARNING

Death or injury may result if the booster pump circuit breaker is not turned off before performing the next step.

Remove access panel and turn shaft between pump and motor.
(a) If the shaft turns, refer to booster pump electrical troubleshooting (malfunction 4).
(b) If the shaft will not turn, there is a foreign object in the pump housing. Replace the pump and motor assembly (para. 4-43).

CAUTION

If the unit is operating in cold weather conditions, the pump may have ice in the impeller due to not being drained. Use an external pump heater to thaw the pump out.

8. Booster pump does not deliver enough pressure or feed flow to operate ROWPU.
   Step 1. Check pump for operation. Remove access cover and visually check that pump is running.
   If pump is not running, refer to booster pump electrical troubleshooting (malfunction 1, 2, 5, or 6).
   Step 2. Refer to "high pressure pump" troubleshooting (malfunction 14).
   Step 3. Check the booster pump inlet for plugging.
   (a) Remove object plugging pump.
   (b) Replace the booster pump (para. 4-43) if troubleshooting done in Step 2 and raw water pump troubleshooting indicates that the booster pump is the only item left that could cause the problem.

NOTE

When deciding to replace booster pump, take into account that 90% of the problems that cause these symptoms are related to the raw water system which takes the most abuse and the raw water pump in particular, as it will wear away internally due to sand erosion. The wear that causes these problems only shows up when the pump is operating at full flow rate or during disassembly.

BASKET STRAINER.

Basket strainer plugged light is on and strainer is clean or, basket strainer plugged light has not come on and strainer is plugged.
Operate the unit and determine that the malfunction is true.
Notify direct support maintenance to troubleshoot the strainer differential pressure switch circuits.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CLEAN/FLUSH TANK.

Clean/flush tank low level alarm is on and tank water level is higher than the bottom flange. Problem only occurs when high pressure pump is running.

Check high pressure pump stable levels.

(a) Increase air pressure in all four stable levels equally until tank vibrations cease to cause an alarm (para. 2-15).

(b) If the tank low level alarm keeps alarming, refer to level switch troubleshooting (malfunction 7).

MEDIA FILTER AIR BLANKET LEVEL INDICATOR.

1. Media filter air blanket level chamber is plugged (flags won't move).

Step 1. Check tubing lines connected to the level chamber.

Remove and clean out tubing lines, if plugged (para. 4-52).

Step 2. Check level chamber.

(a) Remove bottom of chamber and clean chamber (para. 4-52).

(b) Replace float if it is damaged (para. 4-52).

Step 3. Check float for magnetism by holding a steel object near it.

Replace float if no magnetic effect is shown (para. 4-52).

Step 4. Check flag assembly.

(a) Remove flag assembly and float from level chamber and slide the float up and down the flag assembly (para. 4-52).

(b) Replace flag assembly if the flags don't move (para. 4-52).

2. Flags stick (not all flags turn).

Step 1. Check flag assembly clamps.

Loosen clamps until flags turn.

Step 2. Check operation of flags by removing the flag assembly and float and running the float up and down the assembly (para. 4-52).

Replace flag assembly if all the flags don't turn (para. 4-52).

MEDIA FILTER.

1. MEDIA FILTER PLUGGED light IS on at pressure differential less than 20 psi (138 kPa) or, is not on at a pressure greater than 30 psi (207 kPa).

Operate unit and determine that malfunction is true.

Notify direct support maintenance to troubleshoot media filter differential pressure switch circuits.

2. Media filter output is greater than 5 NTU after reconditioning and backwash.

Step 1. Check inline turbidity monitor.

Refer to para. 2-5 and adjust the meter to the correct setting. Recheck media filter outlet turbidity after adjusting meter.

Step 2. Check portable turbidity meter.

(a) Refer to para 2-6 and adjust the meter to the correct setting. Recheck media filter outlet turbidity after adjusting meter.

(b) If both turbidity meters are indicating correctly, replace the filter media (para. 4-53).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

When the media has been changed the filter *must* be backwashed at a reduced flow rate until the media has been in water for 24 hours or it will flush out of the filter. Inform the operators to backwash at a maximum flow rate of 50 gpm during the 24 hour period.

Step 3. Check the media that is removed from the filter.

(a) If the media is sticky or has a lot of mud on it, disassemble the backwash air solenoid and check valve and clean them out (paras. 4-45 and 4-51).

(b) Observe the next backwash and watch the air regulator high pressure gage during the air cycle portion of the backwash. It should drop in pressure by 300-400 psig (2067-2756 kPa). If it doesn't, troubleshoot the backwash air circuit for electrical operation and for plugging of the air tubing, backwash solenoid valve, backwash check valve, and media filter backwash air manifold. (Refer to media filter electrical troubleshooting, malfunction 5.)

3. Media filter pressure drop exceeds 15 psig (103 kPa) after reconditioning and backwash.

Step 1. Check that media filter pressure gage is accurate.

(a) Remove pressure from system and note that the gage reads zero and that both the black and red needles read the same (are on top of each other).

(b) Inform direct support maintenance to replace the gage if it is inaccurate.

NOTE

Operation can continue until the gage is replaced, if the difference in readings of the gage, with no pressure on it, are subtracted from the reading obtained when operating and the result indicates a pressure drop of less than 15 psig (103 kPa).

(c) If the pressure drop is greater than 15 psig(103 kPa), replace the filter media (para. 4-53).

NOTE

When the media has been changed the filter *must* be backwashed at a reduced flow rate until the media has been in water for 24 hours or it will flush out of the filter. Inform the operators to backwash at a maximum flow rate of 50 gpm during this period.

Step 2. Check the media that is removed from the filter.

(a) If the media is sticky or has a lot of mud in it, disassemble the backwash air solenoid and check valves and clean them out (paras. 4-45 and 4-51).

(b) Observe the next backwash and watch the air regulator high pressure gage during the air cycle portion of the backwash. It should drop in pressure by 300-400 psig. If it doesn't, troubleshoot the backwash air circuit for electrical operation and for plugging of the air tubing, backwash solenoid valve, backwash check valve, and media filter backwash air manifold. (Refer to electrical troubleshooting.)

4. Media filter drain sump has media in it.

Check to see if the filter has too much media (para. 3-23) in it or if the filter has been drained down manually and the upper media drain valve was left open after the raw water pump was started for backwash.

(a) If the problem is due to too much media in the filter, it will stop when enough media is lost and the media level is correct.

(b) If the problem is due to manual draindown for backwash, troubleshoot media filter air blanket (malfunction 1).

(c) If the problem is not in the air blanket system, notify direct support maintenance to troubleshoot media filter backwash circuits.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

5. Media filter is plugged and water will not flow through it.

NOTE

This typically would only happen in a cold weather situation where the filter has not been drained properly and then frozen.

Check media filter for ice build up.

Apply heat to filter until ice melts.

6. Media filter won't drain.

WARNING

To prevent injury to personnel, relieve all pressure on filter before proceeding.

Step 1. Check drain valves.

Remove valves and clean the insides. Clean out piping that attaches to valves (para. 4-53).

Step 2. Check vent valve.

Remove valve and clean out the inside. Clean out the tubing and fittings that attach to the valve (para. 4-53).

7. Media filter depth is low.

Add additional media (para. 4-53).

CARTRIDGE FILTER.

1. Cartridge filter outlet turbidity same as inlet turbidity.

Step 1. Check filter vessel bottom plate for cracks.

Replace filter if cracks are found (para. 4-44).

Step 2. Check for loose filter seats on the bottom plate.

Replace the cartridge filter vessel if loose seats are found (para. 4-44).

Step 3. Check media filter outlet turbidity with portable turbidity meter at item 4, Table 2-5. If reading is 0.5-2.0 NTU, particles may be too small for cartridge filtering.

Replace the cartridge filter if the inlet turbidity is greater than 4 and the outlet is the same (para. 4-44).

2. Large or sudden amount of media in the cartridge filter.

Step 1. Remove and check media filter inlet valve for blockage (para. 4-45).

Clean out the four holes in the valve disc (para. 4-47).

Step 2. Check operation of "NORMAL" and "BACKWASH" cycles.

(a) Clean the media out of the cartridge filter and operate unit in "NORMAL" and "BACKWASH" cycles.

If there is little or no media in the cartridge filter, have the operators monitor future operation as a check to see that it does not reoccur.

(b) If after the above operation, there is a large amount of media in the cartridge filter, notify direct support maintenance to replace media filter.

3. CARTRIDGE FILTER PLUGGED light is on at a differential pressure less than 12 psi (83 kPa), or, is not on and the differential pressure is greater than 20 psi (138 kPa).

Operate the unit and determine that malfunction is true.

Notify direct support maintenance to troubleshoot cartridge filter differential switch circuits.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

4. Cartridge filter cover leaks.
   Step 1. Check flanges on filter vessel and cover for warping, cracks or out of round.
      (a) Replace cover if any damage is found (para. 4-44).
      (b) Replace vessel if any damage is found (para. 4-44).
   Step 2. Check the clamp T-bolts for damaged threads or stripping.
      Replace damaged T-bolts (on-board spares) (para. 4-44).

5. Cartridge filter won't drain or drains very slowly.
   Remove the cartridge filter drain valve and tubing.
      (a) Remove anything plugging the valve or tubing (para. 4-44).
      (b) Replace tubing if it can't be cleaned out (para. 4-44).
      (c) Clean out the tubing that is attached to the filter bottom until water flows freely out of the filter (para. 4-44).

PRESSURE GAGES.

1. Pressure gages are inaccurate, do not zero, or do not indicate pressure.
   Step 1. Check valve positions.
      Make sure all manual valves are positioned properly (Table 2-16) and only the media filter inlet and outlet automatic valves are open (system "NORMAL" operation).

NOTE

All pressure pickup points are only active during SYSTEM NORMAL operation. Certain points are not active during SYSTEM CLEAN or BACKWASH due to valve positioning.

   Step 2. Check gage for malfunctions.
      Notify direct support maintenance.

2. Pressure gages leak.
   Isolate leaks.
      Notify direct support maintenance to replace gages or repair leaks.

3. High pressure gage fluctuates.
   Visually inspect gage.
      Notify direct support maintenance.

4. Media or cartridge filter pressure gages fluctuate.
   Visually inspect gages.
      Notify direct support maintenance.

FEED LOW PRESSURE SWITCH.

1. Feed pressure low light is not on and the feed pressure is 3 psig (21 kPa) or less, or, light is on and the feed pressure is 10 psig (69 kPa) or higher.
   Operate unit and determine malfunction is true.
      Notify direct support maintenance to troubleshoot feed low pressure switch circuits.

All data on page 4-23 deleted.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

PORTABLE TURBIDITY METER.

1. Meter does not respond when sample is set into the well.
   - *Step 1.* Check the battery.
     - If the battery is dead; replace the battery and charge the new battery (para. 4-91).
   - *Step 2.* Check the lamp.
     - (a) If the lamp is burnt out, replace the lamp and adjust meter (paras. 4-91 and 2-5).
     - (b) Replace the instrument.

2. Reference adjust knob does not have enough travel to adjust for the reference standard value.
   - *Step 1.* Optics may have aged.
     - Recalibrate meter (para. 4-91).
   - *Step 2.* Lamp maybe faulty.
     - Replace lamp and readjust (para. 4-91).

3. Meter will not respond when battery charger is plugged in.
   - *Step 1.* Check charger connection on the meter.
     - Clean and remove any corrosion.
   - *Step 2.* Check charger adaptor operation.
     - (a) If the charger is putting out 6 ± 0.2 Vdc, replace the battery (para. 4-91).
     - (b) If the charger is not putting out the correct voltage, replace the charger adaptor (para. 4-91).

HYPOCHLORITE BACKWASH PUMP.

Hypochlorite backwash pump has low or no discharge flow.
- *Step 1.* Check strainer in hypochlorite tank.
  - (a) Clean if dirty.
  - (b) Replace if plugged (para. 4-38).
- *Step 2.* Check suction hoses to pump.
  - (a) If loose, tighten.
  - (b) If lines are plugged, replace them (para. 4-26).
- *Step 3.* Check discharge lines from the pump to the injection point.
  - (a) If the lines are plugged, replace them (para. 4-26).
  - (b) If the discharge injector is plugged, replace it (para. 4-26).
- *Step 4.* Check the priming valve above the hypochlorite tank.
  - (a) Replace the valve if it leaks into the hypochlorite tank (para. 4-40).
  - (b) Replace the backwash pump (para. 4-37).

HYPOCHLORITE MIXER.

Hypochlorite mixer vibrates excessively.
- *Step 1.* Check for a loose or bent shaft.
  - (a) Tighten, if loose (para. 4-39).
  - (b) Replace shaft if bent (para. 4-39).
- *Step 2.* Check for loose mixer mounting hardware.
  - (a) Tighten, if loose.
  - (b) Replace mixer motor and mounting (para. 4-39).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CHEMICAL PUMPS.

A chemical pump runs but discharge pressure/flow is low.

Step 1. Check strainer in chemical tank.

NOTE

If the strainers in the polyelectrolyte tank or the sequestrant tank are coated with a whitish, stringy plastic like substance, notify the operators that they have put chemicals in the wrong tanks, as this type of deposit only occurs when polyelectrolyte and sequestrant are mixed together.

(a) Clean if dirty.
(b) Replace if plugged solid (para. 4-40 or 4-55).
(c) If the strainer is plugged, as noted above, make sure the level switch in the tank is not sticking. Replace it if necessary (para. 4-55).

Step 2. Check suction lines to pump.
(a) If loose, tighten.
(b) If lines are plugged, replace (para. 4-26).

Step 3. Check discharge lines from the pump to the injection point.
(a) If the lines are plugged, replace (para. 4-26).
(b) If the discharge injector is plugged, replace (para. 4-26).
(c) If the check balls and seats in the injector are dirty, clean in soap water. Replace the check balls and seats, if necessary (para. 4-26).

Step 4. Check the check bails and seats in the chemical pump discharge and suction ports (para. 4-36).
(a) Clean in soap water.
(b) If deposits will not wash off, replace the check balls and seats (para. 4-36).

Step 5. Refer to chemical pump electrical troubleshooting, malfunction 1, and start at step 6.

Step 6. Remove the priming valve from the chemical pump discharge port and operate the pump. If the pump works satisfactorily, replace the priming valve (para. 4-36).

Step 7. Check the chemical pump diaphragm and head.
(a) Replace the diaphragm if it is punctured or torn (para. 4-34).
(b) Replace the pump head if cracked or damaged (para. 4-36).
(c) If the above checks have not isolated the problem, replace the pump (para. 4-36).

WASTE RELIEF AND PRODUCT RELIEF VALVE.

Waste relief valve leaks.

Check amount of leak.
(a) If leak is minimal, adjust valve by loosening the lock handle and turning adjustment handle slightly clockwise to stop leak. Tighten the lock handle.
(b) If leak is major and there is no restriction in the waste out hoses, notify direct support maintenance to replace valve.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

SAFETY VALVE.

Safety valve leaks.

Remove valve from piping, remove end connectors, and observe valve action as the control panel emergency stop switch is pushed in (para. 4-48).

(a) If the valve is closed when the emergency switch is out (panel energized), replace the valve (para.4-48).

(b) If the valve stays open when the emergency switch is out (panel energized), refer to electrical troubleshooting.

PRODUCTVENT VALVE.

NOTE

When the product pressure is below 5 psig (34 kPa), even a new valve may leak until tapped slightly. This is due to the low spring tension required in the valve for proper functioning.

Valve leaks.

Remove valve, disassemble, and check for damage in the seat area (para. 4-45).

Push valve disc in several times after reassembly. If valve disc does not move at least 0.125 Inch, replace valve (para. 4-45). Be sure to reinstall valve with arrow down.

HIGH PRESSURE RELIEF VALVE.

Valve or gasket leaks.

Notify direct support maintenance.

AUTOMATIC ACTUATED BUTTERFLY VALVES. **(MODEL WTA-060 ONLY**)

An automatic actuated valve is suspected of leaking (letting water or cleaning solution through when it is closed).

Clean/flush tank overflows or clean/flush tank drops in level until no solution is left.

CAUTION

Make this adjustment only when the valve to be adjusted is in its closed operating position. Making this adjustment when the ROWPU automatic control system signals the valve actuator to open will cause the valve to work backwards (valve open when it should be closed or closed when it should be open).

Check valve adjustment.

Remove actuator from valve (para. 4-47). Do not disconnect the air tubing or electrical cable from the valve. Loosen allen head setscrew on actuator mounting frame. Manually turn valve stem until valve is fully closed (slot on valve stem is perpendicular to the piping). The fully closed position can be felt as the valve stem is hard to turn when the valve disc is sealed on the valve seat. Reinstall valve actuator on valve stem and rotate actuator mounting frame until it slides on to the locating pin. Tighten setscrew.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
AUTOMATIC ACTUATED BUTTERFLYVALVES. **(MODEL ROWPU-1 ONLY)**
An automatic actuated valve is suspected of leaking (letting water or cleaning solution through when it is closed). Clean/flush tank overflows or clean/flush tank drops in level until no solution is left.
CAUTION Make this adjustment only when the valve to be adjusted is in its closed operating position. Making this adjustment when the ROWPU automatic control system signals the valve actuator to open will cause the valve to work backwards (valve open when it should be closed or closed when it should be open).
Check valve adjustment.
Push valve position Indicator toward the closed position. If the valve cannot be placed into closed position or continues to remain in the open position, replace valve (para. 4-47).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

PRODUCT HIGH PRESSURE SWITCH.

Product high pressure alarm is on and product pressure is less than 35 psig (241 kPa) or alarm is not on and pressure is higher than 45 psig (310 kPa).

Notify direct support maintenance to check operation of the product high pressure switch.

AIR SYSTEM.

1. Noise or burning smell from air compressor drive belt.

Step 1. Check drive belt.

(a) If belt is loose, adjust belt tension (para. 4-78).
(b) If belt cannot be adjusted, replace it (para. 4-78).

Step 2. Check air compressor.

If compressor does not turn easily by hand, replace air compressor (para. 4-80).

2. Oily, white mixture in outlet air filter chamber.

Notify direct support maintenance to disassemble and clean out filter chamber.

3. Outlet air filter chamber leaks.

Notify direct support maintenance to repair chamber.

4. Air system makes a loud whistling noise when the air tank block valve is opened.

Verify that air system has water in it.

Refer to "air lines, air manifolds have water in them" troubleshooting (malfunction 5 below).

5. Air lines, air manifolds have water in them.

NOTE

It is normal for a small spray (mist) of water to be seen when the air manifold drain valves are opened.

Step 1. Remove the tubing from the backwash air check valve at the media filter. Operate the ROWPU and check if water flows out of the check valve.

(a) If water comes out of the check valve, disassemble check valve and clean it out (para. 4-53).
(b) Disassemble backwash air solenoid valve and clean it out. Blow air through the tubing lines until no water is seen (para. 4-51).
(c) If cleaning the check valve fails to stop water leakage, replace the backwash air check valve (para. 4-53).

NOTE

Check valve must be installed with the arrow pointing to the media filter.

Step 2. Check the air blanket check valve. Remove the check valve from the air blanket solenoid valve (para. 4-51). Operate the ROWPU and check if air or water flow out of the check valve.

(a) If water comes out of the check valve, disassemble check valve and clean it out (para. 4-51).
(b) Disassemble air blanket solenoid valve and clean it out (para 4-51).
(c) Blow air through the tubing lines until no water is seen.
(d) If cleaning the check valve fails to stop water leakage, replace the air blanket check valve (para. 4-51).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

Check valve must be installed with the arrow pointing towards the media filter.

Step 3. Check media filter air purge line. Close the air tank block valve and bleed the pressure off the air manifolds until the air regulator indicates zero pressure. Remove the media filter air purge block valve from the air manifold and put a pipe plug in the air manifold to replace the valve. Install the air tubing which was removed to allow removal of the air purge block from the manifold back onto the valve and close valve. Open the air tank block valve, start and operate the ROWPU and check for air or water leaking out of the block valve.

If the valve leaks either air or water, replace the media filter air purge block valve (para. 4-68).

Step 4. Check outlet air filter for a buildup of water or white, oily sediment. Open the filter manual drain valve and watch the end of the tubing attached to it.

If a large quantity of water is blown out, go to Step 6.

Step 5. Check the inside of the filter by removing the top.

If the inside of the filter has a large amount of a white, oily substance, notify direct support maintenance to clean out the filter and the air blowdown solenoid valve.

Step 6. Check operation of the automatic air blowdown solenoid valve. Operate the air compressor and watch that the solenoid valve opens and blows down a water/air mixture for about 30 seconds every 15 minutes of air compressor operation time.

(a) If the blowdown valve does not operate as noted above, refer to air blowdown solenoid troubleshooting.

(b) If the above checks have not isolated the problem, notify direct support maintenance to check the air storage tank for water and to check the outlet air filter for bypassing.

6. Air pressure cycles rapidly between 1500-1800 psi (10335-12402 kPa).

NOTE

Use soap/water solution when checking for leaks.

Step 1. Check high pressure air lines for leaks.

Notify direct support maintenance if leaks are found.

Step 2. Check air blowdown solenoid for leaks.

Notify direct support if leaks are found.

Step 3. Check the outlet air filter chamber for leaks.

Notify direct support maintenance if leaks are found.

Step 4. Check the air compressor inter-stage relief valves for leaks.

Notify direct support maintenance if leaks are found.

Step 5. Check for low pressure air line leaks.

Repair leaks (para. 4-24).

7. Air compressor runs but discharge does not reach 1700-1800 psi (11713-12402 kPa).

Step 1. Check rotation of compressor motor.

If rotation is wrong, rewire motor by interchanging the T1 and T2 leads in the motor junction box (para. 4-79).

Step 2. Check compressor/motor drive belt tension.

Adjust belt tension (para. 4-78).

Step 3. Check low pressure lines for leaks.

Repair leaking lines or components (para. 4-24).

Step 4. Check all high pressure lines, components, relief valves or leaks.

Notify direct support maintenance if leaks are found

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

AIR COMPRESSOR.

1. Air compressor/motor noisy.
   Step 1. Check air compressor/motor drive belt.
   Adjust belt, if loose (para. 4-78).
   Step 2. Check mounting hardware.
   Tighten hardware, if loose.
   Step 3. Check if motor is causing noise.
   Replace motor (para. 4-79).
   Step 4. Replace air compressor (para. 4-80).

2. Air compressor assembly leaks air.
   Notify direct support maintenance.

3. Air compressor overheats. Fan does not turn.
   Step 1. Check rotation of compressor motor.
   If rotation is incorrect, rewire motor leads by interchanging the T1 and T2 leads in the motor junction box (para, 4-79).
   Step 2. Check if air compressor turns over easily by hand.
   Adjust fan drive belt, if compressor turns easily (para. 4-80).
   Step 3. Check if overheating is general or localized.
   (a) If overheating is general, check and clean all cooling fins.
   (b) If overheating is localized, note location and replace air compressor (para. 4-80).

4. Air compressor runs but does not build up air pressure.
   Step 1. Check rotation of compressor motor.
   If rotation is incorrect, rewire motor leads by interchanging the T1 and T2 leads in the motor junction box (para. 4-79).
   Step 2. Check belt tension.
   Adjust belt (para. 4-78).
   Step 3. Check all air lines and components for leaks with soap/water mixture.
   (a) If there is a high pressure leak, notify direct support maintenance.
   (b) If an automatic valve leaks at vent port, repair automatic valve air control relay (para. 4-47).
   (c) If there are low pressure air leaks, repair leaks (para. 4-24).
   Step 4. Notify direct support maintenance.

5. Air system control pressure greater than 95 psi (655 kPa).
   Notify direct support maintenance.

6. Air system control pressure less than 80 psi (552 kPa).

NOTE

Use soap/water mixture to check for leaks.

   Step 1. Check rotation of compressor motor.
   If rotation is incorrect, rewire motor leads by interchanging the T1 and T2 leads in the motor junction box (para. 4-79).
   Step 2. Check belts for correct tension.
   Adjust belts, if necessary (para. 4-78).
   Step 3. Check high pressure air lines and components for leaks.
   Notify direct support maintenance if leaks are found.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Check low pressure air lines and components for leaks.
(a) Replace/repair leaking components (para. 4-24).
(b) Notify direct support maintenance.
Step 5. Notify direct support maintenance.

7. Air compressor on at more than 1850 psig (12747 kPa), or is not on at less than 1400 psig (9646 kPa).
Notify direct support maintenance.

8. Air compressor oil has water in it (looks milky).
Step 1. Visually confirm malfunction.
Change oil (para. 4-78).
Step 2. Notify operators to check daily for a build up of water in the oil.
If the problem keeps reoccurring on a frequent basis, replace the air compressor (para. 4-80) and have direct support maintenance repair it.

HIGH PRESSURE PUMP.

1. High pressure pump/motor noisy.
Step 1. Check pump and motor mounting hardware.
Tighten, if loose.
Step 2. Check belt guard mounting hardware.
Tighten, if loose.
Step 3. Check skid stable levels for pressure level.
(a) Lower the stable level pressure (equally on each stable level) until noise diminishes
(b) Notify direct support maintenance.

2. High pressure pump/motor belts are noisy or have a burning smell.
Step 1. Check the belt for wear.
Replace, if worn (para. 4-81).
Step 2. Check drive belt tension.
Adjust to correct tension (para. 4-81).

3. High pressure pump discharge pressure won't go to 900 psig (6201 kPa).
Step 1. Check drive belt tension.
(a) Adjust to correct tension (para. 4-81).
(b) Notify direct support maintenance.

4. Feed high pressure alarm on at Iess than 900 psig (6201 kPa) or is not on and the RO system pressure is more than 960 psig (6614 kPa).

CAUTION

The ROWPU can continue in operation but the operator needs to monitor operation to ensure the system pressure does not exceed 900 psig by opening the pressure control valve.

Notify direct support maintenance.

5. High pressure pump and piping pulsating or vibrating moderate to severe. Pump may be making sharp hammering sound.
Step 1. Check mounting hardware for the pump and motor.
(a) Tighten if loose.
(b) If problem continues notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. High pressure pump motor runs but pump doesn't build up any pressure.
   Step 1. Check the belts for wear.
   Replace, if worn (para. 4-81).
   Step 2. Check drive belt tension.
   Adjust to correct tension (para. 4-81).
7. High pressure pump has excess water flowing out of the bottom of the pump.
   Notify direct support maintenance.
8. High pressure pump oil looks milky (has water in it).
   Step 1. Change oil, refer to para. 4-81.
   Step 2. Check pump plunger cavity.
   (a) Clean out drain hole.
   (b) Notify direct support maintenance to change pony rod oil seals and to check plunger packing for wear and excessive leaking.

8.1. High pressure pump does not respond to jog switch.
Refer to MALFUNCTION 9.

9. High pressure pump motor hums and won't turn.

WARNING

Failure to turn off the high pressure pump circuit breaker before proceeding could result in injury or death.

Step 1. Check motor ease of rotation. Loosen drive belt and turn motor by hand (para. 4-81).
If the motor can't be turned easily by hand, notify direct support maintenance.
Step 2. Check pump ease of rotation. Loosen drive belt and turn pump by hand (para. 4-81). The pump will take more effort to turn than the motor but it will not require a great deal of effort.
If the pump turns fairly easily, notify direct support maintenance.
Step 3. Check for pump freezing.
(a) If the pump has not been exposed to freezing conditions and won't turn over, notify direct support maintenance to replace/repair the pump.
(b) Open the seven drain valves on the pump and the high pressure drain valves on the RO elements
(c) Start the raw water pump and make sure the skid heater is on.
(d) If an extra heater is available use it to put more heat on the pump.
(e) Continue until water flows freely from all valves and the pump turns over.
(f) If the pump still won't turn over, notify direct support maintenance to replace/repair the pump

10. High pressure pump runs, pretreatment gages read high, but there is no waste flow.
Check for a plugged line between the cartridge filter and the high pressure pump (para. 4-45).
Remove obstruction.
11. High pressure pump starts but shuts down on product high pressure. System "normal" operation
Step 1. Check that product discharge valve is open.
If closed, open valve.
Step 2. Start the ROWPU and note the product pressure reading when the pump shuts down If the pressure is above 40 psig (1 72 kPa), the product line is plugged. Start with the product out hoses and work back to the van until the plug is found.
(a) If no plug is found on the outside of the van, remove the product water check valve and check it for plugging. Unplug if plugged (para. 4-45).
(b) If the pressure Is below 40 psig (172 kPa), notify direct support maintenance to check operation of the product high pressure switch.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

12. High pressure pump starts but shuts down on product high pressure. System “clean” or heat-up operation.
Start the ROWPU and note the product pressure reading when the pump shuts down.
(a) If the pressure is below 40 psig (172 kPa), notify direct support maintenance to check operation of the product high pressure switch.
(b) If the pressure is over 40 psig (207 kPa) the ROWPU is making too much water during these operations. The product outlet hose to the distribution tanks will have to be brought inside and the end placed into the top of the clean/flush tank. Open the product shut-off valve and continue operation.

13. High pressure pump starts but shuts down on a feed high pressure alarm.
Notify direct support to check operation of the feed high pressure switch.

14. High pressure pump starts but shuts down on a feed low pressure alarm.
Start the ROWPU and watch the filter pressure gages. The two gages indicate water pressure in the system as it flows through the filters.

NOTE

The black needle indicates inlet pressure and the red needle indicates outlet pressure. The red needle on the cartridge filter gage also indicates the pressure the system is shutting down at.

NOTE

There will always be a difference between the two needles, on each gage, when the unit is operating at 100 gpm flow rate depending on how dirty the filter is. The media filter differential pressure should read about 10 psi (69 kPa) when clean and will rise to 25 psi (172 kPa) as it gets dirty. The cartridge filter differential pressure starts at about 2 psi (14 kPa) clean and rises to 15 psi (103 kPa) as it gets dirty.

(a) If the red needle on the cartridge filter reads over 10 psi (69 kPa) when the unit shuts down, notify direct support maintenance to check operation of the feed low pressure switch.
(b) If the differential pressure on the media filter shows it is dirty, backwash or troubleshoot the filter.
(c) If the differential pressure on the cartridge filter shows it is dirty, change filters.
(d) If both above checks are okay, check the basket strainer for plugging and service it if it is found to be plugged and the alarm has not sounded. Refer to para. 2-24b(3).
(e) If all the above checks are okay, troubleshoot the raw water pump and then the booster pump for “Does not supply sufficient flow” (malfunction 6 and malfunction 8, respectively).
(f) If troubleshooting does not reveal the problem, it may be necessary to operate without separators at this site or replace/repair the raw water pump as the tests may not indicate a wear problem which is only evident at full flow conditions.

UNUSUAL NOISE.

Noise level high, piping may be shaking, high pressure pump may be making hammer sounds.
Step 1. Remove the tubing from the backwash air check valve at the media filter. Operate the ROWPU and check if water flows out of the check valve.
(a) If water comes out of the check valve, disassemble check valve and clean it out (para. 4-53).
(b) If cleaning the check valve fails to stop water leakage, replace the backwash air check valve (para. 4-53).

NOTE

Check valve must be installed with the arrow pointing to the media filter.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Remove the tubing from the backwash air solenoid valve outlet. Operate the ROWPU and check for air leakage through the solenoid valve by placing finger over outlet of solenoid valve.
(a) If air is leaking through solenoid, disassemble and clean out the backwash air solenoid valve (para. 4-51).
(b) If cleaning does not stop the air leakage, replace the backwash air solenoid valve (para. 4-51).
Step 3. Isolate noise source.
Refer to individual troubleshooting for the noisy component.

HIGH PRESSURE PUMP ASSEMBLY STABLE LEVELS.

High pressure pump assembly stable levels leak air or will not pump up.
Visually confirm malfunction and notify direct support maintenance to repair/replace leaking stable level.

NOTE

The ROWPU will operate satisfactorily without the stable level pressurized. The results will be a slight vibration and noise increase in the equipment. Replacement can be performed when sufficient downtime is available for replacement.

DISTRIBUTION PUMP.

1. Distribution pump motor hums but won't turn.
Check ease of rotation of pump. Turn motor fan by hand.
(a) If the motor turns easily, refer to distribution pump electrical troubleshooting.
(b) If the motor turns hard or not at all, replace the pump/motor assembly (para. 4-87).

CAUTION

If the pump has been subjected to freezing conditions, make sure that the pump does not have ice in it. Warm it thoroughly.

2. Distribution pump noisy.
Step 1. Check mounting hardware.
(a) Tighten mounting hardware, if loose.
(b) Notify direct support maintenance.

3. Distribution pump assembly leaks.
Step 1. Check the pump shaft or casing for leaks.
Replace the pump/motor assembly (para. 4-87).
Step 2. If other components/piping are leaking.
Replace/repair leaking components/piping (para. 4-87).

4. Distribution pump runs but doesn't pump or has low water flow.
Step 1. Check pump rotation. Rotation is clockwise from the fan end.
Rewire pump motor for correct rotation by interchanging the T1 and T2 leads in the motor junction box (para. 4-87).
Step 2. Check distribution nozzles for broken parts or plugging.
Replace distribution nozzles (para. 4-86).
Step 3. Check suction hoses for plugging or collapsed liners.
(a) Replace hoses with collapsed liners.
(b) Remove anything that might be plugging hoses.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 4. Check inlet of pump for plugging. (a) Remove anything that is plugging pump. (b) Replace distribution pump/motor assembly (para. 4-87).
DIESEL HEATERS.
1. Diesel heater smokes heavily when operating. Inspect carburetor. Adjust carburetor (para. 4-60).
2. Diesel heater shuts down at room temperature instead of going to standby. Inspect thermostat assembly (hold-fire). Adjust thermostat assembly (para. 4-60).
NBC FILTER
1. Cover gasket leaks. Inspect gasket. (a) Replace gasket, if damaged (para. 4-65). (b) Repair clamps if necessary (para. 4-65).
2. NBC filter assembly leaks. Inspect valves or fittings for leak. (a) Replace valve/repair fittings (para. 4-65). (b) If the filter vessel leaks, notify direct support maintenance.
3. NBC media in product tank. Notify direct support maintenance.
ELECTRICAL TROUBLESHOOTING.
NOTE All schematics and interconnection diagrams are located in Appendix I.
NOTE Malfunction 1 is a list of General Procedures for electrical troubleshooting.
1. Electrical problems. *Step 1.* Follow these general procedures. Electrical problem troubleshooting can be very simple if a few basic rules are observed. (a) In order to do work, electricity must go somewhere; from hot to neutral. The ROWPU electrical schematics are set up with the hot line on the left and the neutral on the right side of the ladder diagram. (b) Electricity must go through a load device such as a coil, a motor, a light, or a resistance of some sort before going to neutral. It cannot go through a switch device, such as a relay contact, and then straight to neutral as a dead short will result. (c) The horizontal lines between the vertical hot and neutral lines are the paths the electricity flows through to do work. If it encounters an open contact, a switch or a loose wire, it stops and nothing more will happen to the right of the open circuit.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(d) Relay contacts can be thought of as stop or go signs and switches can be thought of as change direction signs or stop and go signs.

(e) The ROWPU schematic is shown with no power on the circuits and the system shutdown with no pressure in any of the hydraulic or air systems. This means that if you were to check any switch or contact, without power or pressure to the unit, it must match what the schematic shows. Selector switches must be moved to the position shown by the arrow to indicate properly.

(f) Relay contacts are either open (two vertical lines) or closed (two vertical lines with a diagonal across them). When a relay coil is energized it switches all its contacts to the opposite position; closed to open and open to closed. When the power is removed the contacts switch back to their normal positions. The relays can be thought of as the traffic controllers in the electrical circuits.

(g) Dashed lines between switch contacts mean each contact is on that switch operator. A switch contact which has a symbol like OXO next to it means the contact is open when the switch lever is to the left, closed when the lever is in the center and open when the lever points to the right.

(h) Lines which cross but do not have a black circle where they cross are not connected.

(i) Each relay contact will have shown two numbers, such as A3X and A3Y. This refers to where the contact is located on the relay controlling it. The A means first bank (closest to the sub-panel, B means second or middle bank, and C means outer or third bank). The 3 is the left to right designation and X is top of relay, Y is bottom of relay. Some relays only have an 'A' bank or an 'A' and 'B' bank but the reference always follows that shown on the drawing.

(j) The left side, or hot line, on the ROWPU schematic list line numbers (do not confuse them with wire numbers) of each horizontal or control line in the circuit. On the right, or neutral side, is a brief description of each lines function in the circuit.

(k) When troubleshooting the control panel with no power on the system, relay contacts and starter contacts can be manually switched to the "energized" condition by pushing in on the square button on relays and the starter contact back on starters. Releasing them returns the contacts to their unpowered condition. This is useful when checking continuity on a control circuit line.

(l) Remove wires from motor leads or relay coil contacts to determine if a motor or coil has a resistance reading.

Step 2. ELECTRICAL FAULT ISOLATION. It is important when troubleshooting to pinpoint the problem accurately, repair it, and return the system to operational readiness as rapidly as possible. There are several steps that can be taken to help speed up the process of troubleshooting.

(a) The majority of problems will have causes external to the control panel. Water, dirt, chemicals and abuse to components and cables will be the source of most problems. By comparison, the components in the control panel are in a clean environment and are capable of many thousands of cycles before breaking or burning out, and have been proven to work in the proper way. The exception to this are any components with motors such as timers or hourmeters. Keeping the above in mind, all troubleshooting should initially assume the control panel is not the cause of the problem.

(b) Use the reference guide and set up the control panel switches for operation yourself. Never assume that somebody else has done it correctly.

(c) Talk to the operator and try to determine as accurately as possible what really happened so as to eliminate needless troubleshooting time.

(d) Try to do batch troubleshooting whenever possible. This means instead of starting at the hot line and working through a circuit step by step you should start at the hot line and check it halfway, or whatever is possible, through the circuit first. This allows you to eliminate several components in one step, or conversely, pin the problem to the present check points.

(e) Be sure to use the light test to determine that bulbs are not burned out leading to improper troubleshooting.

(f) Be sure all circuit breakers are on before attempting to diagnose a problem.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. TOOLS AND TEST EQUIPMENT. There are only a few tools and procedures necessary to troubleshoot the ROWPU. These and an occasional assistant to help push switches or check continuity are all that is required.

(a) Voltmeter with scales of:
0-500 volts AC
0-30 volts DC
Multiple resistance scales

(b) Common hand tools.

(c) A piece of # 12 or # 16 wire, 30 foot long with either alligator clips or test probes attached to it. This is used to aid in checking cables for continuity or shorts where distances involved do not allow using the standard volt/ohmmeter leads.

(d) Copy of the schematic diagram.

Step 4. PERSONNEL REQUIREMENTS. The procedures, which the electrician should already have been taught, are how to check continuity, resistance short circuits, and voltages. The troubleshooter should also realize the necessity of tight wire connections and should check them as part of his normal procedures when analyzing a problem. These procedures will not be repeated in the following guidelines.

WARNING

Whenever a continuity check is called for, power must be shut off to the circuit being tested. Failure to do so may result in serious injury or death from electrical shock.

2. ROWPU Electrical problems.
Isolate fault.

(a) If a 115 volt circuit breaker keeps tripping, notify direct support maintenance.
(b) If the control panel utility receptacle does not work, notify direct support maintenance.
(c) If the light test circuits do not work, notify direct support maintenance.
(d) If the alarm silence does not work, notify direct support maintenance.
(e) If the system on/system standby circuit does not work, notify direct support maintenance.
(f) If the operation mode circuits do not work, notify direct support maintenance.
(g) If the chemical pumps run but the chemical pump “ON” light does not work, (light test okay) notify direct support maintenance.
(h) If the raw water pump runs but the raw water pump “ON” light does not work (light test okay) notify direct support maintenance.
(i) If the air compressor runs but the air compressor hourmeter does not work, notify direct support maintenance.
(j) If the air compressor runs but the air compressor “ON” light does not work (light test okay) notify direct support maintenance.
(k) If the air blanket circuits work but the air blanket “ON” light does not come on (light test okay) notify direct support maintenance.
(l) If the ROWPU control circuits do not work, notify direct support maintenance.
(m) If the ROWPU utility circuits do not work, notify direct support maintenance.
(n) If the booster pump runs but the booster pump “ON” light does not work (light test okay) notify direct support maintenance.
(o) If the high pressure pump circuit breaker trips when the pump is started or the ROWPU shuts down when the pump is started notify direct support maintenance.
(p) If the high pressure pump starts but shuts down when the “START” button is released, notify direct support maintenance.
(q) If the high pressure pump runs but the pump hourmeter does not work, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(r) If the high pressure pump runs but the high pressure pump "ON" light does not work (light test okay) notify direct support maintenance.
(s) if the high pressure pump circuit breaker opens whenever the high pressure pump is started, notify direct support maintenance.
(t) If the high pressure pump overload heaters trip open continuously, notify direct support maintenance.
(u) If the high pressure pump starts but the van lights go out or dim considerably, notify direct support maintenance.
(v) If the carbon monoxide monitor does not read "60" as a final value during span test, notify direct support maintenance.
(w) If the carbon monoxide monitor does not read zero during the zero test, notify direct support maintenance.
(x) If the media filter backwash cycle does not work properly, notify direct support maintenance.

SAFETY VALVE.

Safety valve does not work (Reference Schematic Diagram FO-1, sheet 8, schematic line 822).

Step 1. Shutdown ROWPU. Shutdown generator. Open the condulet attached to the safety valve solenoid valve. Remove tape and disconnect wire connectors. Check the solenoid for resistance across its leads.
If there is no resistance or shows an open circuit, replace the solenoid valve (para. 4-51).

Step 2. Check wires from solenoid condulet box back to control panel TB1-67 and TB1-77 for continuity.
(a) Replace the cable if any wire does not show continuity or if the wires are shorted (para. 4-27).
(b) If the cable check is okay, notify direct support maintenance to troubleshoot control panel wiring.

PUMP HEAT LAMPS.

Hypochlorite mixer does not work. (Reference Schematic Diagram FO-1, sheet 8 schematic line 820).

Step 1. Remove connector P54 from the bottom of switch panel No. 2 (para. 4-31). Check for 110-120 VAC between J54A and J54B (Reference Interconnection Diagram FO-2, sheet 15) with MIXER switch "ON'.
If voltage is not present, go to step 3.

Step 2. Remove and tag the wires to the mixer motor. Check the cable and connector for continuity and shorts on each wire.
(a) Replace the cable assembly if open or shorted (para. 4-39).
(b) Replace the mixer motor if the cable check is okay (para. 4-39).

Step 3. Remove connector P52 from the side of the switch box 2. Check for 110-120 VAC between P52B and P52J (Reference Interconnection Diagram FO-2, sheet 15).
If voltage is not present, go to step 5.

Step 4. Check continuity, point-to-point, from J52B to J54A and from J52J to J54B.
(a) Repair any hose or damaged wire (para. 4-31).
(b) Replace switch SS4 (Reference Interconnection Diagram FO-2, sheet 15) if open (para. 4-31).
(c) Replace either electrical connector assembly if faulty (para. 4-31).

Step 5. Remove connector P12 (Reference Interconnection Diagram FO-2, sheet 15) from the side of the main control panel. Check for 110-120 VAC between J12B and J12J (Reference Interconnection Diagram FO-2, sheet 9).
If voltage is not present, notify direct support maintenance.

Step 6. Check continuity from P12B to P52B and from P12J to P52J.
Replace the cable if open (para. 4-27).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

ELECTRIC HEATER.

NOTE
Refer to Figure 4-1 for Electric Heater Wiring Diagram.

1. High pressure pump assembly electric heater does not work (no heat, no fan) (Reference Schematic Diagram FO-1, sheet 5, schematic lines 512-516).
   Step 1. Check that the FAN-HEAT toggle switch on top of the heater is set to HEAT.
      Set it to the HEAT position.
   Step 2. Check generator voltage on all tree phases. It must be 435-445 VAC on each phase.
      (a) Adjust to correct voltage.
      (b) If voltage is not correct on all three phases, refer to generator troubleshooting.
   Step 3. Shut down the ROWPU. Shut down the generator. Refer to electrical schematic Appx. -1 and Interconnect diagram Appx. 1-2. Check continuity, point-to-point, from P20D to J66A, P20E to J66B, P20F to J66C, and P20H to J66D (Reference Interconnection Diagram FO-2, sheet 16). Check each lead for shorts between phases and shots to the groundwire. The reading should be infinity for each check.
      (a) Replace any cable that shows open during continuity checks (para. 4-27).
      (b) Replace any cable that shows a short between phases or a short to ground (para. 4-27).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

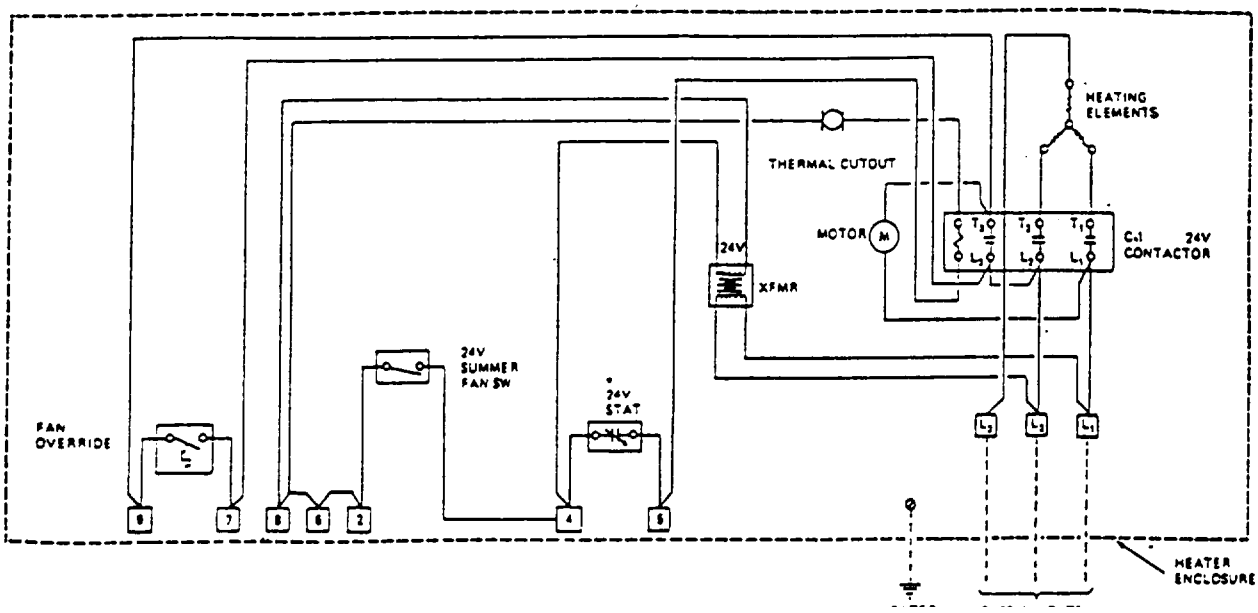


Figure 4-1. Electric Heater Wiring Diagram

Step 4. Open the Metal Oxide Varistor (MOV) junction box. Check MOV Nos. 25,26, and 27 for physical damage or signs of shorting. Remove wire Nos. HL1, HL2, and HL3 from the MOV terminals. Reference Interconnection Diagram FO-2, sheet 16). Use a multimeter and check for continuity from the terminals which the wires were onto ground.

(a) Repair any damaged or loose wires (para. 4-76).

(b) Replace any MOV which is physically damaged or shows continuity to ground from the power terminal (para. 4-76).

(c) Replace any damaged wire harness in the pump skid junction box (para. 4-76).

Step 5. Open the acess panel on the heater. Tag and disconnect the four incoming power leads. Check continuity, point-to-point, from P66A to HL1, P66B to HL2, P66C to HL3, and P66D to HL0 (Reference Interconnection Diagram FO-2, sheet 16). Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.

(a) Replace the cable if-it shows open during continuity checks (para. 4-77).

(b) Replace the cable if it shows a short between phases or a short to ground (para. 4-77).

(c) Notify direct support maintenance if the above checks have not located the problem.

2. Electric heater fan runs but there is no heat.

Step 1. Check that fan heat switch is turned to heat.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(a) Set it to heat position.
(b) Notify direct support maintenance.

3. Electric heater heats up but fan does not work.
Notify direct support maintenance.

4. Electric heater circuit breaker trips whenever the heater is started (Reference Schematic Diagram FO-1, sheet 5, schematic lines 512-515).
Replace heater (para. 4-77).

5. Electric heater circuit breaker will not reset (Reference Schematic Diagram FO-1, sheet 5, schematic lines 512-515).
Check for a short circuit.

PUMP HEAT LAMPS.

1. Raw water pump heat lamp does not work (Reference Schematic Diagram FO-1, sheet 5, schematic lines 1105-1109).

NOTE

Circuit breaker 13 is a ground fault breaker. High humidity or moisture around devices controlled by this breaker may occasionally cause troubles. Check that atmospheric moisture is not causing the tripping by drying out anything controlled by this breaker, including wire connections.

Step 1. Check for voltage (110-120 VAC) across J55A and J55B (Reference Interconnection Diagram FO-2, sheet 16) on the outside of the van. (This heater only works when the pump is shut down and the pump heat switch is on.)
If voltage is not present, go to step 3.

Step 2. Shut down the ROWPU. Shutdown the generator. Refer to the electrical schematics and interconnect diagrams in Appendix I. Check the cable to the heat lamp, point-to-point, for continuity or shorts.
(a) If the cables are defective, replace the cable (para. 4-89).
(b) If the heat lamp is defective, replace the heat lamp (para. 4-89).

Step 3. Remove connector P18 (Reference Interconnection Diagram FO-2, sheet 15) from the control panel and check for voltage across J18D and J18E (Reference Interconnection Diagram FO-2, sheet 9).
If voltage is not present, notify direct support maintenance.

Step 4. Shut down the ROWPU. Shutdown the generator. Refer to the electrical schematics and interconnect diagrams in Appendix I. Check for shorts and continuity, point-to-point, from P18D and E to J56A and B, (Reference Interconnection Diagram FO-2, sheet 16) respectively. Open the raw water pump outside electrical panel. Check MOV Nos. 14 and 15 (Reference Interconnection Diagram FO-2, sheet 16) for physical damage or signs of shorting. Remove wire Nos. 443 and 448 from the MOV terminals. Use a multimeter and check for continuity from the terminals which the wires were on to ground.
(a) If a cable or connector is defective, replace the cable assembly (para. 4-27).
(b) Repair any loose or damaged wires in the external electrical panel (para. 4-34).
(c) Replace any damaged wiring harness in the external electrical panel (para. 4-34).
(d) Replace any MOV which is physically damaged or shows continuity to ground from the power terminal (para. 4-34).

2. Distribution pump heat lamp does not work (Reference Schematic Diagram FO-1, sheet 11, schematic lines 1110-1114).

NOTE

Circuit breaker 14 is a ground fault breaker. High humidity or moisture around devices controlled by this breaker may occasionally cause troubles. Check that atmospheric moisture is not causing the tripping by drying out anything controlled by this breaker, including wire connections.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Check for voltage (110-120 VAC) across J60A and J60B (Reference Interconnection Diagram, FO-2, Sheet 16) on the outside of the van. (This heater only works when the pump is shut down and the pump heat switch is on.)
If voltage is not present, go to step 3.

Step 2. Shut down the ROWPU. Shutdown the generator. Refer to the electrical schematics and interconnect diagrams in Appendix I. Check the cable to the heater, point-to-point, for continuity or shorts.
(a) If the cable or connectors are defective, replace the cable (para. 4-89).
(b) If the heat lamp is defective, replace the heat lamp (para. 4-89).

Step 3. Remove connector P15 (Reference Interconnection Diagram FO-2, Sheet 14) from the control panel and check for voltage across J15J and J15K (Reference Interconnection Diagram FO-2, Sheet 9).
If voltage is not present, notify direct support maintenance.

Step 4. Shutdown the ROWPU and the generator. Refer to the electrical schematics and interconnect diagrams in Appendix I. Check for shorts and continuity, point-to-point, from P15J and K to J60A and B, respectively. Open the distribution pump outside electrical panel. Check MOV Nos. 12 and 13 for physical damage or signs of shorting. Remove wire Nos. 446 and 447 from the MOV terminals. Use a multimeter and check for continuity from the terminals which the wires were onto ground.
(a) If a cable or connector is defective, replace/repair the cable or connector (para. 4-27).
(b) Repair any loose or damaged wire in the external electrical panel (para. 4-35).
(c) Replace any damaged wiring harness in the external electrical panel (para. 4-35).
(d) Replace any MOV which is physically damaged or shows continuity to ground from the power terminal (para. 4-35).

POWER SUPPLY.

Heater power supply does not work when connected to generator batteries (Reference Schematic Diagram FO-1, Sheet 11 schematic lines 1131-1132).

Step 1. Check that batteries are charged. The power supply serves only as a junction box during battery power source.
Charge generator batteries.

Step 2. Disconnect batteries and check cables from battery to van wall and from van wall to power supply for shorts and for continuity.
Replace any cables that are open or shorted (para. 4-27).

Step 3. Check cables from power supply to the heaters for shorts and for continuity.
(a) Replace any cables or wires that are open or shorted (paras. 4-27 and 4-60).
(b) If the above checks do not isolate the problem, notify direct support maintenance to check the power supply cable assemblies for continuity.

2. Heater power supply does not work on AC power (Reference Schematic Diagram FO-1, Sheet 11, schematic line 1129).

Step 1. Open access panel on the power supply and check for voltages (110-120 VAC) across the incoming leads from the control panel.
If voltage is present, go to step 4.

Step 2. Remove connector P17 (Reference Interconnection Diagram FO-2, Sheet 14) from control panel and check for voltage across J17F and J17G (Reference Interconnection Diagram FO-2, Sheet 9).
If the voltage is not 110-120 VAC, notify direct support maintenance.

Step 3. Check continuity from P17F to L in the power supply and from P17G to L2 in the power supply.
Replace the cable assembly if open or shorted (para. 4-27).

Step 4. Check the power supply output for voltage.
If it is not 24-29 VDC, have direct support maintenance check the MOV's for shorts.

Step 5. Check cables from power supply to the heaters for shorts and for continuity.
Replace any cables or wires that are open or shorted (paras. 4-27 and 4-60).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

ALARM CIRCUITS.

1. Alarm test does not work (Reference Schematic Diagram FO-1, Sheet 11, schematic lines 1002 and 1013).
   - *Step 1.* Remove connector P52 from the alarm box. Check for voltage across pins P52A and P52J and also across P52N and P52J (Reference Interconnection Diagram FO-2, Sheet 15) when the ALARM TEST button is pushed.
     - (a) If no voltage is present, go to step 4.
     - (b) If there is voltage across P52AJ, go to step 2.
     - (c) If there is voltage across P52NJ, go to step 3.
     - (d) If there is voltage across both sets, do both steps 2 and 3.
   - *Step 2.* Shutdown the ROWPU. Shut down the generator. Refer to the electrical schematic Appx. -1 and check continuity, point-to-point, from J52A to J52J (Reference Interconnection Diagram FO-2, Sheet 15).
     - (a) Repair any loose or damaged wire (para. 4-31).
     - (b) Replace connector assembly J52, if faulty (para. 4-31).
     - (c) Replace alert horn HN1 if all wires and the connector are good (para. 4-31).
   - *Step 3.* Shutdown the ROWPU. Shutdown the generator. Refer to the electrical schematic Appx. 1- and check continuity, point-to-point, from J52N to J52J .
     - (a) Repair any loose or damaged wire (para. 4-31).
     - (b) Replace connector assembly J52, if faulty (para. 4-31).
     - (c) Replace warning horn HN2 (Reference Interconnection Diagram FO-2, Sheet 15) if all wires and the connector are good (para. 4-31).
   - *Step 4.* Remove connector P12 from the control panel. Check voltage across pins J12A and J12J, also check across J12F and J12J (Reference Interconnection Diagram FO-2, Sheet 9) when the alarm test is pushed.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(a) If no voltage is present, notify direct support maintenance.
(b) If voltage is present across J12A/J, check continuity from P12A and J to P52A and J respectively.
(c) Rep ace the cable and connector if faulty (para. 4-27).
(d) If voltage is present across J12F/J, check continuity from P12F and J to P52N and J respectively.
(e) Replace the cable and connector if faulty (para. 4-27).

2. Alarm(s) will not reset (Reference Interconnection Diagram FO-1, Sheet 6, schematic line 638, and Schematic diagram FO-1, Sheet 9, Schematic lines 902-936).

NOTE

The alarm will not reset if conditions which caused the alarm have not been fixed. The chemical tanks and the clean/flush tank must have sufficient solution in them to raise the level switches. Operating pressures must be below the setpoint of pressure switches or they will not reset.

Check the operating pressures of the ROWPU against the setpoints shown on the electrical schematic before troubleshooting and that the chemical tanks and clean flush tank are full.

Notify direct support maintenance if the pressures and levels noted above are okay and individual pressure/level switch troubleshooting has not isolated the problem.

3. Alarm horns turn on when INITIATE is pushed.

Refer to alarm circuit troubleshooting, malfunction 2, “alarms will not reset”.

4. Alarm horns did not sound and ROWPU shut down. Alarm horns did not sound and chemical tanks ran dry.

NOTE

This situation is normal whenever alarm reset has been pushed and any chemical tank, the clean/flush tank, or feed low pressure switch has not been satisfied. Clear those alarms before troubleshooting this symptom.

Step 1. Press light test.
(a) If any of the ten alarm lights do not come on, replace the light bulb (para. 3-17).
(b) If replacing a light bulb doesn’t turn the light on during test, notify direct support maintenance.

Step 2. Press alarm test.
(a) If both horns don’t come on, refer to alarm circuit troubleshooting, malfunction 1, “alarm test does not work”.
(b) Notify direct support maintenance.

PRESSURE SWITCHES.

NOTE

All pressure switch troubleshooting should be done without any water or air pressure on the system unless otherwise noted.

1. High pressure pump high pressure switch does not work (Reference Interconnection Diagram FO-1, Sheet 9 schematic lines 902-903).

Step 1. Test operation of switch. Refer to unit PMCS for procedure.
If switch is not working, go to step 2.

Step 2. Shutdown the ROWPU. Remove connectors P12 Reference Interconnection Diagram FO-2, Sheet 15) and P11 Reference Interconnection Diagram FO-2, Sheet 14) from the control panel. Check for 110-120 VAC across J11A and J12J (Reference Interconnection Diagram FO-2, Sheet 9).
If voltage is not present, notify direct support maintenance.

Step 3. Check continuity acrossP11A and P11D.
If the continuity check is okay, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Remove connector P24 from the switch panel. Check continuity across J24A and J24D.
If the continuity check is okay, replace the cable between P11 and P24 (Reference Interconnection Diagram FO-2 , Sheet 14) (para. 4-27).

2. High pressure pump high pressure light or horn doesn't work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 903-904 and Schematic Diagram FO-1, sheet 10, schematic line 1011). Refer to light testing and alarm troubleshooting for additional test procedures.
Notify direct support maintenance.

3. High pressure pump high pressure alarm on at less than 900 psig (6205 kPa), or, is not on and system pressure is more than 960 psig (6619 kPa).
Notify direct support maintenance.

4. Product high pressure switch does not work (Reference Interconnection Diagram FO-1, Sheet 9, schematic lines 905-906).
Step 1. Check operation of switch. Refer to unit PMCS for procedure.
If switch is not working, go to step 2.
Step 2. Shut down the ROWPU. Remove connectors P12 and P11 from the control panel. Check for 110-120 VAC across J11A and J12J.
If voltage is not present, notify direct support maintenance.
Step 3. Check continuity across P11A and P11E.
If the continuity check is okay, notify direct support maintenance.
Step 4. Remove connector J24 from the switch panel. Check continuity across J24A and J24E (Reference Interconnection Diagram FO-2, Sheet 14).
If the continuity check is okay, replace the cable betweenP11 and P24 (para. 4-27).

5. Product high pressure light or horn does not work (Reference Interconnection Diagram FO-1, Sheet 9, schematic lines 906-907 and 1012).
Refer to light testing and alarm troubleshooting for additional test procedures.
Notify direct support maintenance.

6. Product high pressure alarm is on and product pressure is less than 35 psig (241 kPa) or alarm is not on and pressure is higher than 45 psig (310 kPa).
Notify direct support maintenance.

7. Strainer high differential switch does not work (Reference Interconnection Diagram FO-1, Sheet 9, schematic lines 908-909).
Step 1. Shutdown the ROWPU. Remove connectors P12 and P11 from the control panel. Check for 110-120 VAC across J11A and J12J.
If voltage is not present, notify direct support maintenance.
Step 2. Check continuity acrossP11A and P11F.
If the continuity check is okay, notify direct support maintenance.
Step 3. Remove connectors P24 from the switch panel. Check continuity across J24A and J24F. If the continuity check is okay, replace the cable between P11 and P24 (para. 4-27).

8. Strainer high differential light or horn does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 909-910, and Schematic Diagram FO-1, Sheet 10, schematic line 1006).
Refer to light testing and alarm troubleshooting for additional test procedures.
Notify direct support maintenance.

9. Strainer plugged light is on and basket strainer is clean or light is not on and strainer is plugged.
Notify direct support maintenance.

10. Media filter high differential switch does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 911-912).
Step 1. Check operation of switch. Refer to unit PMCS for procedure.
If the switch is not working, go to step 2.
Step 2. Shutdown the ROWPU. Remove connectors P12 and P11 from the control panel. Check for 110-120 VAC across J11A and J12J.
If voltage is not present, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Check continuity across P11A and P11N.
If the continuity check is okay, notify direct support maintenance.
Step 4. Remove connector P24 from the switch panel. Check continuity across J24A and J24N.
If the continuity check is okay, replace the cable betweenP11 and P24 (para. 4-27).

11. Media fitter high differential light or horn doesn't work (Reference Interconnection Diagram FO-1, Sheet 9, schematic lines 912-913 and Schematic Diagram FO-1, Sheet 10, schematic line 1007).
Refer to light testing and alarm troubleshooting for additional test procedures.
Notify direct support maintenance.

12. Media filter plugged light is on at a differential less than 20 psid (138 kPa), or is not on at a pressure greater than 30 psid (207 kPa).
Notify direct support maintenance.

13. Cartrdge filter high differential switch does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 914-915).
Step 1. Check operation of switch. Refer to unit PMCS for procedure.
If the switch is not working, go to step 2.
Step 2. Shut down the ROWPU. Remove connectors P12 and P11 from the control panel, Check for 110-120 VAC across J11A and J12J.
If voltage is not present, notify direct support maintenance.
Step 3. Check continuity across P11A and P11 H.
If the continuity check is okay, notify direct support maintenance.
Step 4. Remove connector P24 from the switch panel. Check continuity across J24A and J24H.
If the continuity check is okay, replace the cable between P11 and P24 (para. 4-27),

14. Cartridge filter high differential light or horn doesn't work (Reference Schematic Diagram FO-1, Sheet 9, Shematic lines 915-916 and Schematic Diagram FO-1, Sheet 10, schematic line 1008).
Refer to light testing and alarm troubleshooting for additional test procedures.
Notify direct support maintenance.

15. Cartridge filter plugged light is on at a differential pressure less than 12 psid (83 kPa), or is not on and differential pressure is greater than 20 psid (138 kPa).
Notify direct support maintenance.

16. Feed pressure low switch does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 917-918).
Check operation of switch. Refer to unit PMCS for procedure.
If switch does not work, notify direct support maintenance.

17. Feed pressure low light or horn does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic line 920, and Schematic Diagram FO-1, sheet 10, schematic line 1009).
Refer to light test and alarm circuit troubleshooting for additional test procedures.
Notify direct support maintenance.

18. Feed pressure low light is not on and the feed pressure is 3 psig (21 kPa) or less, or, the light is on and the feed pressure is 10 psig (69 kPa) or higher.
Notify direct support maintenance.

19. Air compressor switch does not work (Reference Interconnection Diagram FO-1, Sheet 8) (schematic line 824).
Notify direct support maintenance.

20. Air compressor is on at more than 1850 psig(12755 kPa) or, is not on at less than 1400 psig (9653 kPa).
Notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

LEVEL SWITCHES.

1. HYPOCHLORITE TANK LOW LEVEL switch does not work (Reference Schematic Diagram FO-1, Sheet 9 schematic lines 920-921).

NOTE

Drain the chemical tank before troubleshooting.

Step 1. Remove connector P12 (Reference Interconnection Diagram FO-2, Sheet 15) from the control panel. Check for 110-120 VAC across J12C and J12J (Reference Interconnection Diagram FO-2, Sheet 9).
If voltage is not present, notify direct support maintenance.

Step 2. Check for continuity across P12C and P12.
(a) If the continuity check is okay, go to step 3.
(b) If there is no continuity, go to step 4.

Step 3. Use the chemical mixing paddle and lift the float in the chemical tank. Check for continuity across pins P12C and P12D.
If the continuity check is okay, notify direct support maintenance to troubleshoot the main control panel.

Step 4. Remove connector P52 from the alarm panel. Check for continuity across J52C and J52D with the float set as in step 3. Let the float drop and check for continuity across J52C and J52E (Reference interconnection Diagram FO-2, Sheet 15).
if both continuity checks are okay, replace the cable between P12 and P52 (para. 4-27).

Step 5. Refer to the electrical schematic Appx. I-1. Check continuity, point-to-point, from J52C to JS2E.
(a) Repair any hose or damaged wire (para. 4-31).
(b) Replace connector J52 if faulty (para. 4-31).
(c) Replace LSL4 if it shows an open circuit (para. 4-40.

Step 6. Refer to the electrical schematic Appx. I-1. Check for continuity, point-to-point, from J52C to J52C to J52D with the float lifted as in step 3.
(a) Repair any hose or damaged wire (para. 4-31).
(b) Replace connector J52 if faulty (para. 4-31).
(c) Replace LSL4 if it shows an open circuit (para. 4-40).

2. HYPOCHLORITE TANK LOW LEVEL indicator tight or warning horn does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic line 923 and Schematic Diagram FO-1, Sheet 10, schematic line 1003). Refer to light testing and alarm circuit troubleshooting for additional test procedures.
Notify direct support maintenance.

3. POLYELECTROLYTE TANK LOW LEVEL switch does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 923-924).

NOTE

Drain the polyelectrolyte tank before troubleshooting.

Step 1. Remove connector P15 (Reference interconnection Diagram FO-2, Sheet 14) and P12 from the control panel. Check for 110-120 VAC across J15C and J1J2.
if voltage is not present, notify direct support maintenance.

Step 2. Check for continuity across P15C and P15D. No power.
(a) If the continuity check is okay, go to step 3.
(b) If there is no continuity, go to step 4.

Step 3. Use the chemical mixing paddle and lift the float in the chemical tank. Check for continuity across pins P15C and P15F.
If the continuity check is okay, notify direct support maintenance to troubleshoot the main control panel.

Step 4. Remove connector P30 from the JB3 junction panel. Check for continuity across J30A and J30D with the float set as in step 3. Let the float drop and check for continuity across J30A and J30B (Reference interconnection Diagram FO-2, Sheet 14).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
If both continuity checks are okay, replace the cable between P15 and P30 (para. 4-27).
Step 5. Refer to the electrical schematic Appx. l-1. Check continuity, point-to-point, from J30A to J30B. (a) Repair any hose or damaged wire (para. 4-32). (b) Replace connector J30 assembly if faulty (para. 4-32). (c) Replace LSL2 (Reference Interconnection Diagram FO-2, Sheet 14) if it shows an open circuit (para. 4-55).
Step 6. Refer to the electrical schematic Appx. l-1. Check for continuity, point-to-point, from J30A to J30D with the float lifted as in step 3. (a) Repair any hose or damaged wire (para. 4-32). (b) Replace connector J30 assembly if faulty (para. 4-32. (c) Replace LSL2 reference Interconnection Diagram FO-2, Sheet 14) if it shows am open circuit (para. 4-5).
4. POLYELECTROLYTE TANK LOW LEVEL indicator Iight or warning horn does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic line 926, and Schematic Diagram FO-1, Sheet 10, schematic line 1004). Refer to light testing and alarm circuit troubleshooting for additional test procedures. Notify direct support maintenance.
5. SEQUESTRANT TANK LOW LEVEL switch does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic lines 924,926-927). **NOTE** Drain the chemical tank before troubleshooting.
Step 1. Remove connector P15 and P12 from the control panel. Check for 110-120 VAC across J15C and J1 2J. If voltage is not present, notify direct support maintenance.
Step 2. Check for continuity across P15C and P15D. No power. (a) If the continuity check is okay, go to step 3. (b) If there is no continuity, go to step 4.
Step 3. Use the chemical mixing paddle and lift the float in the chemical tank. Check for continuity across pins P15C and P15E. If the continuity check is okay, notify direct support maintenance to troubleshoot the control panel.
Step 4. Remove connector P30 from the JB3 junction panel. Check for continuity across J30A and J30C with the float set as in step 3. Let the float drop and check for continuity across J30A and J30B. If both continuity checks are okay, replace the cable between P15 and P30 (para. 4-27).
Step 5. Refer to the electrical schematic Appx. I-1. Check continuity, point-to-point, from J30A to J30B. (a) Repair any hose or damaged wire (para. 4-32). (b) Replace connector J30 assembly if faulty (para. 4-32. (c) Replace LSL3 (Reference Interconnection Diagram FO-2, Sheet 14) if it shows an open circuit (para. 4-55).
Step 6. Refer to the electrical schematic Appx. I-1. Check for continuity, point-to-point, from J30A to J30C with the float lifted as in step 3. (a) Repair any hose or damaged wire (para. 4-32). (b) Replace connector J30 assembly if faulty (para. 4-32). (c) Replace LSL3 if it shows an open circuit (para. 4-55).
6. SEQUESTRANT TANK LOW LEVEL indicator light or warning horn does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic line 929, and Schematic Diagram FO-1, Sheet 10, schematic line 1005). Refer to light testing and alarm circuit troubleshooting for additional test procedures. Notify direct support maintenance.
7. CLEAN/FLUSH TANK LOW LEVEL switch does not work (Reference Schematic Diagram FO-1, Sheet 9 schematic lines 924,929-930). **NOTE** Drain the clean/flush tank and remove the level switch from the clean/flush tank (para. 4-54) before troubleshooting.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 1. Remove connector P15 and P12 from the control panel. Check for 110-120 VAC across J15C and J12J.

If voltage is not present, notify direct support maintenance.

Step 2. Check for continuity acmes P15C and P15D. Hold the level switch so the float is down. No power.

(a) If the continuity check is okay, go to step 3.
(b) If there is no continuity, go to step 4.

Step 3. Raise the float and check for continuity between pins P15C and P15G.

if the continuity check is okay, notify direct support maintenance to troubleshoot the control panel.

Step 4. Remove connector P30 from the JB3 junction panel. Check for continuity across J30A and J30E with the float set as in step 3. Let the float drop and check for continuity across J30A and J30B.

if troth continuity checks are okay, replace the cable between PI 5 and P30 (para. 4-27).

Step 5. Refer to the electrical schematic Appx. l-1. Check for continuity, point-to-point, from J30A and J30B.

(a) Repair any hose or damaged wire (para. 4-32).
(b) Replace connector J30 assembly if faulty (para. 4-32.
(c) Replace LSL1 (Reference interconnection Diagram FO-2, Sheet 14) if it shows and open circuit (para. 4-54).

Step 6. Refer to the electrical schematic Appx. l. Check for continuity, point-to-point, from J30A to J30E with the float lifted as in step 3.

(a) Repair any hose or damaged wire (para. 4-32).
(b) Replace connector J30 assembly if faulty (para. 4-32).
(c) Replace LSL1 if it shows an open circuit (para. 4-54).

8. CLEAN/FLUSH TANK LOW LEVEL indicator light or warning horn does not work (Reference Schematic Diagram FO-1, Sheet 9, schematic line 932 and Schematic Diagram FO-1, Sheet 10, schematic line 1010). Refer to light testing and alarm circuit troubleshooting for additional test procedures.

Notify direct support maintenance.

VENT FAN.

' Vent fan does not work preference Schematic Diagram FO-1, Sheet 10. schematic line 1023).

Step 1. Remove connector P53 from the top of switch box 2. Check for 110-120 VAC between J53A and J53B (Reference Interconnection Diagram FO-2, Sheet 15) with fan switch “ON”.

if voltage is not present, go to step 3.

Step 2. Remove and tag the wires to the fan motor. Check the cable and connector for continuity and shorts on each wire.

(a) Replace the cable assembly if open or shorted (para. 4-69).
(b) Replace the fan assembly if no cable faults are found (para. 4-69).

Step 3. Remove connector P52 from the side of the switch box 2. Check for 110-120 VAC between P52C and P52J (Reference interconnection Diagram FO-2, Sheet 15).

if voltage is not present, go to step 5.

Step 4. Check continuity, point-to-point, from J52B to J53A and from J52J to J53B.

(a) Repair any loose or damaged wire (para. 4-31).
(b) Replace switch SS7 if open (Reference interconnection Diagram FO-2, Sheet 15) (para. 4-31).
(c) Replace either electrical connector assembly if faulty (para. 4-31).

Step 5. Remove connector P12 (Reference Interconnection Diagram FO-2, Sheet 15) from the side of the control panel. Check for 110-120 VAC between J12C a J12J, (Reference interconnection Diagram FO-2, Sheet 9).

If voltage is not present, notify direct support maintenance.

Step 6. Check continuity from P12C to P52C and from P12J to P52J.

Replace the cable if open (para. 4-27).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CHEMICAL PUMPS.

1. Chemical pump(s) do not run (Reference Schematic Diagram FO-1, Sheet 6,schematic lines 621-627).

Step 1. Set the control panel up in system "NORMAL" and push the "CHEMICAL PUMP" start pushbutton. The green "CHEMICAL PUMP ON" light should come on.

If light does not come on, notify direct support maintenance.

Step 2. Remove connectors P12 and PReference Interconnection Diagram FO-2, Sheet 15) from the side of the panel. Check for 110-120 VAC across pins J12R/J12S (poly rep), J121/J12N (product chlorine pump). and J16A/J16B (Reference Interconnection Diagram FO-2, Sheet 9)(sequest

If voltage is not present for the pump(s) being troubleshoot, notify direct support maintenance.

Step 3. Reconnect P12 and P16. Disconnect the connector(s) at the pump(s) being troubleshoot. Check for 110-120 VAC across the A and B pins in each connector (control panel end).

If voltage is not present, refer to the electrical schematic and replace the cable and connectors from the control panel to the pump that are faulty (para. 4-27).

Step 4. Remove the pump control panel by removing the four corner screws and loosening the hex nut on the stroke length knob. Check that the two fuses are not blown. Check that power leads in the pump are tight and no corrosion is present on the connections.

(a) Replace the fuses if blown (para. 4-36)

(b) Clean off any corrosion.

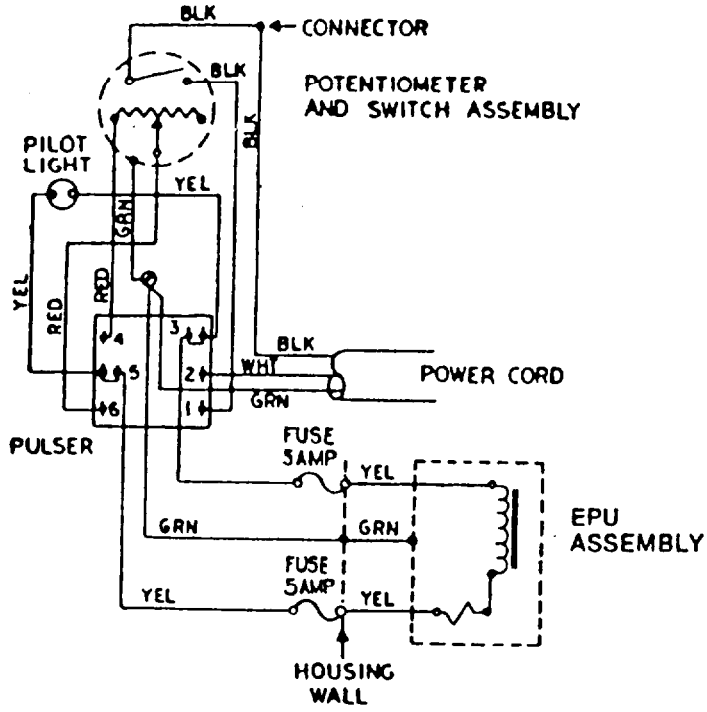


Figure 4-2. Chemical Pumps Wiring Diagram

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 5. Install pump control panel.

NOTE

The following tests should be conducted with the pump head and diaphragm installed. If pump head is removed it is common for the shaft to hang forward and not stroke.

NOTE

If the stroke length knob does not go to 100, turn it counterclockwise until motion stops. Remove the yellow cap and loosen hex nut. Reset knob by setting the knob to point to zero and retightening hex nut.

Step 6. Reconnect the connector disconnected in step 3 and push the chemical pump "START" pushbutton. Set the speed knob at 100. Set the stroke knob to 100. Listen to the stroking action. The pump should pulse between 95 and 110 times per minute. This indicates that the electronic pulser module is working correctly. Count the number of strokes in 6 seconds and multiply the total by 10 to obtain the strokes per minute.

(a) If pump strokes faster than 110 times per minute, replace the pulser module (para. 4-36). Light would stay on almost continuously.
(b) If stroke light stays on, got to step 10.
(c) If stroke light stays off, go to step 7.
(d) If pump strokes slower than 95 times per minute, go to step 9.

Step 7. Push the CHEMICAL PUMP STOP switch. Remove the pump control panel as in ate 4. Push the CHEMICAL PUMP START button. Check for 110-120 VAC across terminal 2 and the black incoming power wire.

If voltage is not present, replace the pump cable (para. 4-36).

Step 8. Check for 110-120 VAC across pulser terminals 1 and 2,

(a) If no voltage is present, replace the switch (para. 4-36).
(b) If the terminals of the pulser are getting proper voltage, the EPU is stroking, and the stroke light is off, replace the stroke light (para. 4-36).
(c) If EPU does not stroke with power applied, go to step 9.

Step 9. Push the CHEMICAL PUMP STOP switch. Disconnect the pump connector. Remove the red wire from pulser terminals 4 and 6. Power off. Measure resistance across these two wires making sure the speed knob is set fully clockwise. Resistance should be less than 100 Ohms. Turn speed nob fully counter clockwise. The resistance should be 1,000,000 Ohms (1 megohm ± 20%).

(a) If the resistance is not correct, replace the potentiometer (para. 4-36).
(b) If the resistance check is not okay, replace the pulser (para. 4-36).

Step 10. Push the CHEMICAL PUMP STOP switch. Disconnect the pump connector. Remove the pump control panel as in step 4. Disconnect yellow EPU wires from pulser terminals 3 and 5. Measure the resistance across the EPU wires. Cold coil (64-72°F) resistance readings should be 42-50 Ohms.

Replace the EPU assembly if readings are other than those listed (para. 4-36).

Step 11. Use an ohmmeter set for high resistance and measure the resistance between either EPU lead and the green EPU ground lead. Resistance should be infinity.

(a) Replace the EPU assembly if resistance is not infinity (para. 4-36).
(b) Replace the chemical pump if all the preceding checks are satisfactory and the pump will not run (para. 4-36).

2. Chemical pumps run but light does not come on (Reference Schematic Diagram FO-1, Sheet 6, schematic lines 610-611).

Notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

AUTOMATIC VALVES.

CAUTION
(MODEL WTA-060 ONLY)

Whenever an automatic valve assembly (valve and actuator) is removed from the piping it must be reinstalled with the valve disc open. Attach the air tubing and electrical connector after the valve assembly is Installed in the piping. the actuator is removed from the valve it must be reinstalled with its air and electrical connection removed from it. Additionally, the maintainer must determine that the valve itself Is open. This can be done either by removing the valve from the piping to check it, or, by looking at the bottom of the valve housing and noting the position of the groove on the end of the valve stem. The groove is in alignment with the inner valve disc. Turn the square end of the valve stem a quarter turn to make the groove point towards the inlet/outlet openings on the valve and then installing the actuator. Failure to follow these procedures will result in the valve operating opposite to what it was meant to do in the system.

NOTE
(MODEL WTA-060 ONLY)

The automatic valves on the ROWPU are spring loaded open and air pressure closed. The electrical system controls whether air is, or, is not supplied to the valve. In the event of an electrical circuit or air system failure the valves will automatically open. The actual position of a valve can be determined by removing the plastic valve cap and observing the position of the stem: if the stem Is extended out from the top of the actuator housing, it is closed; if it is sitting on the top of the actuator housing, it is open.

CAUTION
(MODEL ROWPU-1 ONLY)

Whenever an automatic valve assembly (valve and actuator) is removed from the piping, it must be reinstalled with the valve disc open. Attach the air tubing and electrical connector after the valve assembly is installed in the piping. If the actuator is removed from the valve it must be reinstalled with its air and electrical connection removed from it. Additionally, the maintainer must determine whether the valve itself is open. The actual position of the valve can be determined by looking at the position indicator at the bottom of the actuator.

NOTE
(MODEL ROWPU-1 ONLY)

The automatic valves on the ROWPU are spring loaded open and air pressure closed. The electrical system controls whether air is, or, is not supplied to the valve. In the event of an electrical circuit or system failure the valves will automatically open. The actual position of the valve can be determined by looking at the position indicator at the bottom of the actuator.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. Media filter inlet valve does not open (system normal). MEDIA FILTER INLET valve light off (Reference Schematic Diagram FO1, Sheet 7, schematic line 715).
   - Step 1. Check valve for actual position.
     - (a) If valve is closed, go to step 2.
     - (b) If valve is open, refer to valve light does not show correct valve position troubleshooting (malfunction 3).
   - Step 2. Disconnect the valve electrical connector P39. Check for 110-120 VAC across pins J39D and J39E (Reference Interconnection Diagram FO-2, Sheet 15). If there is voltage present, notify direct support maintenance.

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnecting the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

   - Step 3. Close the air block valve at the air manifold for the media filter inlet valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.
     - (a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).
     - (b) If the stem does not retract or if it retracts with a jerky motion, replace the actuator (para. 4-47).

Table 4-2. Unit Troubleshootlng Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. Media fitter inlet valve will not close (system backwash position or system clean position). MEDIA FILTER lN-LET valve light on (Reference Schematic Diagram FO-1, Sheet 7, schematic line 715).

Step 1. Check valve for actual position.
(a) Refer to "AUTOMATIC VALVES" general note.
(b) If valve is closed, refer to valve light does not show correct valve position troubleshooting (malfunction 3).

Step 2. Turn off the raw water pump circuit breaker CB4, the booster pump circuit breaker CB5, and the high pressure pump breaker C (Reference Interconnection Diagram FO-2, Sheet 10). Disconnect the backwash chlorine pump, connector J45 (Reference Interconnection Diagram FO-2, Sheet 10). Disconnect the media filter inlet connector J39. Set the control panel up in SYSTEM CLEAN and push lNITIATE. Check for 110-120 VAC across J39D and J39E (Reference Interconnection Diagram FO-2, Sheet 15).
If voltage is not present, go to step 7.

Step 3. Drain the media filter down until water stops coming out of the media filter top drain. Set the contol-panel up in SYSTEM BACKWASH and push lNITIATE. Observe the BACKWASH AIR INLET valve light on the control panel and check for 110-120 VAC across J39D and J39E when it comes on.
(a) If the backwash air valve light does not come on, refer to backwashing circuit troubleshooting.
(b) If the backwash air light comes on and there is no voltage, go to step 7.

Step 4. Reconnect J39 and check for 110-120 VAC across terminals 4 and 5 on the valve. Follow the control-panel setup as in either step 2 or 3 above when checking voltage on the valve.
If no voltage is present at the terminals, replace the valve cable and connector (para. 4-47).

CAUTION

Even after closing the bbckvalve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Step 5. Cbse the air block valve at the air manifold for the media fitter feed valve. Remove the air tubing from the valve and check that air is being supplied to the valve by opening the air block valve.
If air does not come out the tubing with the air blockvalve open, find the blockage in the air tubing and repair it (paras. 4-24 and 4-68).

Step 6. Check the wiring on the valve for damage or looseness.
(a) Repair any damage to the wiring (para. 4-47).
(b) If the wiring is okay, replace the air control relay and solenoid valve (para. 4-47).

Step 7. Remove connector P14 (Reference Interconnection Diagram FO-2, Sheet 15) from the control panel. Turn off the raw water pump circuit breaker CB4, the booster pump circuit breaker CBS, and the high pressure pump breaker CBS. Disconnect the backwash chlorine pump, connector J45. Set the control panel up in SYSTEM CLEAN and push INITIATE. Check for 110-120 VAC across J14R and J14S (Reference Interconnection Diagram FO-2, Sheet 9).
If voltage is not present, notify direct support maintenance.

Step 8. Drain the media filter down until water stops coming out of the media fitter top drain. Set the control panel up in SYSTEM BACKWASH and push INTIATE. Observe the BACKWASH AIR INLET valve light on the control panel and check for 110-120 VAC across J14R and J14S when it comes on.
(a) if the backwash air valve light does not come on, refer to 'media filter backwashing circuit troubleshooting.
(b) If the BACKWASH AIR light comes on and there is no voltage, notify direct support maintenance.

Step 9. Check for continuity fromP14R to J39D and from P14S and J39E. Power off. Replace the cable and connectors as required (para. 4-27).

Table 4-2, Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

3. MEDIA FILTER INLET light does not work Light tests okay. MEDIA FILTER INLET light does not show the actual valve position (Reference Schematic Diagram FO-1, Sheet 7, schematic line 716).

Step 1, Check the actual position of the valve.

Refer to the "AUTOMATIC VALVES" general note and compare the actual position of the valve to what the indicator light is showing,

Step 2. Check for damaged wires on the valve actuator. Check the limit switches on the valve actuator for damage. Disconnect the valve electrical connector J39 and check for continuity across P39A and P39C (Reference Interconnection Diagram FO-2, Sheet 15) when the valve stem is retracted into the actuator housing (valve open).

(a) Repair any damaged wires (para. 4-47).

(b) Replace the valve limit switch (LS4) (Reference Interconnection Diagram FO-2, Sheet 15) if the actuating lever is broken or if there is no continuity across P39A/C (para. 4-47).

4. Media filter outlet valve does not open (system running). Valve light off (Reference Schematic Diagram FO-1 Sheet 7,schematic line 718).

Step 1. Check valve for actual position.

(a) Refer to "AUTOMATIC VALVES" general notes.

(b) If valve is open, refer to valve light does not show correct valve position troubleshooting (malfunction 6).

Step 2. Disconnect the valve electrical connector P41. Check for 110-120 VAC across pins J41 D and J41 E (Reference Interconnection Diagram FO-2, Sheet 15). If there is voltage present, notify direct support maintenance.

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnect the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

Step 3. Close the air block valve at the air manifold for the media filter outlet valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.

(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).

(b) If the stem does not retractor if it retracts with a jerky motion, replace the actuator (para.

5. Media fitter outlet valve"will not close (system backwash position ors stem clean position). MEDIA FILTER OUTLET valve light on (Reference Schematic Diagram FO-1, Sheet 7, schematic line 718).

Step 1, Check valve for actual position. Refer to 'AUTOMATIC VALVES" general note.

If valve is closed, refer to valve light does not show correct valve position troubleshooting (malfunction 6).

Step *2*, Turn off the raw water pump circuit breaker CB4, the booster pump circuit breaker CB5, and the high pressure pump breaker CB6 (Reference Interconnection Diagram FO-2, Sheet 10). Disconnect the backwash chlorine pump, connector J45. Disconnect the media filter outlet connector J41. Set the control panel up in SYSEM CLEAN and push INITIATE. Check for 110-120 VAC across J41D and J41E,

If voltage is not present, go to step 7.

Step 3. Drain the media filter down until water stops coming out of the media filter top drain. Set the control panel up in SYSTEM BACKWASH and push INITIATE. Observe the backwash air valve light on the control panel and check for 110-120 VAC across J41 D and J41 E when it comes on.

(a) If the backwash air valve light does not come on, refer to 'MEDIA FILTER" backwashing circuit troubleshooting.

(b) If the BACKWASH AIR INLET light comes on and there is no voltage, go to step 7.

Step 4. Reconnect J41 and check for 110-120 VAC across terminals 4 and 5 on the valve. Follow the control panel setup as in either step 2 or 3 above when checking voltage on the valve.

If no voltage is present at the terminals, replace the valve cable and connector (para. 4-47).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Step 5. Close the airblock valve at the air manifold for the media filter outlet valve, Remove the air tubing from the valve and check that air is being supplied to the valve by opening the air block valve.

If air does not come out the tubing with the air block valve open, find the blockage In the air tubing and repair it (parse. 4-24 and 4-68).

Step 6. Check the wiring on the valve for damage or looseness.

(a) Repair any damage to the wiring para. 4-47).

(b) If the wiring is okay, replace the air control relay and solenoid valve (para. 4-47).

Step 7. Remove connector P14 from the control panel. Turnoff the raw water pump circuit breaker CB4, the booster pump circuit breaker CB5 Reference Interconnection Diagram FO-2, Sheet 10), and the high pressure pump breaker CB6. Disconnect the backwash chlorine pump, connector J45. Set the control panel up in SYSTEM CLEAN and push INITIATE. Check for 110-120 VAC across J14A and J14B.

If voltage is not present, notify direct support maintenance.

Step 8. Drain the media filter down until water stops coming out of the media filter top drain. Set the control-panel up in system “BACKWASH” and push "INITIATE". Observe the BACKWASH AIR INLET valve light on the control panel and check for 110-120 VAC across J14A and J14B when it comes on.

(a) If the BACKWASH AIR INLET valve light does not come on, refer to “MEDIA FILTER backwashing circuit troubleshooting.

(b) If the BACKWASH AIR light comes on and there is no voltage, notify direct support maintenance.

Step 9. No power. Check for continuity from P14A to J41 D and from P14B to J41E.

Replace the cable and connectors as required (para. 4-27).

6. MEDIA FILTER OUTLET valve light does not work. Light tests okay. MEDIA FILTER OUTLET valve light does not show the actual position (Reference Schematic Diagram FO-1, Sheet 7, schematic line 719).

Step 1. Check the actual position of the valve.

Refer to the general note on “AUTOMATIC VALVES” and compare the actual position of the valve to what its indicator light is showing.

Step 2. Check for damaged wires on the valve actuator. Check the limit switches on the valve actuator for damage. Disconnect the valve electrical connector J41 and check for continuity across P41A and P41 C when the valve stem is retracted into the actuator housing (valve open).

(a) Repair any damaged wires para. 4-47.

(b) Replace the valve limit switch (LS5) (Reference Interconnection Diagram FO-2, Sheet 15) if the actuating lever is broken or if there is no continuity across P41 A/C (para. 4-47).

7. Backwash inlet valve will not open (system backwash position). Valve light off (Reference Schematic Diagram FO-1, Sheet 7, schematic line 709).

Step 1. Check valve for actual positoin. Refer to “AUTOMATIC VALVES” general note.

If valve is open, refer to valve light does not show correct valve position troubleshooting (malfunction 10).

CAUTION

Even after closing the block valve in the next step there will be85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Disconnect the valve electrical connector P40. Check for 110-120 VAC across pins J4OD and J4OE (Reference Interconnection Diagram FO-2, Sheet 15).

(a) If there is voltage present, notify direct support maintenance.

(b) If there is no voltage present, go to step 3.

Step 3. Close the air block valve at the air manifold for the backwash inlet valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.

(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).

(b) If the stem does not retract, or if it retracts with a jerky motion, replace the actuator (para. 4-47).

8. Backwash inlet valve will not close (s tern normal). BACKWASH INLET valve light on (Reference Schematic Diagram FO-1, Sheet 7, schematic line 709).

Step 1. Check valve for actual position. Refer to “AUTOMATIC VALVES” general note.

If valve is closed, refer to valve light does not show correct valve position troubleshooting (malfunction 10).

Step *2.* Disconnect the valve electrical connector J40. Check for 110-120 VAC across J40D and J40E.

If voltage is not present, go to step 6.

Step 3. Reconnect J40 and check for 110-120 VAC across terminals 4 and 5 on the valve.

If no voltage is present at the terminals, replace the valve cable and connector (para. 4-47).

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Step 4. Close the air block valve at the air manifold for the backwash inlet valve. Remove the air tubing from the automatic valve and check that air is being supplied to the valve by opening the air block valve.

If air does not come out the tubing with the air block valve open, find the blockage in the air tubing and repair it (paras. 4-24 and 4-68).

Step 5. Check the wiring on the valve for damage or looseness.

(a) Repair any damage to the wiring (para. 4-47).

(b) If the wiring is okay, replace the air control relay and solenoid valve (para. 4-47).

Step 6. Remove connector P14 from the control panel and check for 110-120 VAC across J14E and J14F.

(a) If there is voltage present, go to step 7.

(b) If voltage is not present, notify direct support maintenance.

Step 7. Check for continuity from P14E to J40D and from P14F to J40E.

Replace the cable and connectors if faulty (para. 4-27).

9. Backwash inlet valve will not close (system clean position). BACKWASH INLET valve light on (Reference Schematic Diagram FO-1, Sheet 7, schematic line 709).

Refer to the same problem in system “NORMAL” (malfunction 8).

10. Backwash inlet valve does not work. Light tests okay. BACKWASH INLET valve light does not show the actual valve position (Reference Schematic Diagram FO-1, Sheet 7, schematic line 71 O).

Step 1. Check the actual position of the valve.

Refer to the general note on ‘AUTOMATIC VALVES” and compare the actual position of the valve to what its indicator light is showing.

Step 2. No power. Check for damaged wires on the valve actuator. Check the limit switches on the valve actuator for damage. Disconnect the valve electrical connector J40 and check for continuity across P40A and P40C when the valve stem is retracted into the actuator housing (valve open).

(a) Repair any damaged wires para. 4-47).

(b) Replace the valve limit switch (LS2) if the actuating lever is broken or if there is no continuity across P40A/C (para. 4-47).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

11. Backwash outlet valve will not open (system backwash position), BACKWASH OUTLET valve light off (Reference Schematic Diagram FO-1, Sheet 7, schematic line 712).
Step 1. Check valve for actual position. Refer to 'AUTOMATIC VALVES" general note.
If valve is open, refer to valve light does not show correct valve position troubleshooting (malfunction 14).
Step 2. Disconnect the valve electrical connector P38. Check for 110-120 VAC across pins J38D and J38E (Reference Interconnection Diagram FO-2, Sheet 15).
It there is voltage present, notify direct support maintenance.

CAUTION

Even after closing the blockvalve in the next step there will be85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnecting the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

Step 3. Close the air blockvalve at the air manifold for the backwash outlet valve. Disconnect the airtubing to the valve actuator. Check if the valve stem retracts into the actuator.
(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).
(b) If the stem does not retract, or if it retracts with a jerky motion, replace the actuator (para. 4-47).

12. Backwash outlet valve will not close (system normal). Valve light on (Reference Schematic Diagram FO-1, Sheet 7, schematic line 712).
Step 1. Check valve for actual position. Refer to 'AUTOMATIC VALVES" general note.
If valve is closed, refer to valve light does not show correct valve position troubleshooting (malfunction 14).
Step 2. Disconnect the valve electrical connector J38. Check for11O-120 VAC across J36D and J38E.
(a) If voltage is not present, go to step 6.
(b) If voltage is present, go to step 3.
Step 3. Reconnect J38 and check for 110-120 VAC across terminals 4 and 5 on the valve.
If no voltage is present at the terminals, replace the valve cable and connector (para. 4-47).

CAUTION

Even after closing the block valve in the next step there will be85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Step 4. Close the air block valve at the air manifold for the backwash outlet valve. Remove the air tubing from the automatic valve and check that air is being supplied to the valve by opening the air block valve.
If air does not come out the tubing with the air block valve open, find the blockage in the air tubing and repair or replace it (para. 4-24 and 4-68).
Step 5. Check the wiring on the valve for damage or looseness.
(a) Repair any damage to the wiring (para. 4-47).
(b) If the wiring is okay, replace the air control relay and solenoid valve (para. 4-47).
Step 6. Remove connector P14 (Reference Interconnection Diagram FO-2, Sheet 15) from the control panel and check for 110-120 VAC across J14J and J14K.
(a) If voltage is not present, notify direct support maintenance.
(b) If voltage is present, go to step 7.
Step 7. Power off. Check for continuity from P14J to J38D and from P14K to J38E.
Replace the cable and connectors if faulty (para. 4-27).

13. Backwash outlet valve will not close (system clean). Valve light on (schematic line 712).
Refer to the same problem in system "NORMAL" (malfunction 12).

Table 4-2. Unit Troubleshooting Guide (continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

14. BACKWASH OUTLET valve light does not work. Light tests okay. BACKWASH OUTLET valve fight does not show the actual valve position (Reference Schematic Diagram FO-1, Sheet 7, schematic line 713).

Step 1. Check the actual position of the valve.

Refer to the "AUTOMATIC VALVES" general note and compare the actual position of the valve to what its indicator light is showing.

Step 2. Check for damaged wires on the valve actuator. Check the limit switches on the valve actuator. Disconnect the valve electrical connector J38 and check for continuity across P38A and P38C when the valve stem is retracted into the actuator housing (valve open).

Repair any damaged wires (para. 4-47).

(a) Replace the valve limit switch (LS3) (Reference Interconnection Diagram FO-2, Sheet 14) if the actuating lever is broken or if there is no continuity across P38A/C (para. 4-47).

15. Clear/flush tank valve does not open (system clean). Valve light off (Reference Schematic Diagram FO-1, Sheet 7, schematic line 735).

Step 7. Check valve for actual position. Refer to "AUTOMATIC VALVES" general note.

If valve is open, refer to valve light does not show correct valve position troubleshooting (malfunction 19).

Step 2. Disconnect the valve electrical connector P33. Check for 110-120 VAC across pins J33D and J33E (Reference Interconnection Diagram FO-2, Sheet 14). If there is voltage present, notify direct support maintenance.

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnecting the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

Step 3. Close the air Blockvalve at the air manifold for the clean/flush tank valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.

(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).

(b) If the stem does not retract, or if it retracts with a jerky motion, replace the actuator (para. 4-47).

16. Clear/flush tank valve does not open during the last base of media filter backwasher . CLEAN/FLUSH OUTLET valve light off (Reference Schematic Diagram FO-1, Sheet 7, schematic line 735).

Step 1. Turn off the raw water pump circuit breaker CB4 and the booster pump circuit breaker CB5 (Refer-*ence* Interconnection Diagram FO-2, Sheet 10). Disconnect the backwash chlorine pump, connector J45 (Reference Interconnection Diagram FO-2, Sheet 15). Drain the media filter down until water stops coming out of the top media filter drain valve. Set the control panel up in SYSTEM BACKWASH position and push INTIATE. The clear/flush tank valve should open when the raw water pump shuts down near the end of the backwash cycle. Check valve for actual position (should be closed).Refer to "AUTOMATIC VALVES" general note.

If valve is open, refer to valve light does tm show correct valve position troubleshooting (malfunction 19).

Step 2. Disconnect the valve electrical connector P33. Check for 110-120 VAC across pins J33D and J33E during the last phase of the backwash cycle (after the raw water pump shuts down).

(a) If there is voltage present, notify direct support maintenance.

(b) If there is no voltage present, go to step 3.

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnecting the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Close the airlock valve at the air manifold for the clean/flush tank valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.
(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 447).
(b) If the stem does not retract, or if it retracts with a jerky motion, replace the actuator (para. 4-47).

17. Clean/flush tank valve does not open (system shutdown). CLEAN/FLUSH OUTLET valve light off (Reference Schematic Diagram FO-1, Sheet 7, schematic line 735).

Step 1. Check valve for actual position.
(a) Refer to "AUTOMATIC VALVES" general note.
(b) If valve is open refer to valve light does not show correct valve position troubleshooting (malfunction 19).

Step 2. Disconnect the valve electrical connector P33. Check for 110-120 VAC across pins J33D and J33E. If there is voltage present, notify direct support maintenance.

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnecting the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

Step 3. Close the air blockvalve at the air manifold for the clean/flush tank valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.
(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).
(b) If the stem does not retractor if it retracts with a jerky motion, replace the actuator (para. 4-47).

18. Clean/flush tank valve does not close (system running normal). Clean/flush valve is not closed when it should be. Valve light on (Reference Schematic Diagram FO-1, Sheet 7, schematic tine 735).

Step 1. Check valve for actual position. Refer to "AUTOMATIC VALVES" general note.
If valve is closed, refer to valve light does not show correct valve position troubleshooting (malfunction 19).

Step 2. Disconnect the valve electrical connector J33. Check for 110-120 VAC across J33D and J33E. If voltage is not present, go to step 6.

Step 3. Reconnect J33 and check for 110-120 VAC across terminals 4 and 5 on the valve.
If no voltage is present at the terminals, replace the valve cable and connector (para. 4-47).

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Step 4. Close the air block valve at the air manifold for the clean/flush valve. Remove the air tubing from the automatic valve and check that air is being supplied to the valve by opening the air block valve.
If air does not come out the tubing with the air block valve open, find the blockage in the air tubing and repair it (paras. 4-24 and 4-68).

Step 5. Check the wiring on the valve for damage or looseness.
(a) Repair any damage to the wiring (para. 4-47).
(b) If the wiring is okay, replace the air control relay and solenoid valve (para. 4-47).

Step 6. Remove connector P15 (Reference Interconnection Diagram FO-2, Sheet 14) from the control panel and check for 110-120 VAC across J15H and J15I (Reference Interconnection Diagram FO-2, Sheet 9).
If voltage is not present, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continuad)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 7. Shut power off. Refer to the electrical schematic and check continuity, point-to-point, from P15H to J33D and from P15I to J33E.

Replace the cables and connectors if faulty (para. 4-27).

19. CLEAN/FLUSH OUTLET valve light does not work. Light tests okay. CLEAN/FLUSH OUTLET valve light does not show the actual valve position (Reference Schematic Diagram FO-1, Sheet 7, schematic line 736).

Step 1. Check the actual position of the valve.

Refer to the general note on 'AUTOMATIC VALVES" and compare the actual position of the valve to what its indicator light is showing.

Step 2. Check for damage wires on the valve actuator. Check the limit switches on the valve actuator for damage. Power off. Disconnect the valve electrical connector J33 and check for continuity across P33A and P33C when the valve stem is retracted into the actuator housing (valve open).

(a) Repair any damaged wires (para. 4-47).

(b) Replace the valve limit switch (LS7) (Reference Interconnection Diagram FO-2, Sheet 14) if the actuating lever is broken or if there is no continuity across P33A/C (para. 4-47).

20. Media filter flush valve light does not work. Light tests okay. Media filter flush valve light does not show the actual valve position (Reference Schematic Diagram FO-1, Sheet 7, schematic line 707).

Step 1. Check the actual position of the valve.

Refer to the general note on 'AUTOMATIC VALVES" and compare the actual position of the valve to what its indicator light is showing.

Step 2. Check for damaged wires on the valve actuator. Check the limit switches on the valve actuator for damage. Disconnect the valve electrical connector J48 and check for continuity across P48A and P48C (Reference Interconnection Diagram FO-2, Sheet 15) when the valve stem is retracted into the actuator housing (valve open).

(a) Repair any damaged wires (para. 4-47).

(b) Replace the valve limit switch (LS1) (Reference Interconnection Diagram FO-2, Sheet 15) if the actuating lever is broken or if there is no continuity across P48A/C (para. 4-47).

21. Media filter flush valve will not open in fitter backwash or when the flush valve switch is pushed. MEDIA FILTER FLUSH valve light off (Reference Schematic Diagram FO-1, Sheet 7, schematic lines 706-707).

Step 1. Check valve for actual position.

(a) Refer to automatic valve general notes.

(b) If valve is open, refer to valve light does not show correct valve position troubleshooting(malfunction 20).

Step 2. Disconnect the valve electrical connector P48. Check for 110-120 VAC across pins J48D (Reference Interconnection Diagram FO-2, Sheet 15) and J48E.

If there is voltage present, notify direct support maintenance.

CAUTION

Even after closing the block valve in the next step there will be 85 psig (586 kPa) air in the tubing to the automatic valve. Be careful when disconnecting the tubing at the block valve. Slowly back off the tubing nut to allow air pressure drainage.

Step 3. Close the air block valve at the air manifold for the backwash outlet valve. Disconnect the air tubing to the valve actuator. Check if the valve stem retracts into the actuator.

(a) If the stem retracts, repair the valve actuator by replacing the air control relay and solenoid valve (para. 4-47).

(b) If the stem does not retract, or if it retracts with a jerky motion, replace the actuator (para. 4-47).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTWE ACTION

22. Media filter flush valve will not close in fitter backwash or when the MEDIA FILTER FLUSH valve switch is pushed. Indicator light on (Reference Schematic Diagram FO-1, Sheet 7, schematic line 706).

Step 1. Check valve for actual position. Refer to "AUTOMATIC VALVES" general note.
If valve is closed, refer to valve light does not show correct valve position troubleshooting (malfunction 20).

Step 2. Disconnect the valve electrical connector J48. Check for 110-120 VAC across J48D and J48E.
If voltage is not present, go to step 6.

Step 3. Reconnect J48 and check for 110-120 VAC across terminals 4 and 5 on the valve.
If no voltage is present at the terminals, replace the valve cable and connector (para. 4-47).

CAUTION

Even after closing the block valve in the next step there will be85 psig (586 kPa) air in the tubing to the automatic valve. Slowly back off the tubing nut at the block valve to relieve air pressure before removing the air tubing at the automatic valve.

Step 4. Close the air block valve at the air manifold for the filter flush valve. Remove the air tubing from the automatic valve and check that air is being supplied to the valve by opening the air block valve.
If air does not come out the tubing with the air block valve open, find the blockage in the air tubing and repair if (paras. 4-24 and 4-68).

Step 5. Check the wiring on the valve for damage or looseness.
(a) Repair any damage to the wiring (para. 4-47).
(b) If the wiring is okay, replace the air control relay and solenoid valve (para. 4-47).

Step 6. Remove connector P14 Reference Interconnection Diagram FO-2, Sheet 15) from the control panel and check for 110-120 VAC across J14b and J14d (Reference Interconnection Diagram FO-2, Sheet 9).
(a) If voltage is not present, notify direct support maintenance.
(b) If voltage is present, go to step 7.

Step 7. Refer to the electrical schematic and check continuity, point-to-point, from P14b to J48D and from P14d to J48E.
Replace the cable and connectors if faulty (para. 4-27).

BOOSTER PUMP.

WARNING

Electrical high voltage can cause serious injury or death. Some tests performed in troubleshooting require power to be connected. Always take proper measures to ensure personal safety.

NOTE

Ensure that all circuit breakers are set. Refer to Appendix I for schematic and interconnection diagrams. Continuity and short circuit test arrangement for pump motor is shown in Figures 4-3 and 4-4.

NOTE

Several of the following procedures require that the ROWPU be set up in "SYSTEM NORMAL" operating mode to check if the pump works properly. If it is known that the pump functions properly in that mode it is not necessary to check again.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

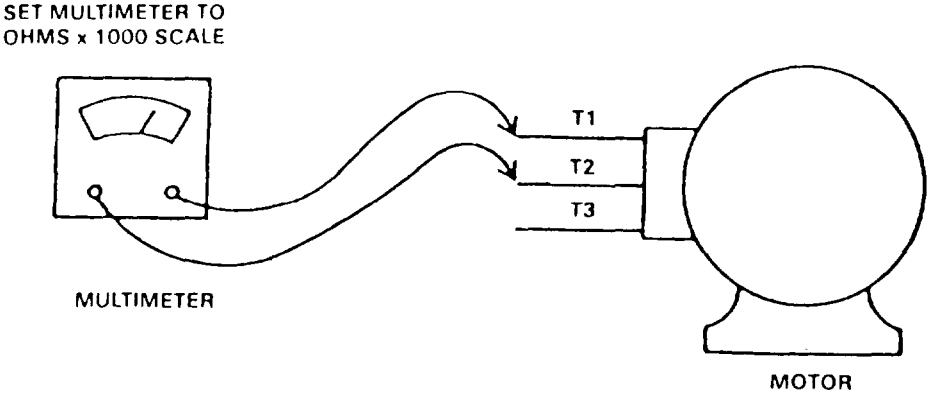


Figure 4-3. Continuity Test Arrangement

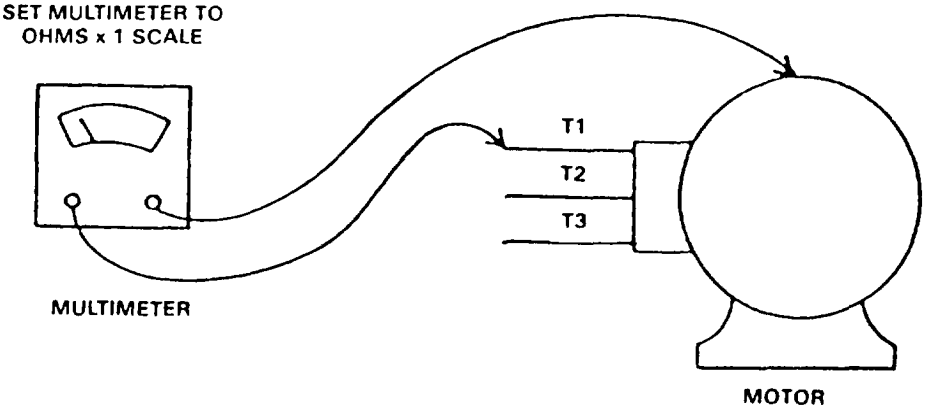


Figure 4-4. Short Circuit Test Arrangement

1. Booster pump won't start (SYSTEM NORMAL) (Reference Schematic Diagram FO-1, Sheet 6 schematic lines 625-631 control circuits - Reference Schematic Diagram FO-1, Sheet 5, schematic lines 540-542 power circults).

   Step 1. Shutdown the ROWPU. Open the main control panel lower door. Check that the overload reset button on MS7(Reference Interconnection Diagram FO-2, Sheet 10) is in by pushing it.

   (a) If the reset button is in, go to step 2.

   (b) If the button is out and won't reset, notify direct support maintenance to replace the overload heaters on M57 and then go to step 3.

   (c) If the reset button is out but resets when pushed, notify direct support maintenance to adjust the door reset assembly for M57 and then go to step 3.

   Step 2. Leave the control panel door open. Refer to para. 2-19 and start the ROWPU in “SYSTEM NORMAL”. Watch the indicating plunger on the M57 motor starter. It should pull in when the booster pump is started.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(a) If it does not pull in, or, if it pulls in but does not stay in, notify direct support maintenance to troubleshoot the booster pump circuits.
(b) If it pulls in and stays in, go to step 3.

Step 3. Shut down the generator. Remove connector P21 (Reference Interconnection Diagram FO-2, Sheet 16) from the side of the control panel. Set the multimeter to Ohms x 1000 scale. Check each pin, P21A, P21B, and P21C for a circuit to P21D. Each reading should be infinity.

If any reading is zero, there is a short circuit, go to step 5.

Step 4. Set the multimeter to Ohms x 1 scale and check for continuity between all pin pairs; P21A and P21B, P21B and P21C, and P21A and P21C. Readings should be zero or near zero for each step.

If the checks performed in both steps 3 and 4 are okay return the ROWPU to operation.

Step 5. Check connectors J/P21 and J/P23 (Reference Interconnection Diagram FO-2, Sheet 16) for Ioose pins and for signs of arcing.

Replace any cable that shows damage (para. 4-27 and 4-43).

Step 6. Check continuity, point-to-point, from P21A to J23A, P21B to J23B, P21C to J23C, and P21D to J23D. Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.

(a) Replace any cable or connector that shows open during continuity checks (pare. 4-27).
(b) Replace an cable or connector that shows a short between phases or a short to ground (para. 4-27).

Step 7. Remove the booster pump cover (para. 4-42). Tag and disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1000 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.

Replace booster pump/motor assembly if the meter reading is zero (para. 4-43).

Step 8. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2, T1 and T3, T2 and T3. Readings should be zero or near zero for each step.

Replace booster pump/motor assembly if reading is infinity (para. 4-43).

Step 9. Check motor cable for continuity on each read and for shorts between phases and ground. Replace the cable if open or shorted (para. 4-43).

2. Booster pump will not start in SYSTEM NORMAL when forward flushing the media filter (Reference Schematic Diagram FO-1, Sheet 6, schematic line 625).

Open the cartridge filter block valve. Start the raw water pump and then the booster pump.

(a) If the pump won't start, refer to booster pump won't start in SYSTEM NORMAL troubleshooting (malfunction 1).
(b) Notify direct support maintenance.

3. Booster pump circuit breaker opens whenever booster pump is stated. ROWPU shuts down when booster pump is started (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 540-542).

Check for short circuits.

(a) Shut down the ROWPU. Shutdown the generator.
(b) Refer to booster pump won't start (SYSTEM NORMAL), steps 5-9 (malfunction 1).
(c) Notify direct support maintenance.

4. Booster pump motor hums but won't turn (Reference Schematic Diagram FO-2, Sheet 15, schematic lines

Step 1. Check generator voltage on all 3-phases. If must be 435-445 VAC on each phase.

(a) Adjust to correct voltage.
(b) If voltage is not correct on all 3-phases, refer to generator troubleshooting.

Step 2. Check system air pressure and use an air manifold drain valve to lower it below 1400 psig (9653 kPa). Turn the air compressor switch on and note if the air compressor runs.

If the air compressor does not operate, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Shutdown the ROWPU. Shut down the generator. Check continuity, point-to-point, from P21A to J23A, P21B to J23B, P21C to J23C, and P21 D to J23D. Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.
(a) Replace any cable or connector that shows open during continuity checks (para. 4-27).
(b) Replace an cable or connector that shows a short between phases or a short to ground (para. 4-27).

Step 4. Tag and disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1000scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.
Replace pump/motor assembly if the meter reading is zero (para. 4-43).

Step 5. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2, T1 and T3, T2 and T3. Readings should be zero or near zero for each step.
Replace pump/motor assentdy if reading is infinity (para. 4-43).

Step 6. Check motor cable for continuity on each lead and for shorts between phases and ground.
(a) Replace the cable if open or shorted (para. 4-43).
(b) Notify direct support maintenance if above checks have not found the problem.

5. Booster pump does not run in 'SYSTEM BACKWASH" position (Reference Schematic Diagram FO-1, Sheet 6, schematic fines 627-628).

Step 1. Check that booster pump runs in "SYSTEM NORMAL" by setting the control panel up for normal operation and starting the raw water pump and then the booster pump.
(a) If the booster pump does not run, refer to booster pump won't run in "SYSTEM NORMAL" troubleshooting (malfunction 1).
(b) Notify direct support maintenance.

6. Booster pump does not start in "SYSTEM CLEAN" (Reference Schematic Diagram FO-1, Sheet 6, schematic lines 628-629).

Check that booster pump runs in "SYSTEM NORMAL" by setting the control panel up for normal operation and starting the raw water pump and then the booster pump.
(a) If the booster pump does not run, refer to booster pump won't run in "SYSTEM NORMAL" troubleshooting (malfunction 1).
(b) Notify direct support maintenance.

7. Booster pump starts in "SYSTEM CLEAN" but won't stay running.
Notify direct support maintenance.

8. Booster pump won't start in the "SYSTEM STANDBY" mode (Reference Schematic Diagram FO-1, Sheet 6, schematic line 629).

Step 1. Check if the pump runs in "SYSTEM NORMAL".
(a) Refer to that problem troubleshooting if it does not operate correctly (malfunction 1).
(b) Notify direct support maintenance.

9. Booster pump runs but pilot light does not work. Light tests okay (Reference Schematic Diagram FO-1, Sheet 6, schematic line 629).
Notify direct support maintenance.

HIGH PRESSURE PUMP.

WARNING

Electrical high voltage can cause serious injury or death. Some tests performed in troubleshooting require power to be connected. Always take proper measures to ensure personal safety.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

Continuity and short circuit test arrangements for pump motor are shown in Figures 4-3 and 4-4.

NOTE

Ensure that all circuit breakers are set before troubleshooting.

1. High pressure pump will not start (Reference Schematic Diagram FO-1, Sheet 6, schematic lines 632-637-control circuits, Reference Schematic Diagram FO-1, Sheet 5, schematic lines 502-510-power circuits).

   Step 1. Shutdown the ROWPU. Open the main control panel lower door. Check that the overload reset button on MS8-1M (Reference Interconnection Diagram FO-2, Sheet 10) is in by pushing it.

   (a) If the reset button is in, notify direct support maintenance to troubleshoot the high pressure pump motor circuits.

   (b) If the button is out and won't reset, notify direct support maintenance to replace the overload heaters on MS8-1M and troubleshoot the high pressure pump motor circuits.

   (c) If the reset button is out but resets when pushed, notify direct support maintenance to adjust the door reset assembly for MS8-1M and then restart the pump.

   (d) If the pump won't start or starts and shuts down, notify direct support maintenance to troubleshoot the high pressure pump motor circuits.

2. High pressure pump motor hums but won't turn. High pressure pump turns over easily.

   Notify direct support maintenance to check for shorted motor.

3. High pressure pump starts, but generator loads down and won't let the pump come up to full speed. Lights may dim. Generator circuit breaker may open. Generator exhaust is thick and black.

WARNING

Do not start the high pressure pump if water is not flowing freely out of the waste hose.

Check that water is flowing from the waste hose when the raw water and booster pump are running.

(a) If water is not flowing, check through the system and find where the water flow stops. Repair as necessary.

(b) If operating in freezing conditions check that the high pressure hoses on the high pressure pump skid are not frozen.

(c) Notify direct support maintenance.

RAW WATER PUMP.

WARNING

Electrical high voltage can cause serious injury or death. Some tests performed in troubleshooting require power to be connected. Always take proper measures to ensure personal safety.

NOTE

Continuity and short circuit test arrangements for pump motor are shown in Figures 4-1 and 4-2.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

NOTE

Ensure that all circuit breakers are set. Refer to Appendix l-1 for schematic diagram and Appendix I-2 for interconnection diagram.

1. Raw water pump won't start (SYSTEM NORMAL) (Reference Schematic Diagram FO-1, Sheet 6, schematic lines 619-621 - control circuits, Reference Schematic Diagram FO-1, Sheet 5, schematic lines 532-537-power circuits).

Step 1. Shutdown the ROWPU. Open the main control panel lower door. Check that the overload reset button on MS3 (Reference Interconnection Diagram FO-2, Sheet 10) is in by pushing it.

(a) If the reset button is in, go to step 2.
(b) If the button is out and won't reset, notify direct support maintenance to replace the overload heaters on M53 and then go to step 3.
(c) If the reset button is out but resets when pushed, notify direct support maintenance to adjust the door reset assembly for M53 and then go to step 3.

Step 2. Leave the control panel door open. Refer to para. 2-19 and start the ROWPU in "SYSTEM NORMAL". Watch the indicating plunger on the M53 motor starter. It should pull in when the raw water pump is started.

(a) If it does not pull in, or, if if pulls in but does not stay in, notify direct support maintenance to troubleshoot the raw water pump circuits.
(b) If it pulls in and stays in, go to step 3.

Step 3. Shut down the generator. Refer to the electrical schematic Appx. l-1 and interconnect diagram Appx. l-2. Set multimeter to Ohms x 1000 scale. Check each lead, 3T1, 3T2, and 3T3 from the outlet side of M53 to ground. The reading should be infinity for each lead.

If the meter reading is zero there is a short circuit, go to step 5.

Step 4. Set the multimeter to Ohms x 1 scale and check for continuity between all pairs of leads; 3T1 and 3T2, 3T1 and 3T3, 3T2 and 3T3. Readings should be zero or near zero for each step.

If the checks performed in both steps 3 and 4 are okay, return the ROWPU to operation.

Step 5. Check connectors J/P21, J/P22, J/P57, J/P58, and J/P59 (Reference Interconnection Diagram FO-2, Sheet 16) for hose pins and for signs of arcing.

Replace any cable that shows damage (paras. 4-27 and 4-13).

Step 6. Check continuity, point-to-point, from P21E to J59A, P21 F to J59B, P21 G to J59C, and P21 H to J59D. Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.

(a) Replace any cable or connector that shows open during continuity checks (paras. 4-27 and

(b) Replace any cable or connector that shows a short between phases or a short to ground para. 4-27 and 4-13.
(c) Repair any hose or damaged wires in the outside junction box (para. 4-34).
d) Replace any MOV's (Reference Interconnection Diagram FO-2, Sheet 16) in the external electrical panels that show physical damage or are shorted to ground from the power terminal (para. 4-34).

Step 7. Tag and disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1000 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.

Replace pump/motor assembly if the meter reading is zero (para. 4-15).

Step 8. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2, T1 and T3, T2 and T3. Readings should be zero or near zero for each step.

Replace pump/motor assembly if reading is infinity (para. 4-15).

Step 9. Check motor cable for continuity on each lead and for shorts between phases and ground.

Replace the cable if open or shorted (para. 4-15).

2. Raw water pump starts but stops when start button is released (Reference Schematic Diagram FO-1, Sheet 6, schematic lines 619-620).

Notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

3. Raw water pump motor hums but won't turn (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 532-535).

step 1. Check generator voltage on all three phases. it must be 435-445 VAC on each phase.
Adjust to correct voltage.
If voltage is not correct on all three phases, refer to generator troubleshooting.

Step 2. Check system air pressure and use an air manifold drain valve to lower it below 1400 psig (9653 kPa). Turn the air compressor switch on and note if the air compressor runs. Alternately, turn on both switches for the distribution pump and note if it runs.
If the 3-phase motors listed do not operate, notify direct support maintenance.

Step 3. Check continuity, point-to-point, from P21E to J59A, P21F to J59B, P21G to J59C, and P21H to J59D. Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.
(a) Replace any cable or connector that shows open during continuity tests (para. 4-27).
(b) Replace any cable or connector that shows a short between phases or a short to ground para 4-27).
(c) Replace any loose or damaged wires in the external electrical and (para. 4-34).
(d) Replace any MOV's in the external electrical panel that show physical damage or are shorted to ground from the power terminal (para. 4-34).

Step 4. Tag and disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1000 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.
Replace pump/motor assembly if the meter reading is zero (para. 4-15).

Step 5. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2, T1 and T3, T2 and T3. Readings should be zero or near zero for each step.
Replace pump/motor assembly if reading is infinity (para. 4-15).

Step 6. Check motor cable for continuity on each lead and for shorts between phases and ground. Replace the cable if open or shorted (para. 4-15).

Step 7. Notify direct support maintenance if the above checks have not found the problem.

4. Raw water pump won't start in system backwash (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 532-535).
Check that raw water pump starts in "SYSTEM NORMAL".
(a) If the pump does not operate, refer to raw water pump won't operate 'SYSTEM NORMAL" troubleshooting (malfunction 1).
(b) Notify direct support maintenance.

5. Raw water pump circuit breaker opens whenever the pump is started, ROWPU shuts down when the raw water pump is started (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 532-535).
Check for short circuits.
(a) Shut down the ROWPU. Shutdown the generator.
(b) Refer to the electrical schematic Appx. I-1 and interconnect diagram Appx. I-2.
(c) Refer to raw water pump won't start troubleshooting, steps 5 thru 9 (malfunction 1).
(d) Notify direct support maintenance.

6. Raw water pump circuit breaker trips repeatedly, raw water ground fault trips repeatedly (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 532-537).

NOTE

This problem is hard to pin point directly as the two circuit breakers are electrically tied together so that what affects one will usually trip the other even though each is sensing different levels of short circuit. The direct-acting circuit breaker will only trip

NOTE Continued Next Page

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE (CONTINUED)

when overcurrents exceed its setpoint, such as a direct bolted short circuit. By contrast, an arcing short circuit may amount to only a fraction of the direct-acting circuit breaker setpoint and not cause it to trip. Arcing faults are typically caused by loose connections, the presence of vermin, rodents, and insects in equipment, or insulation deterioration as a result of mechanical damage, heat aging, or moisture, dust, and other contaminants. Since the arcing type fault usually involves a flow of current in the ground path, the ground fault circuit breaker monitors the ground circuit for current flow. When it senses current in the ground circuit it will trip and also trip out the pump circuit breaker. Under other circuit conditions-balanced, unbalanced, or single phase load currents, or single or three phase short circuits not involving ground- it will not trip even though the pump breaker does. For these reasons the following troubleshooting steps are very general and success in isolating the problem relies on the electrician to carefully inspect all cables, connectors, and connections for signs of damage or moisture intrusion. In some cases only the substitution of known reliable components will identify the cause.

Step 1. Shut down the ROWPU. Shut down the generator. Open the external electrical panel. Check all cables and connections from the control panel to the pump for tightness, physical damage, and evidence of water, dirt, or arcing.. Open the motor connection box and check the connection inside it.
Repair an damage found.

Step 2. Check the MOV's in the external electrical panel for physical damage or shorts to ground from the power terminal.
Replace any faulty MOV'S (para. 4-34).

Step 3. Check for short circuits.
Refer to malfunction 1, steps 5 thru 9.

Step 4. Use a pump from another unit and check it for operation.
(a) If the replacement pump runs okay, continue to check the faulty pump/motor for the problem.
(b) If the problem cannot be found, notify direct support maintenance.

7. Raw water pump circuit breaker will not reset, raw water pump ground fault will not reset (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 532-537).
Notify direct support maintenance.

CIRCUIT BREAKERS 440 VAC.

Circuit breaker will not reset.

NOTE

This procedure does not apply to the distribution or raw water pump circuit breakers. Refer to individual troubleshooting for those breakers.

Shut down ROWPU and reset the circuit breaker.
(a) If the breaker will not stay set, notify direct support maintenance.
(b) Refer to individual circuit troubleshooting for the breaker if it stays set with no power on the system.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CARBON MONOXIDE (CO) MONITOR.

1. Alarm does not activate at 25 or at 50 ppm display.
   Adjust setpoints (para. 4-63).
   Notify direct support maintenance.
2. Monitor does not dispfay.

NOTE

The monitor will work on either 28 VDC or 115VAC. It does not require both voltages for operation. The monitor will automatically work off of the higher voltage that appears at its terminals.

Step 1. Open the monitor and check for 110-120 VAC across terminals ACHI and ACLO. Check for 24-28 VDC across DC+ and DC-.
(a) If 24-28 VDC is not present, go to step 3.
(b) If 110-120 VAC is not present, go to step 6.

Step 2. Reset the circuit breaker.
If the monitor does not display, notify direct support maintenance.

Step 3. Disconnect the 28 VDC supply connector 2A at the power supply. Test the CO monitor fuse and check for continuity across the fuse
(a) Replace the fuse if it is blown (para. 4-63).
(b) If the monitor does not show a display after replacing the fuse, notify direct support maintenance.

Step 4. Check if the diesel fuel heaters operate.
Refer to power supply troubleshooting if the heaters do not operate.

Step 5. Disconnect the 28 VDC supply connector 2A at the power supply. Disconnect the 115 VAC connector 3A at the power supply. Check continuity from the power supply + terminal to DC+ in the monitor. Check continuity from the power supply - terminal to DC-in the monitor.
If either wire is open, notify direct support maintenance.

Step 6. Shut down the ROWPU. Shutdown the generator. Open the control panel and check continuity from terminal strip 1-52 to ACHI in the monitor. Check continuity from terminal strip 1-88 to ACLO in the monitor.
If either wire is open, notify direct support maintenance.

DIESEL HEATERS.

WARNING

Electrical high voltage can cause serious injury or death. Some tests performed in troubleshooting require power to be connected. Always take proper measures to ensure personal safety.

NOTE

Diesel heater wiring diagrams are shown in Figure 4-5.

NOTE

Ensure that all circuit breakers are set before troubleshooting.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. Diesel fuel heater does not start (motor fails to run) (Reference Schematic Diagram FO-1, Sheet 11, schematic lines 1131-1135).

Step 1. Disconnect the electrical connector for the heater (P/J4 for heater No. 1 and P/J5 (Reference Interconnection Diagram FO-2, Sheet 14) for heater No. 2). Check for 28 VDC (24 VDC minimum) across the A and B pins of the J (female) connector.

It voltage is not present, refer to power supply troubleshooting.

Step 2. Remove the cover on the heater control box. Be careful that any wire connections are not touching the metal enclosure. Reconnect the heater connnector that was disconnected in step 1. Check for 28 VDC (24 minimum) across terminal 1 (negative) and heater circuit breaker CB-1 (positive) (Reference Interconnection Diagram FO-2, Sheet 10).

If voltage is not resent, replace the heater cable and connector (P4 or P5) (para. 4-60).

Step 3 Check for 24-28 VDC across terminal 1 and CB-1 (red wire).

If voltage is not present, replace the circuit breaker CB-1 (para. 4-60).

Step 4. Remove the heater cover. Check for 24-28 VDC across the heater terminals T2 and T1 and between T4 and T1 when the START-RUN-OFF switch on the heater control box is toggled to START.

If voltage is present and the motor does not run, replace the heater (para. 4-60).

Step 5. Disconnect the connector on the bottom of the heater. Check for 24-28 VDC across the jack (female) pins B and A and between D and A when the START switch is toggled to START.

If voltage is present, replace the heater electrical connector cable assembly (para. 4-60).

Step 6. Check for 24-28 VDC at terminals T2 and T1 and between T4 and T1 in the heater control box with the START switch toggled to START.

(a) If voltage is present, replace the electrical cable from the control box to the heater (para. 4-60).

(b) If voltage is not present, replace the heater control box (para. 4-60).

2. Diesel fuel heater motor runs but there is no combustion.

Step 1. Check for fuel at the float bowl (para. 4-60). Remove the 1/8 NPT pipe plug in side of float bowl and gently depress the float. If fuel is present, it will show on the object used to depress the float and buoyancy can be felt.

If there is no fuel, go to step 8.

Step 2. Check for hold-fire thermostat control assembly maladjustment.

Refer to maintenance procedures for adjustment (para. 4-60).

WARNING

If the high tension lead is disconnected from the igniter for any reason, DO NOT energize the unit without first providing a discharge gap of 1/8 inch or less from the high tension lead to the grounded igniter. With a larger gap, electrical potential can build up to a point which can cause an insulation breakdown in the ignition pack assembly or in the high tension lead. The same also applies if the high tension lead is attached to the igniter with the igniter removed from the unit. Provide a gap of 1/8 inch or less here also.

Step 3. Check for spark by holding an insulated-handle screwdriver with the shaft grounded and the tip approximately 1/8 inch away from the high tension lug of the ignition pack assembly. There should be a continuous strong yellowish spark.

If no spark or a weak spark is produced, go to step 7.

Step 4. Remove and check the igniter. There should no heavy deposits and the electrode should be centered. Visually check operation with the igniter removed-from the burner head, but connected to the high tension lead. Disconnect the fuel pump electrical connector at the fuel pump and lay t he igniter on the heater case to check for spark. The igniter must be grounded when testing.

Replace the igniter if it has heavy deposits or the center electrode is damaged or if there is no spark (para. 4-60).

Step 5. Remove the preheat cartridge from the carburetor. Lay it on the heater case so it is rounded and toggle the cheat switch on. The cartridge should start to heat up. Check for 24-28 VDC across heater terminal T8 and T1.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(a) If there is power but the preheater does not warm up, replace the preheat cartridge (para. 4-60).

(b) If there is no power, disconnect the heater power cable and check continuity from the heater terminal T8 back to the heater control box terminal T8 and through the preheat switch. Tighten any loose wires.

(c) Replace the heater if the preceeding steps have not located the problem (para. 4-60).

Step 6. Check for 24-28 VDC at the heater terminal T5 to terminal T1.

(a) Replace the ignition pack assembly if there is voltage present at the terminals and there is a weak or no spark from the ignition pack (para. 4-60).

(b) Replace the heater if there is no voltage at the terminals (para. 4-60).

Step 7. Remove the fuel bowl from the fuel pump strainer and check that it is clean.

Clean the screen if dirty and reinstall. Fill fuel bowl with clean fuel.

Step 8. Check the fuel pump suction lines for tightness and damage.

Replace/repair the lines as necessary (para. 4-61).

Step 9. Remove the fuel line from the bottom of the heater and place its end in a container. Toggle the START switch to the START position and watch if fuel comes out of the line.

If fuel comes out the fuel line, install a fuel pump test gage on the pump and check pressure. It should be 4 psig (28 kPa). Replace the fuel pump if it is not 4 psi (28 kPa) (para. 4-61).

Step 10. Disconnect the fuel pump electrical connector and check for 24-28 VDC between the center pin of the connector and ground when the START switch is toggled to start.

(a) If voltage is present, replace the fuel pump (para. 4-61).

(b) If voltage is not present, replace the fuel pump harness cable (para. 4-60).

3. Diesel fuel heater has excessive backfiring or popping.

Step 1. Check fuel for water.

If water is present in the fuel, change fuel or follow Army SOP for water in fuel problems.

Step 2. Disconnect the electrical connector for the heater (P/J4 for heater No. 1 and P/J5 or heater No. 2). Check for 28 VDC (24 VDC minimum) across the A and B pins of the J (female) connector.

(a) If voltage is not resent, refer to power supply troubleshooting.

(b) If the voltage is less than 24 VDC, notify direct support maintenance to troubleshoot power supply.

Step 3. Check the carburetor fuel solenoids. Dirt in the solenoid will cause an uneven flow of fuel and backfiring upon recycling.

Clean as needed (para. 4-61).

Step 4. Check the ignition pack assembly and igniter for operation.

Refer to heater runs but no combustion troubleshooting for test procedures (malfunction 2).

Step 5. Carefully check fuel control setting. Remove the heater cover. The adjusting needle is located just above the preheat cartridge on the carburetor body.

Carburetor adjustment must be made while the heater is running. If the carburetor fuel needle is seated so that insufficient fuel is allowed to pass to start combustion, back if off one turn and then start the heater. Adjust the setting of the fuel needle after the heater is operational. Turning the needle clockwise will lean out the fuel mixture. When properly adjusted, the heater will burn evenly and smoothly with no smoke in the exhaust. The end of the combustion chamber should also turn a red color when the adjustment is correct.

4. Diesel fuel heater fan fails to go to high speed during burning cycle.

Step 1. Disconnect the electrical connector for the heater (P/J4 for heater No. 1 and P/J5 for heater No. 2). Check for 28 VDC (24 VDC minimum) across the A and B pins of the J (female) connector.

(a) If voltage is not resent, refer to power supply troubleshooting.

(b) If the voltage is less than 24 VDC, notify direct support maintenance to troubleshoot power supply.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Check adjustment of the hold-fire thermostat assembly. The flame switch maybe opening.
(a) Refer to para. 4-60 for adjustment procedures. Replace the flame switch if adjustment does not solve the problem (para. 4-60).
(b) Replace heater relay K1 (Reference Interconnection Diagram FO-2, Sheet 6) (para. 4-60).
(c) Replace heater (para. 4-60).

5. Diesel fuel heater remains on burner cycle after heat demands are met.
Step 1. Check adjustment of the hold-fire thermostat assembly, It may be out of adjustment, preventing operation of the van thermostat.
Adjust thermostat assembly (para. 4-60).
Step 2, Check van thermostat operation. Disconnect the connector going to the thermostat controlling the heater. Check for continuity across the A and B pins of the thermostat cable. Turn the thermostat to a high temperature and check if the thermostat contact opens and then turn it down and check that the contact closes.
Replace the thermostat if it does not cycle as described (para. 4-62).
Step 3. Remove the fuel solenoids on the carburetor and check for dirt on the fuel solenoid actuator lip.
Refer to para. 4-60 for procedures.

6. Diesel heaters do not operate off of the auxiliary power input.
Refer to power supply troubleshooting and auxiliary power circuit troubleshooting.

7. Diesel fuel heater exhaust drips fuel.
Step 7. If this happens during starting of the heater, refer to heater runs but no combustion troubleshooting (malfunction 2).
Srep 2. If this happens during operation, refer to heater backfires troubleshooting and adjust the fuel control (malfunction 3).

8. Fumes from the diesel heaters in the ROWPU van.

WARNING

The exhaust pipes can reach temperatures exceeding 600 degrees. Do not touch the exhaust pipes without putting on protective gloves first. Do not touch them with bare hands.

Step 1. Remove the exhaust pipe shrouds and check if the fumes are being blown back into the ROWPU through the exhaust pipe gaskets.
Replace the exhaust pipe gaskets if they are leaking (para. 4-60).
Step 2. Check if pipe has been added to the exhaust to make it vent farther from the ROWPU. Refer to operator's troubleshooting if pipe has been added to the ROWPU exhaust. If pipe has been added and it has arise to it, check that a condensate drain hole is located at the low point of the piping and that it has not frozen over allowing ice to buildup in the piping. This will cause backpressure on the heater combustion chamber and allow exhaust fumes to back up in the ROWPU.
Remove pipe in excess of recommendations and remove any ice that maybe blocking the exhaust.
Step 3. Check the exhaust for smoking and backfiring.
If the exhaust is smoking or dripping fuel refer to those symptoms in heater troubleshooting (malfunction 7).
Step 4. If the wind is blowing straight at the exhaust pipes, erect a wind block to reduce backpressure on the exhaust.
(a) If the wind block eliminates the problem of fumes operate with the wind block in place or reposition the equipment so that the wind is not creating backpressure on the exhaust.
(b) If the wind block has no effect, replace the heater (para. 4-60).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALDUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

Diesel heater wiring diagrams are shown in Figure 4-5.

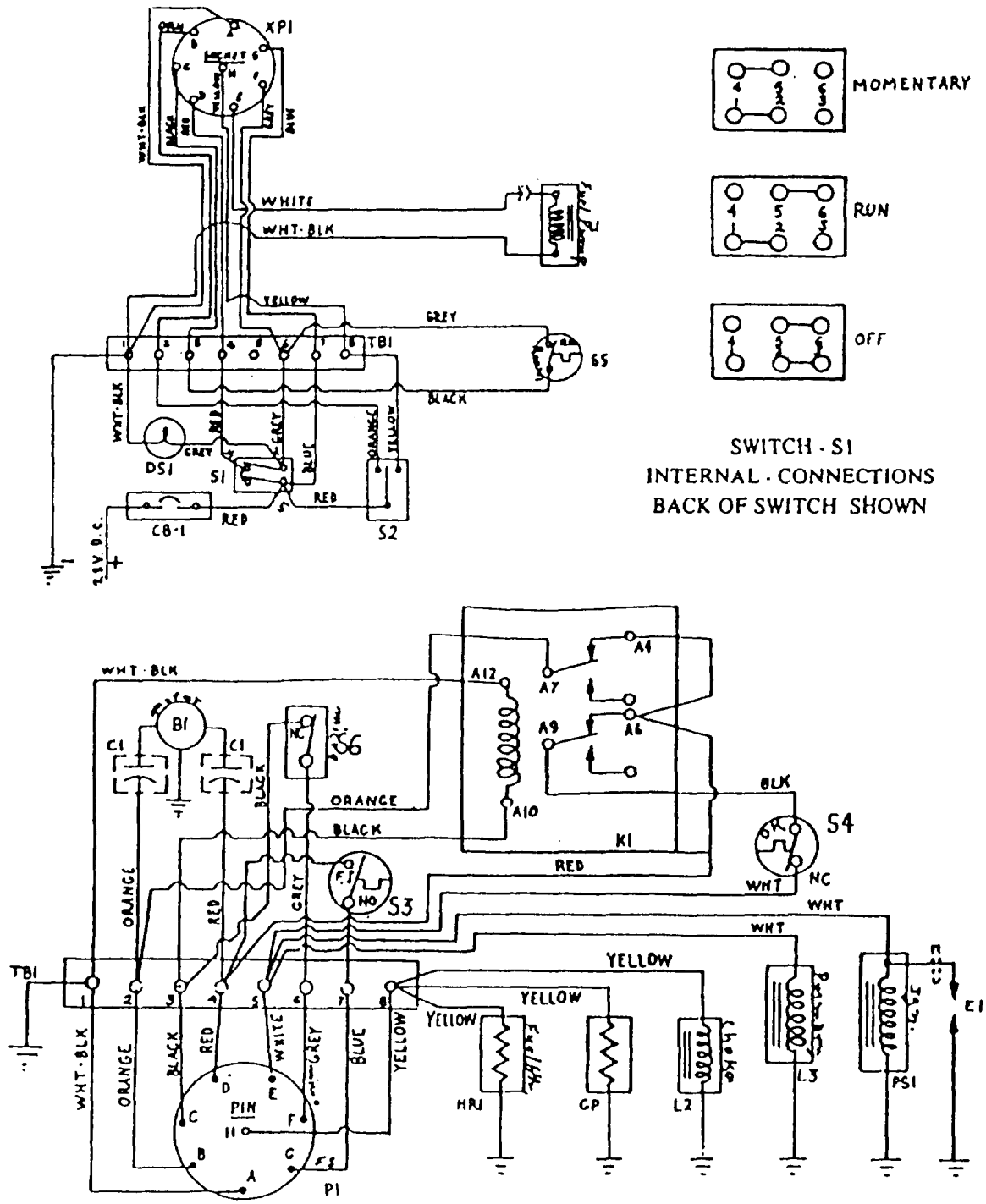


Figure 4-5. Diesel Heater Wiring Diagram

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

AIR BLOWDOWN SOLENOID.

Air blowdown solenoid valve does not work schematic lines 826-827).

Step 1. Shutdown the ROWPU. Open the control panel and power up the unit. Open the air manifold drain valve and bleed air off the air manifold until air pressure is less than 1000 psig (6895 kPa). Start the air compressor and watch TDK1 (Reference Interconnection Diagram FO-2, Sheet 8). The outside indicater should be set on 15 and the inner dial should be somewhere between 15 and zero. The inner indicator should move down towards zero as the aircompressor runs. When the inner indicator gets somewhere below 1 the timer should supply voltage to the solenoid valve for about 30 seconds. It will then reset to 15 and start the process over.

If the timer does not operate as noted above, notify direct support maintenence.

Step *2.* Disconnect connector J28 at the high pressure solenoid valve. Check for 110-120 VAC across pins J28A and J28B Reference Interconnection Diagram FO-2, Sheet 14) during the time period noted in step 1. (Timer TDK1 can be reset to a lower time cycle during testing to speed up the process. It must be reset to 15 when testing is over.)

(a) If there is no voltage during the last 30 seconds of the time cycle, go to step 3.

(b) If there is voltage, notify direct support maintenance to replace/repair the high pressure air blowdown solenoid valve.

Step *3.* Disconnect connector P13 (Reference Interconnection Diagram FO-2, Sheet 14) from the control panel. Check for 110-120 VAC across J13T and J13U (Reference Interconnection Diagram FO-2, Sheet 9) during the last 30 secords of the timer cycle.

If voltage is not present, notify direct support maintenance.

Step 4. Check continuity from P13T to J28A and from P13U to J28B.

Replace the connectors and cable if continuity is not present as noted (para. 4-27).

FLOWMETERS

1. Flowmeter(s) do not show flow (Reference Schematic Diagram FO-1, Sheet 8, schematic lines 815-819).

Step 1. IRemove the flow sensor for the inoperative meter from the piping. The feed flow sensor is located on the front wall piping, the waste sensor is located on the ceiling next to the control panel, and the product sensor is on the back wall piping behind the control panel. Check the paddle wheel for debris and ease of rotation.

a) Use a stiff brush and remove any debris that maybe sticking to the wheel.

b) If the paddle wheel cannot be cleaned up so that it spine very easily, notify direct support

Step 2. Watch the flowmeter and spin the paddle wheel on the flow sensor. The flowmeter needle should rise as the paddle wheel is spun vigorously in the right direction.

Notify direct support maintenance if the meter does not indicate flow.

2. Flowmeter is inaccurate.

Notify direct support maintenance.

AIR COMPRESSOR.

WARNING

Electrical high voltage can cause serious injury or death. Some tests performed in troubleshooting require power to be connected. Always take proper measures to ensure personal safety.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

NOTE

Continuity and short circuit test arrangements for compressor motor are shown in Figures 4-1 and 4-2.

NOTE

Ensure that all circuit breakers are set before troubleshooting.

1. Air compressor won't start (Reference Schematic Diagram FO-1, Sheet 8, schematic lines 824-629 -control circuits, Reference Schematic Diagram FO-1, Sheet 5, schematic lines 518-521 - power circuits).

Step 1. Shut down the ROWPU. Open the control panel. Check that the overload reset button on MS1 is in by pushing it.

(a) If the reset button is in, go to step 2.
(b) If the button is out and won't reset, notify direct support maintenance to replace the overload heaters on MS1 (Reference Interconnection Diagram FO-2, Sheet 10) and then go to steep 4.
(c) If the reset button is out but resets when pushed, notify direct support maintenance to adjust the door reset assembly for MS1 and then go to step 4.

Step 2. Refer to the operator's manual and power up the control panel. Observe MS1 when the air compressor start switch is turned on. Be sure the system air pressure is below 1400 psig (9653 kPa) before turning on the air compressor. The indicating plunger should go in and stay in which indicates the control circuits are working properly.

(a) If the indicating lunger goes in and stays in, go to step 4.
(b) If it does not pull in, or, if it pulls in but does not stay in, notify direct support maintenance to troubleshoot the air compressor circuits.

Step 3. Disconnect PI 1 from the control panel and check for continuity across PI1 C and PI1 C (Reference Interconnection Diagram FO-2, Sheet 14). It should read zero.

If it does not read zero, notify direct support maintenance to troubleshoot the air compressor pressure switch.

Step 4. Shut down the generator. Refer to the electrical schematic Appx. I-1 and interconnect diagram Appx. I-2. Set ohmmeter to Ohms x 1000 scale. Check each lead, 1T1, 1T2, and 1T3 from the outlet side of MS1to ground. The reading should be infinity for each lead.

If the meter reading is zero there is a short circuit, go to step 6.

Step 5. Set the multimeter to the Ohms x 1 scale and check for continuity between all pairs of leads; 1T1 and 1T2,1T2 and 1T3, 1T1 and 1T3. Readings should be zero or near zero for each step.

If the checks performed in both steps 4 and 5 are okay , return the ROWPU to operatbn.

Step 6. Check connectors J/P20, J/P65, and J/P67, (Reference Interconnection Diagram FO-2, Sheet 16) for hose pins and for signs of arcing.

Replace any connector or cable that shows damage (pare. 4-27 and 4-79).

Step 7. Check continuty, point-to- piont, from P20A to J67A, P20B to J67B, P20C to J67C, and P20H to J67D. Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.

(a) Replace any cable or connector that shows open during continuity checks (pares. 4-27 and 4-76).
(b) Replace an cable or connector that shows a short between phases or a short to ground paras.4-27 and 4-76).
(c) Repair any hose or damaged wires in the pump skid junction box (para. 4-76).
(d) Replace any MOV'S (Reference Interconnection Diagram FO-2, Sheet 16) in the pump skid junction box that show physical damage or are shorted to ground from the power terminal (para. 4-76).

Step 8. Tag and disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1000 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.

Replace motor if the meter reading is zero (para. 4-79).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 9. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2, T1 and T3, T2 and T3. Readings should be zero or near zero for each step.
Replace motor if reading is infinity (para. 4-79).

Step 10. Check motor cable for continuity on each lead and for shorts between phases and ground. Replace the cable if open or shorted (para. 4-79).

2. Air compressor motor hums but won't turn (Reference Schematic Diagram FO-1, Sheet 5, schematic lines

Step 1. Check generator voltage on all three phases. It must be 435-445 VAC on each phase.
(a) Adjust to correct voltage.
(b) If voltage is not correct on all three phases, refer to generator troubleshooting.

Step 2. Check for correct voltage by starting the raw water pump. Alternately, turn on both switches for the distribution pump and note if it runs.
If the 3-phase motors listed do not operate, notify direct support maintenance.

Step 3. Check continuity, point-to-point, from P20A to J67A, P20B to J67B, P20C to J67C, and P20H to J67D (Reference Interconnection Diagram FO-2, Sheet 16). Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.
(a) Replace any cable assembly that shows open during continuity checks (para. 4-27).
(b) Replace any cable or connector that shows a short between phases or a short to ground
(c) Repair any hose or damaged wires in the external junction box (para. 4-76).
(d) Replace any MOV's in the external junction box that show physical damage or are shorted to ground from the power terminal (para. 4-76).

Step 4. Tag and disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1000 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.
Replace motor if the meter reading is zero (para. 4-79).

Step 5. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2, T1 and T3, T2 and T3. Readings should be zero or near zero for each step.
Replace motor if reading is infinity (para. 4-79).

Step 6. Check motor cable for continuity on each lead and for shorts between phases and ground.
Replace the cable if open or shorted (para. 4-79).

3. Air compressor circuit breaker opens whenever air compressor is started, ROWPU shuts down when air compressor is started (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 518-521).

Check for short circuits.
(a) Shut down the ROWPU. Shutdown the generator. Refer to electrical schematic Appx. I-1 and interconnect diagram Appx. I-2.
(b) Refer to air compressor won't start troubleshooting, (malfunction 1) steps 4 thru 10.

VAN LIGHTS.

Van lights do not work (Reference Schematic Diagram FO-1, Sheet 10, schematic lines 1026-1030).

Step 1. Remove connector P10 from top of control panel. Check across J10A and J106 (Reference interconnection Diagram FO-2, Sheet 9) for 110-120 VAC. Push either van light switch while testing.
If voltage is not present, go to step 3.

Step 2. Check the light cables and light fixtures for shorts and for continuity.
Replace any cables or fixtures that show they have shorts or open circuits (para. 4-27).

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Remove connector P52 from the side of switch panel No. 2. Check for voltage across pins P52C and P52J (Reference Interconnection Diagram FO-2, Sheet 15).

If voltage is not present, go to step 6.

Step 4. Check for continuity between pin J52C and J52R. Check for continuity between pins J52C and J52W. One circuit should be open and the other closed. Pushing PB19 (Reference Interconnection Diagram FO-2, Sheet 15), the light switch at the front door will reverse the open/closed circuits.

If the circuit responds as descriped, go to step 6.

Step 5. Check continuity, point-to-point, from P52C to P52R and from P52C to P52W. Push in PB19 while testing to close its contacts.

(a) Repair an hose or damaged wires (para. 4-31).

(b) Replace PB19 if its contacts don't alternately close when the button is pushed (para. 4-31).

Step 6. Remove connector P12 (Reference Interconnection Diagram FO-2, Sheet 15) from the control panel. Check for 110-120 VAC across J12C and J12J (Reference Interconnection Diagram FO-2, Sheet 9).

If voltage is not present, notify direct support maintenance.

Step 7. Check continuity from P12C to P52C, from P12G to P52R, and from P12H to P52W.

Replace the cable and connectors if open (para. 4-27).

Step 8. Install connectors P12 and P52. Remove connector P13 (Reference Interconnection Diagram FO-2, Sheet 14) from the control panel and check for 110-120 VAC across J13N and J13H. Check for 110-120 VAC across J13P and J13H (Reference Interconnection Diagram FO-2, Sheet 9). One of the two circuits should have voltage. Push the light switch on the alarm box to switch voltage to the other set of pins.

If there is no voltage or if the circuits don't perform as described, notify direct support maintenance.

Step 9. Connect P13 and remove connector J29 (Reference Interconnection Diagram FO-2, Sheet 14) from the junction box at the back door. Check for 110-120 VAC between J29P and J29E. Check for 110-120 VAC across J29R and J29E. One of the two circuits should have voltage. Push the light switch on the alarm box to switch voltage to the other set of pins.

If there is no voltage or if the circuits don't perform as described, go to step 12.

Step 10. Check for continuity between pins P29P and P29N (Reference Interconnection Diagram FO-2, Sheet 14). Check for continuity between pins P29R and P29N. One set should have continuity and the other should be open. Pushing the light switch at the back door should reverse the set with continuity.

If the circuits respond as described, go to step 12.

Step 11. Check for continuity, point-to-point, from P29N to P29P and from P29N to P29R. Push in switch PB20 (Reference Interconnection Diagram FO-2, Sheet 14) while testing to close its contacts.

(a) repair an hose or damaged wire (para. 4-30).

(b) Replace PB20 it its contacts don't close para. 4-30).

Step 12. Remove connector P13 from the control panel. Check continuity from P131 to J29N, from P13N to J29P, and from P13P to J29R.

Replace the cable and connectors if any are open (para. 4-27).

MEDIA FILTER.

1. Air blanket does not work (Reference Schematic Diagram FO-1, Sheet 8, schematic lines 804-808).

NOTE

The air blanket circuits only supply air to the to of the media filter when the ROWPU is operating in system "NORMAL and the high pressure pump is running. The level assembly on the media filter controls the cycling of the air blanket solenoid valve. When the water level rises to the height of the top switch on the assembly the air blanket solenoid valve opens. It stays open until the water level drops to the middle switch on the level assembly at which time it closes until the water level again rises to the top switch.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 1. Shut down the ROWPU. Drain water out of the media filter until all the flags on the level assembly are white, or until water does not come out of the media filter top drain valve. Restart the ROWPU. en the media filter vent valve and leave open until water is flowing steadily out of it. Watch that all the flags turn red on the level assembly as the filter fills with water.

If the flags do not turn red it indicates the float is sticking. Refer to level assembly sticking troubleshooting.

Step 2. Check that when the ROWPU is operating and the level assembly flags have turned red to the top, that the air blanket solenoid valve light has turned on. When the system is operating correctly air will flow into the top of the filter and the flags should start turning white as the water level drops.

(a) If the air blanket solenoid valve light does not come on, notify direct support maintenance.
(b) If the light comes on but the flags do not turn white, go to step 3.

NOTE

Air flows into the filter at a low rate. Do not assume the air blanket is not working if the flags don't turn over at a high rate of speed.

Step 3. Check the media filter inlet pressure and the air system pressure. The air pressure must be 10-15 psig higher than the media filter pressure to allow air to flow into the filter.

(a) Adjust the air pressure up if the two pressures are close to each other.
(b) If the flags still do not turn white, go to step 4.

Step 4. Disconnect the air blanket solenoid valve connector, J47. Check for 110-120 VAC across J47A and P47B (Reference Interconnection Diagram FO-2, Sheet 15).

If voltage is not present, notify direct support maintenance.

Step 5. Shut down the ROWPU. Open the vent valve on the media filter and relieve the media filter pressure. Turn off the air compressor and close the air tank block valve. Open an air manifold drain valve and vent off the air pressure in the system. Remove the airline to the air blanket solenoid valve at the solenoid valve. Open the air tank block valve and check for air flow through the disconnected line.

If air flows through the line, go to step 7.

Step 6. Check the air blanket solenoid air line and block valve for plugging.

Replace/repair the air line or block valve (paras. 4-24 and 4-68).

Step 7. Disassemble the air blanket solenoid and check valve. Inspect for plugging (para. 4-51).

Clean out any foreign matter in the valves.

Step 8. Check for resistance. across pins P47A and P47B (Reference Interconnection Diagram FO-2, Sheet 15) of the air solenoid valve connector.

(a) If the multimeter reads infinity or short circuit, replace the air blanket solenoid valve (para. 4-51).
(b) Return the ROWPU to operation after the above checks and repairs. Check the air blanket for correct operation.
(c) Notify direct support maintenance.

2. Backwash air solenoid valve works but pilot light does not come on (Reference Schematic Diagram FO-1, Sheet 7, schematic lines 727-728).

Notify direct support maintenance.

3. Media filter backwash cycle works okay until water starts filling the filter during phase 2 and then the backwash stops (Reference Schematic Diagram FO-1, Sheet 7, schematic line 705).

Notify direct support maintenance.

4. Filter media comes out the waste line when backwashing (Reference Schematic Diagram FO-1, Sheet 8, schematic lines 802-804).

NOTE

Five things can cause this problem. Check that the first three are not causing the problem before checking the last two.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. The media was just changed or media was added and has not been “wet-for 24 hours. See mechanical troubleshooting.
2. Too much media in the filter. Refer to para. 4-53 for the correct level. The situation is self correcting.
3. Too high a flow rate during backwashing. Check operating conditions and ensure the correct flow rates for each phase and for the operating temperature.
4. Leaking backwash air solenoid valve.
5. Media filter level assembly not working correctly. The bottom switch is possibly stuck dosed which can allow the fitter to start backwashing with too high a water level.

Step 1. Check that the backwash air solenoid is not leaking by shutting down the ROWPU and opening the media filter vent valve to relieve filter pressure, Remove the tubing on the outlet of the solenoid valve. Place a finger tightly over the valve outlet fitting. If it is leaking, air pressure will build up and force its way past the finger.

(a) if the valve is leaking air, disassemble it and clean it out (para. 4-51).
(b) if cleaning if out does not stop the air leakage, replace the valve assembly (para. 4-51).

Step 2. Disconnect connector P35 (Reference interconnection Diagram FO-2, Sheet 1) at the bottom switch of the media level assembly. Remove the bottom of the level assembly and remove the flat. Be careful when removing the float. It will drop out when the cover is removed from the level assembly. Check for continuity across J35A and J35B with the float removed.

If there is no continuity, replace the bottom level switch, LSLL (Reference Interconnection Diagram FO-2, Sheet 15) para. 4-52).

Step 3. Check that J35A and J35B show continuity and insert the float into the level chamber with the arrow up. Slowly push it up the chamber and watch the muitimeter. it should show the switch opening as the float goes past it and stay open. Slowly let the float drop and watch that the switch closes as the float goes y it. it should then stay closed. heck that the flags turn red as the float is pushed up the chamber and turn white as it comes down.

(a) If the flags don’t turn, replace the float (par and test the flags and switch again.
(b) If the switch (LSLL) does not operate as replace it (para. 4-52).
(c) Return the ROWPU to operation and check operattion.

5. Air does not go into media filter during backwash. (Air system gage does not show any or very littie drop in pressure) backwash air valve light is "on" indicating proper operaton.

Step 1. Shutdown the ROWPU. Open the media filter vent valve and relieve pressure on the filter. Remove the tubing on the outlet of the backwash air solenoid valve. Close the media fitter vent valve, initiate the backwash code, and check to see if air comes out of the solenoid valve during the second phase of backwashing. Check that water does not flow out of the backwash air check valve on the media filter during the backwash operation.

(a) If water flows out of the check valve, disassetile it and clean it out (para. 4-53). Reinstall it and check if water flows out of it. Replace it if the Clean did not stop water flow (para. 4-53).
(b) if air flows freely out of the solenoid valve and the air system pressure gage drops from 400-500 pounds during the second phase of backwashing, go to step 2.
(c) if little or no air flows from the solenoid valve, disassemblet and dean it out (para. 4-51).
(d) Notify direct support maintenance to check backwash circuits phase 2 for eiectrical checks on the backwash air soienoid.

Step 2. Remove the backwash air check valve. Disassemble and dean it out (para. 4-53). Operate the ROWPU in system “NORMAL” with just the raw water pump on and the backwash air check valve off of the filter. Flush water until anything plugging the media filter air manifold is washed out.

When the water coming out of the filter check tubing is free of debris, reinstaii the check valve.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

AUXILIARY POWER.

Heater power supply, utility outlets, or panel light does not work on auxiliary power (Reference Schematic Diagram FO-1, Sheet 11, schematic lines 1137-1138).

step 1. Disconnect the J26 (Reference Interconnection Diagram FO-2, Sheet 14) connector at the back wall. Plug a powered extension cord into the auxiliary power receptacle on the outside of the van. Check for 110-120 VAC across P26A and B.
If voltage is present, go to step 3.

Step 2. Disconnect the extension cord and check the auxiliary receptacle and its cable for continuity and shorts.
a Replace the cable if fault para. 4-33).
b Replace) receptacle, SR7, (Reference Interconnection Diagram FO-2, Sheet 16) if faulty

Step 3. Reconnect J26 and disconnect P17 Reference Interconnection Diagram FO-2, Sheet 14) from the control panel. Check for 110-120 VAC across P17A and B.
(a) " If there is no voltage, replace the cable between P17 and J26 (para. 4-27).
(b) Notify direct support maintenance.

SUMP HEATER.

Sump heater heat trace does not work (Reference Schematic Diagram FO-1, Sheet 11, schematic lines 1102-1 104).

Determine which heat trace does not work and refer to the schematic Appx. l-1 to determine which connectors to check. Step through each connector (point-to-point) for the individual heat traces and determine where the voltage stops. Start at the control panel connector for each heat trace.
a If the power stops, indicating a cable is bad, replace the cable (para. 4-27).
b If there is still voltage at the last connector to the heat trace, replace the heat trace assembly (para. 4-70).
(c) If there is no voltage at the control panel connector, notify direct support maintenance.

UTILITY CIRCUITS.

Utility receptacle does not work, panel light does not work, or control panel receptacle does not work (Reference Schematic Diagram FO-1, Sheet 11, schematic lines 1117-1126).

NOTE

These devices are controlled by circuit breaker CB11 (Reference Schematic Diagram FO-2, Sheet 8).This is a ground fault breaker and high humidity or moisture around devices controlled by this breaker may cause troubles. Check that atmospheric moisture is not causing problems by drying out anything controlled by this breaker.

NOTE

Notify direct support maintenance for problems relating to the panel receptacle or panel light.

Step 1. Refer to the schematic and interconnect drawing Appx. I and determine which circuit to test. Disconnect that connector from that circuit and check across the pins shown on the schematic for voltage (110-120 VAC).
If there is no voltage at the control panel, notify direct support maintenance.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Reconnect the connector checked in the last step and refer to the schematic to determine the next connector in the circuit being tested. Disconnect it and check for voltage (110-120 VAC) across the pins shown in the schematic.

If there is no voltage, replace the cable and connectors (para. 4-27).

Step 3. Check the receptacle and its wires for sheds and for continuity.

a Repair any hose or damaged wires.
b Replace any faulty receptacles (paras. 4-30,4-31,4-33 and 4-34).

DISTRIBUTION PUMP.

WARNING

Electrical high voltage can cause serious injury or death. Some tests performed in troubleshooting require power to be connected. Always take proper measures to ensure personal safety.

NOTE

Continuity and short circuit test hook ups for the pump are shown in Figures 4-1 and 4-2.

NOTE

Ensure that all circuit breakers are set before troubleshooting.

Distribution pump won't run (Reference Schematic Diagram FO-1, Sheet 8, schematic lines 831-837- control, Reference Shematic Diagram FO-1, Sheet 5, schematic lines 524-529- power).

Step 1. Shutdown the ROWPU. Open the control panel. Check that the overload reset button on MS2 (Reference Interconnection Diagram FO-2, Sheet 10) is in by pushing it.

a If the reset button is in, go to step 2.
b If the button is out and won't reset, notify direct support maintenance to replace the overload heaters on MS2 and then go to step 3.
(c) If the reset button is out but resets when pushed, notify direct support maintenance to adjust the door reset assembly for MS2 and then go to step 3.

Step 2. Power up the control panel (para. 2-19). Turn the selector switch on the distribution pump "ON". Push the distribution pump "ON" switch at the back door. Watch the indicating plunger on MS2. It should go in and stay in which indicates the control circuits are working properly.

(a) If the distribution pump "power on" light at the back is on, the MS2 indicating plunger did notgo in, go to step 10.
(b) If the indicating plunger goes in but comes out when the distribution pump ON switch at the backdoor is released, notify direct support maintenance to troubleshoot the distribution pump circuits.
(c) If the indicating plunger on MS2 goes in and stays in, go to step 3.
(d) If the distribution pump "ON" light at the back door does not come on when the pump "ON"

Step 3. Shut down the ROWPU. Shut down the generator. Refer to the electrical schematic Appx. l-1 and interconnect diagram Appx. I-2. Set ohmmeter to Ohms x 1000 scale. Check each lead, 2T1, 2T2, and 2T3 from the outlet side of MS2 to ground. The reading should be infinity for each lead.

If the meter reading is zero there is a short circuit, go to step 5.

Step 4. Set the multimeter to Ohms x 1 scale and check for continuity between all pairs of leads; 2T2 and 2T2, 2T2 and 2T3, 2T1 and 2T3, Readings should be zero or near zero for each step.

If the checks performed in both steps 3 and 4 are okay, return the ROWPU to service.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 5. Check connectors J/P19, J/P34, and J/P62 (Reference Interconnection Diagram FO-2, Sheet 16), for loose pins and for signs of arcing.
Replace any cable assembly that shows damage (para. 4-27 and 4-85).

Step 6. Check continuity, point-to-point, from P19A, P1 9B to J62B, P19C, and P19D to J62D.Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.
(a) Replace any cable assembly that shows open during continuity checks (para. 4-27 and 4-33).
(b) Replace an cable or connector that shows a short between phases or a short to ground. (paras. 4-27 and 4-33).
(c) Repair any loose or damaged wires in the external electrical panel (para. 4-33).
(d) Replace any MOVS (Reference Interconnection Diagram FO-2, Sheet 16) in the external electrical panel that show physical damage or are shorted to ground from the power terminal (para. 4-33).

Step 7. Tag arid disconnect motor leads (T1, T2, T3). Set multimeter to Ohms x 1 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.
Replace pump/motor assembly if the meter reading is zero (para. 4-67).

Step 8. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads, T1 and T2,T1 and T3, T2 and T3. Readings should be zero or near zero for each step.
Replace pump/motor assembly if reading is infinity (para. 4-87).

Step 9. Check motor cable for continuity on each lead and fors shorrts between phases and ground.
Replace/repair the cable if open or shorted (para. 4-67).

Step 10. Disconnect P61 (Reference Interconnection Diagram FO-2, Sheet 16) from the outside junction box. Check for approximately 9 VDC across pins J61A and J61B.
If voltage is not present, notify direct support maintenance.

Step 11. Check continuity, point-to-point, from P61 A to P61B (Reference Interconnection Diagram FO-2, Sheet 16). Turn the distribution pump switch (SS1) on while testing.
(a) Replace switch SS1 if it shows open while testing (para. 4-87).
(b) Replace cable and connector P61 if faulty (para. 4-87).
(c) Repair any loose or damaged wires.

Step 12. Push the LIGHT TEST switch.
If the light comes on, notify direct support maintenance to troubleshoot the distribution pump circuits.

Step 13. Shut down the ROWPU. Shut down the generator. Refer to the electrical schematic Appx. l-1 and interconnect diagram Appx. I-2. Check continuity, point-to-point, from connector P1 3D to P1 3E (Reference Interconnection Diagram FO-2, Sheet 14).
(a) Repair any hose or damaged wires (para. 4-30).
(b) Replace any cable and connector that shows open during testing (para. 4-27 and 4-30).
(c) Replace PB1 (Reference Interconnection Diagram FO-2, Sheet 14 if it shows open during testing (para. 4-30).

Step 14. Check continuity, point-to-point, from P13D to P13F. Depress PB2 (Reference Interconnection Diagram FO-2, Sheet 14) when testing across its contact.
(a) Repair any hose or damaged wires (para. 4-30).
(b) Replace any cable and connector that shows open during testing (para. 4-27 and 4-30).
(c) Replace PB2 if it shows open during

Step 15. Check continuity, point-to-point, from P13G to P13H.
(a) Repair any hose or damaged wires (para. 4-30).
(b) Replace any cable assembly that shows open during testing (para. 4-27 and 4-30).

Step 16. Remove the wires from PL1 (Reference Interconnection Diagram FO-2, Sheet 14) and check for resistance across its terminals. It should be zero or near zero.
Replace PL1 if it shows open (para. 4-30).

Step 17. Notify direct support maintenance if the problem cannot be isolated.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. Distribution pump motor hums but won't turn (Reference Schematic Diagram FO-1, Sheet 5, schematic tines 524-526).

Step 1. Check generator voltage on all three phases. it must be 435/445 VAC on each phase.
(a) Adjust to correct voltage.
(b) If voltage is not correct on all three phases, refer to generator troubleshooting.

Step 2. Check system air pressure and use an air manifold drain valve to lower it blow 1400 psg (9653 kPa). Turn the air compressor switch on and note if the air compressor turns.
If the air compressor does not operate, notify direct support maintenance.

Step 3. Check continuity, point-to-point, from P19A to J62A, P19B to J62B, P19C to J62C, and P19D to J62D. Check each lead for shorts between phases and shorts to the ground wire. The reading should be infinity for each check.
(a) Replace any cable or connector that shows open during continuity checks (paras. 4-27 and 4-33).
(b) Replace an cable or connector that shows a short between phases or a short to ground (paras. 4-27 and 4-33)
(c) Repair any loose or damaged wires in the external electrical panel (para. 4-33).
(d) Replace any MOV'S in the external electrical panel that show physical damage or are shorted to ground from the power terminal (para. 4-33).

Step 4. Tag and disconnect motor leads (T1 , T2, T3 . Set multimeter to Ohms x 1000 scale and connect test leads between each motor lead and the motor frame. Readings should be infinity for each step.
Replace pump/motor assembly if the meter reading is zero (para. 4-87).

Step 5. Set multimeter to Ohms x 1 scale and check for continuity between all pairs of motor leads T1 and T2,T1 and T3, T2 and T3. Readings should be zero or near zero for each step.
Replace pump/motor assembly if reading is infinity (para. 4-87).

Step 6. Check motor cable for continuity on each lead and for shorts between phases and ground
(a) Replace the cable if open or shorted (para. 4-87).
(b) Notify direct support maintenance if the above checks have not found the problem.

3. Distribution pump circuit breaker opens whenever distribution pump is started, ROWPU shuts down when distribution pump is started (Reference Schematic Diagram FO-1, sheet 5, schematic fines 524-526).

Step 1. Check for short circuits.
(a) Shut down the ROWPU. Shut down the generator. Refer to electrical schematic Appx. l-1 and interconnect diagram Appx. I-2. Refer to "distribution pump won't start" (malfunction 1) steps 3 thru9.
(b) Notify direct support maintenance.

4. Distribution pump circuit breaker trips open repeatedly, distribution pump ground fault trips open repeatedly (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 524-530).

NOTE

This problem is hard to pin point directly as the two circuit breakers are electrically tied together so that what affects one will usually trip the other even though each is sensing different levels of short circuit. The direct-acting circuit breaker will only trip when overcurrents exceed its setpoint, such as a direct bolted short circuit. By contrast, an arcing short circuit may amount to only a fraction of the direct-acting circuit breaker setpoint and not cause it to trip. Arcing faults are typically caused by loose connections, the presence of vermin, rodents, and insects in equipment, or insulation deterioration, as a result of mechanical damage, heat aging, or moisture, dust, and other contaminants. Since the arcing type fault usually involved a flow of current in the ground path, the ground fault circuit breaker monitors the ground circuit for current flow. When it senses current in the ground circuit it will trip and also trip out the pump circuit breaker. Under other circuit conditions — balanced, unbalanced, or single-phase load currents, or single or three phase short circuits not involving ground — it will not trip even though the pump breaker does. For these reasons the following troubleshooting steps are very general and success in isolating the problem relies on the electrician to carefully respect all cables, connectors, and connections for signs of damage or moisture intrusion. In some cases only the substitution of known reliable components will identify the cause.

Table 4-2. Unit Troubleshooting Guide (Continued)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Shut down the ROWPU. Shut down the generator. Open the external electrical panel. Check all cables and connections from the control panel to the pump for tightness, physical damage, and evidence of water, dirt, or arcing. Open the motor connection box and check the connections inside it.
Repair any damage found.

Step 2. Check the MOVS in the external electrical panel for physical damage or shorts to ground from the power terminal.
Replace any faulty MOV's (para. 4-35).

Step 3. Check for short circuits. Refer to malfunction 1, steps 3 thru 9.

Step 4. Use a pump from another unit and check it for operation.
(a) If the replacement pump runs okay, continue to check the faulty pump/motor for the problem.
(b) If the problem cannot be found, notify direct support maintenance.

5. Distribution pump circuit breaker will not reset, distribution pump ground fault will not reset (Reference Schematic Diagram FO-1, Sheet 5, schematic lines 524-530).
Notify direct support maintenance.

SECTION V. MAINTENANCE PROCEDURES

4-9. GENERAL. This section contains instructions for organizational personnel and follows the Maintenance Allocation Chart. These tasks ensure smooth operation and maintenance of the ROWPU. Tasks are summarized in the following table.

Maintenance Task **Para.**

4-10. GENERAL REPAIR PROCEDURES. This task covers:

a. Replacement of Nameplates.
b. Replacement of Rivnuts.
c. Replacement of Rivets.
d. Replacement of Tie Mounts.
e. Repair of Terminal Strips.
f. Replacement of Ring Tongue Terminals.
g. Replacement of Tubing Markers.
h. Cleaning of Check Valves.
i. Replacement of Wire Markers.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics (1)
Hand Riveter (2)
Rivnut Repair Kit (15)
Crimper, Hand Terminal (16)
Terminal Strip Tool (16)
Wire Stripper (1 6)
Heat Gun (16)

References:
TM 43-0139

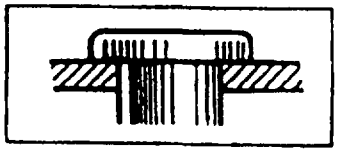
Materials/Parts:
Markers, Tubing (Appx E, Sec II, Item 53)
Markers, Wire (Appx E, Sec II, Item 54)
Rags, Wiping (Appx E, Sec II, Item 58)
Rivets (Appx E, Sec II, Item 59)
Sandpaper (Appx E, Sec II, Item 61)
Tubing Sleeves (Appx E, Sec II, Item 64)
Soap (Appx E, Sec II, Item 65)
Terminals, Ring (Appx E, Sec II, Item 70)
Ties, Wire/Tubing (Appx E, Sec II, Item 71)

REPLACEMENT OF NAMEPLATES.

a. Remove damaged nameplates by removing attaching drive screws or drill out pop rivets.
b. Clean mounting surfaces as follows:
   (1) Using fine sandpaper, clean dirt and corrosion from mounting surfaces.
   (2) Wipe surface clean with a cloth.
c. Touch up the surface paint if necessary. Refer to TM 43-0139.
d. Install the new nameplate using drive screws or rivets.

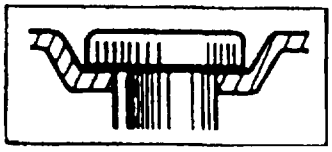
REPLACEMENT OF RIVNUTS.

a. Determine types of installation as follows:
   (1) Refer to Figure 4-6, sheet 1 and select either a surface installation or a flush installation.



SURFACE INSTALLATION

The flat head rivnut fastener is used when head thickness won't interfere with surface contour or possible attachments to the rivnut.



FLUSH INSTALLATION

When the metal to be fastened is thinner than the rivnut head and a flush surface installation is required, the metal may be dimpled and a flat head rivnut fastener used.

Figure 4-6. Rivnuts (Sheet 1 of 4)

b. Thread a new rivnut fastener on the mandrel of an installation tool and install as follows:

(1) Refer to Figure 4-6, sheet 2 and insert the rivnut fastener (1) on the tool mandrel (2) into the hole drilled for installation in plates (3).

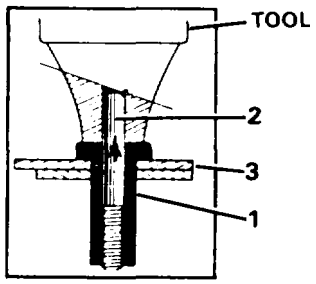


Figure 4-6. Rivnuts (sheet 2 of 4)

(2) Retract the mandrel (2) as shown in Figure 4-6, sheet 3 to form a bulge in the rivnut (1) on the blind side of plates (3).

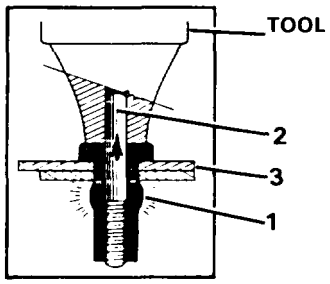


Figure 4-6. Rivnuts (sheet 3 of 4)

(3) Refer to Figure 4-6, sheet 4, View A and continue to retract the mandrel (2) until the rivnut (1) is clinched securely in place. Then, unscrew the mandrel (2) leaving the rivnut in place. The rivnut now can be used to install any item (such as bracket (4)) on plates (3) as shown in View B.

c. Clean area and apply touch-up paint as needed.

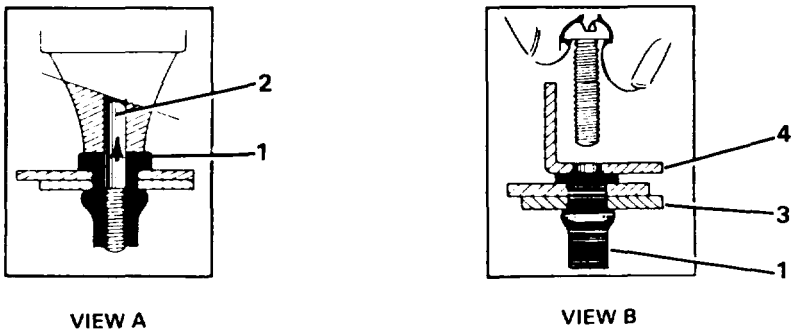


Figure 4-6. Rivnuts (sheet 4 of 4)

REPLACEMENT OF RIVETS.

a. Refer to Figure 4-7, View A and drill out remainder of damaged rivet (1), if necessary.

b. Refer to Figure 4-7, View B and place rivet (2) into head of hand riveter (3) and push rivet into hole.

c. Refer to Figure 4-7, View C and squeeze handle until the rivet stem (4) breaks free. This action compresses the rivet end.

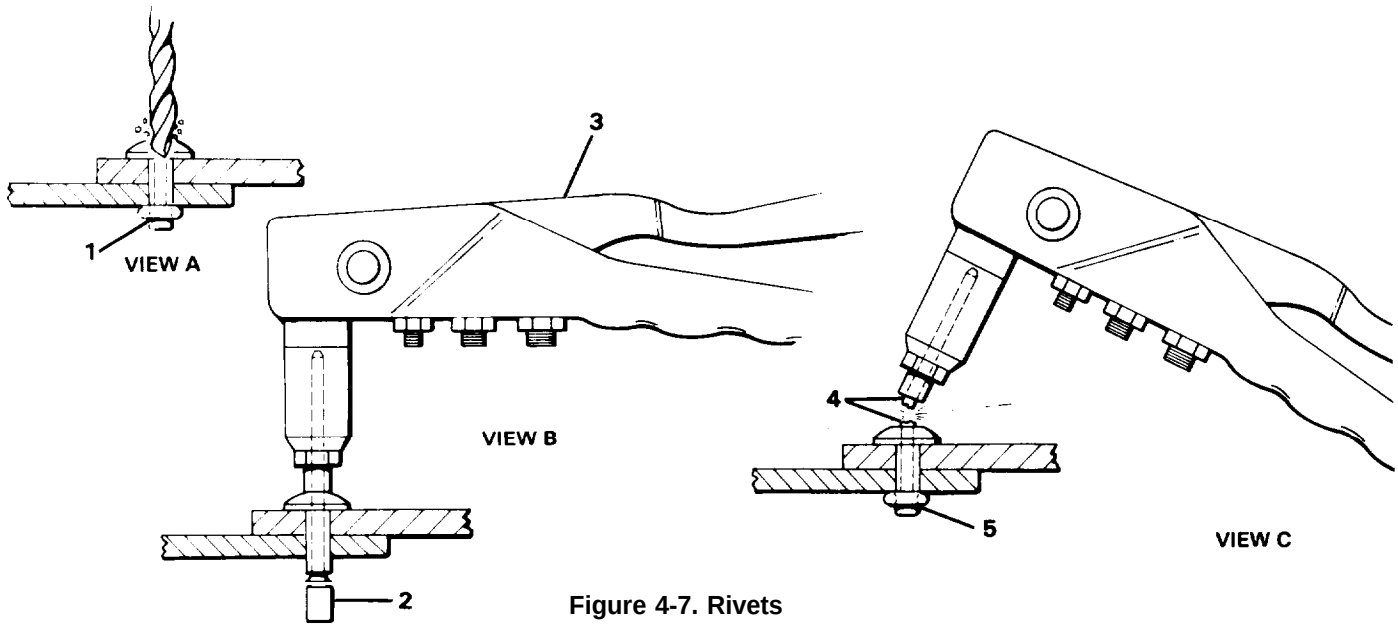


Figure 4-7. Rivets

REPLACEMENT OF TIE MOUNTS.

a. All cable tie mounts on the ROWPU are installed as shown in Figure 4-8. Initial installation is as follows:

(1) Remove paper covering tie mount back (1) and push tie mount against the surface it is to be permanently attached to.

CAUTION

It is possible to install tie strap (5) backwards. Be sure to position as shown in Figure 4-8.

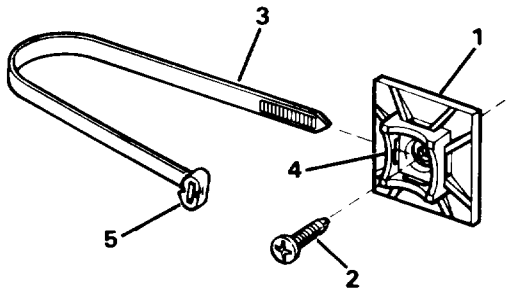


Figure 4-8. Tie Mounts

(2) Secure the tie mount using drive screw (2).

(3) Run the cable clamp tie end (3) through one or both slots of cable mount (4), as needed and push end (3) into slot of cable tie end (5) to secure.

b. Cable clamp tie (3) is removed by clipping with diagonal cutter or knife. When replacing cable tie (3) it is not necessary to replace mount (1).

REPAIR OF TERMINAL STRIPS.

a. Removal and Installation of Wires.

(1) Refer to Figure 4-9, sheet 1 and insert tool into slot and push tool to depress clip. Remove wire by pulling upward.

(2) Install wire by placing tool into slot, push tool to depress clip and hold that position, Insert wire and release tool.

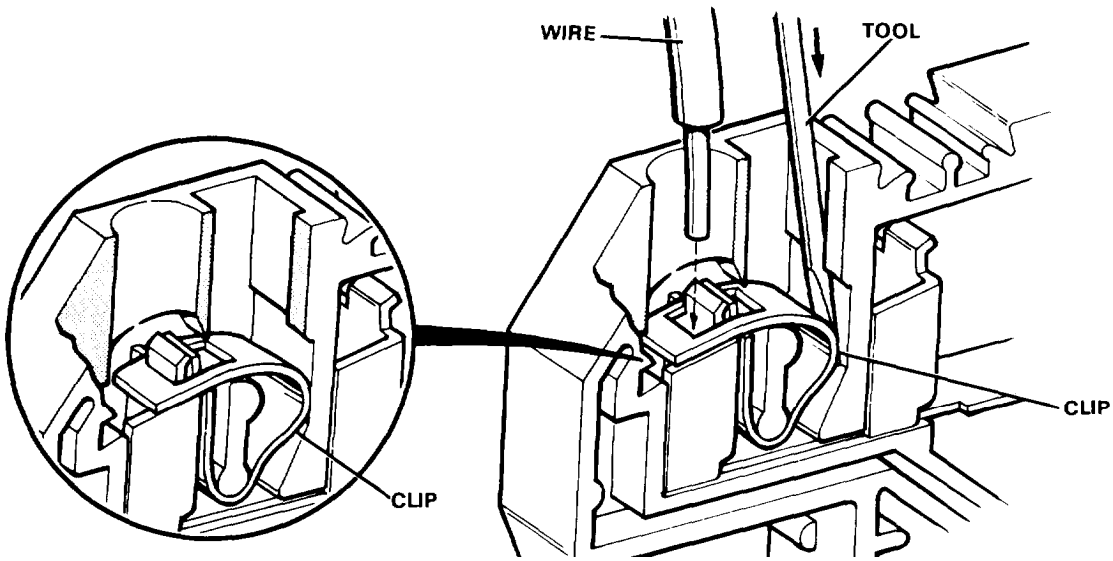


Figure 4-9. Terminal Strips (sheet 1 of 3) Wires

b. Replacement of Jumpers.

(1) Refer to Figure 4-9, sheet 2, View A and insert tool into slot of jumper.

(2) Carefully pry up on jumper and remove jumper.

(3) Refer to Figure 4-9, sheet 2, View B and install new jumper by inserting into slot and press down into position.

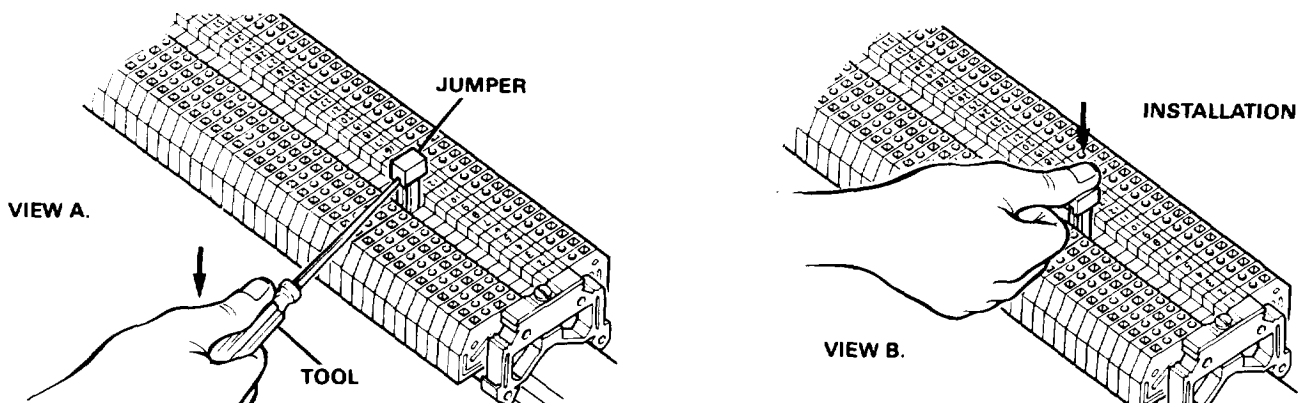


Figure 4-9. Terminal Strips (sheet 2 of 3) Jumpers

c. Replacement of Terminal Strip.

(1) Refer to Figure 4-9, sheet 3, View A and insert tool in slot at side of terminal strip.

(2) Carefully pry out the strip to be removed.

(3) Refer to Figure 4-9, sheet 3, View B and install new strip by alining terminal strips and pressing downward with thumb.

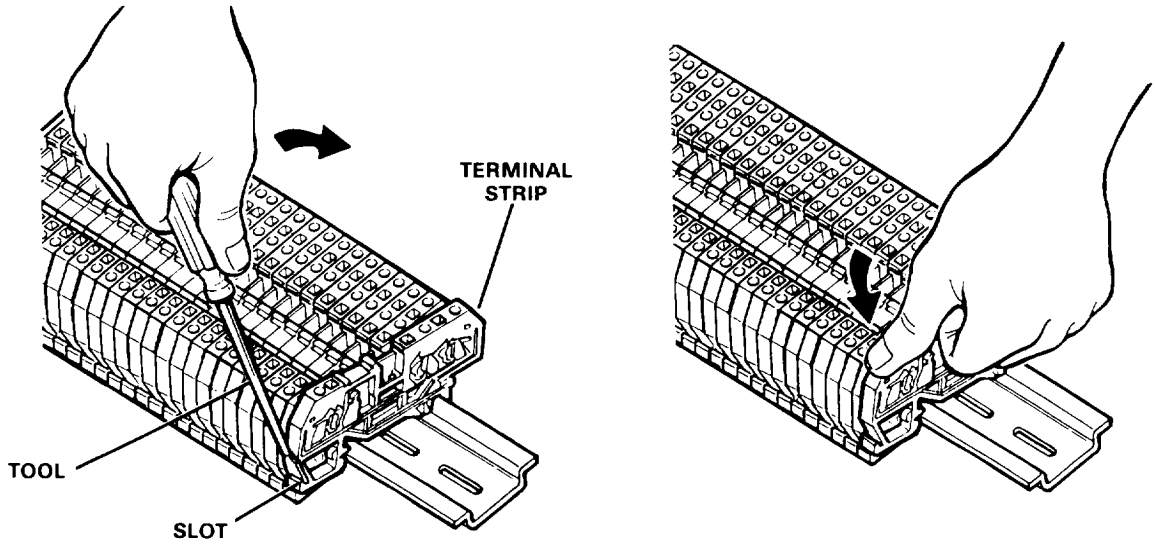


Figure 4-9. Terminal Strips (sheet 3 of 3)

REPLACEMENT OF RING TONGUE TERMINALS.

a. Cut terminal (1, Figure 4-10) from wires (2) as close to terminal insulator (3) as possible.

b. Strip wire end, using wire stripper tool, to the length of the new terminal insulator (5) being installed.

c. Slide new terminal (1) onto exposed wire end (4) and crimp securely at the center of the insulator (5).

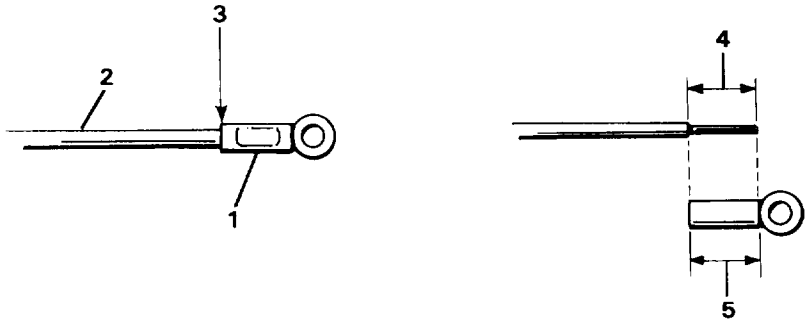


Figure 4-10. Ring Tongue Terminal

REPLACEMENT OF TUBING MARKERS.

a. Using knife, carefully cut away tubing marker being replaced (1, Figure 4-11).

NOTE

Check to determine if the new marker will slide over the tubing nut on the line. It may be necessary to cut the tubing just behind the nut as indicated in by (2) to slide new marker onto tube.

CAUTION

When using heat gun be careful when applying heat. Too much heat will damage tubing.

b. Slide new tubing marker (3) onto tube and use heat gun to shrink to proper fit.

NOTE

If tubing nut has been removed, place tubing nut (4) then new compression fitting (5) onto tube. Insert into fitting and tighten.

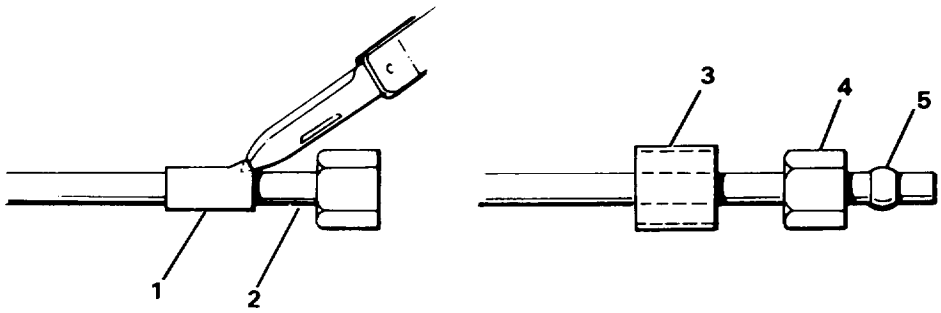


Figure 4-11. Tubing Markers

CLEANING OF CHECK VALVES.

a. Disconnect tubing or piping from check valve (see detailed procedures for specific removal steps). Remove assembled check valve.

b. Unscrew valve cap (1, Figure 4-12) from valve body (2) to remove spring (3) and seat (4).

c. Clean any debris from check valve body (2), spring (3) and valve seat (4). Flush components with soap and water solution, rinse thoroughly and dry.

d. Install seat (4) and spring (3) into body (2). Thread hex collars (1) onto body (2) and connect tubing or piping.

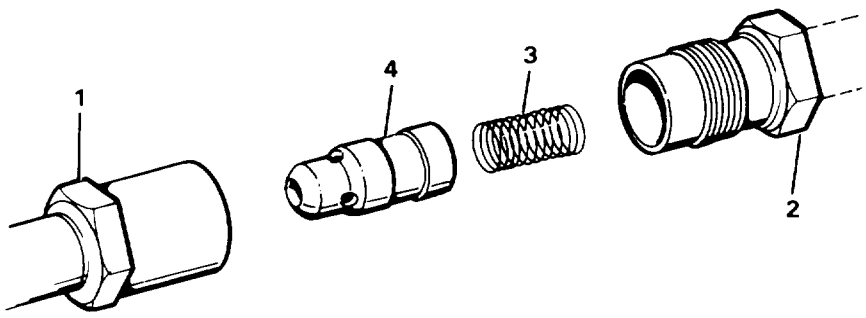


Figure 4-12. Cleaning of Check Valves

REPLACEMENT OF WIRE MARKERS.

NOTE

Check and note number of wire being replaced and mark new marker with same number.

a. Cut open the old marker at the seam. Remove and discard old marker.

CAUTION

When using a heat gun be careful when applying heat. Too much heat will damage machine and wires.

b. Slide new wire marker onto wire and use heat gun to shrink marker to proper fit.

4-11. REPAIR WATER HOSES. This task covers:

a. Inspection. b. Repair.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics (1)

Materials/Parts:
Gaskets (TM 10-4610-232-24P)

INSPECTION.

a. Refer to Figure 4-13 and inspect and isolate water leak. Replace any hose (5) that leaks at any point other than a joint with gasket.

b. Inspect hard suction style hose for collapsed inner liner by holding hose up to light and visually observing the inside of the hose. Replace any hose that shows a collapsed inner liner, This can often happen when hoses are run over by a vehicle.

c. Inspect hose for missing dust caps (2), dust plugs (1), or missing canvas straps (7). Repair by replacing missing caps, plugs or straps.

d. Inspect hose (5) for missing or damaged gaskets (8). Replace missing or damaged gaskets. Clean dirty gaskets.

e. Inspect hose for damaged end connectors. Item (9) is a male end connector; item (10) is a female end connector. Replace any hose with damaged end connectors.

f. Inspect hose for damaged dust caps (2) or dust plugs(1). Repair by replacing dust cap or dust plug.

REPAIR.

a. Refer to Figure 4-13 and remove damaged dust plugs (1) and caps (2) by using a wire cutter to cut the attaching wire (3) at wire clamps (4).

b. Install a new piece of wire (3) around hose (5) and secure with a new clamp(4). Squeeze clamp tight with a pliers or use a punch and hammer to compress the clamp.

c. Thread the wire (3) through the grommet (6) on the strap (7) and then through the eyelet on the cap or plug. Secure the end of the wire with another clamp (4). Secure the clamp with pliers or punch and hammer.

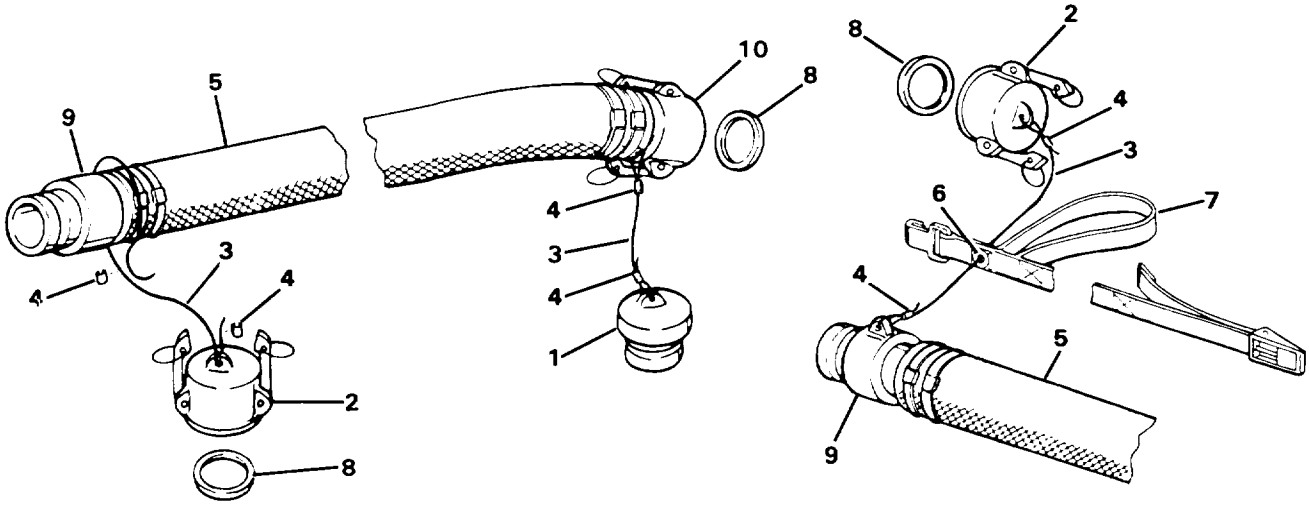


Figure 4-13. Water Hoses

4-1 2. **RAW WATER SYSTEM HOSES AND ADAPTERS**. Raw water system hoses are illustrated in Figure 4-14. Replacement of hose gaskets is described in para. 3-8. Repair hose as required (para. 4-11). Note these hoses are connected to the ROWPU by a cam type coupling, an adapter elbow and another coupling. Repair coupling gaskets by replacement, if required.

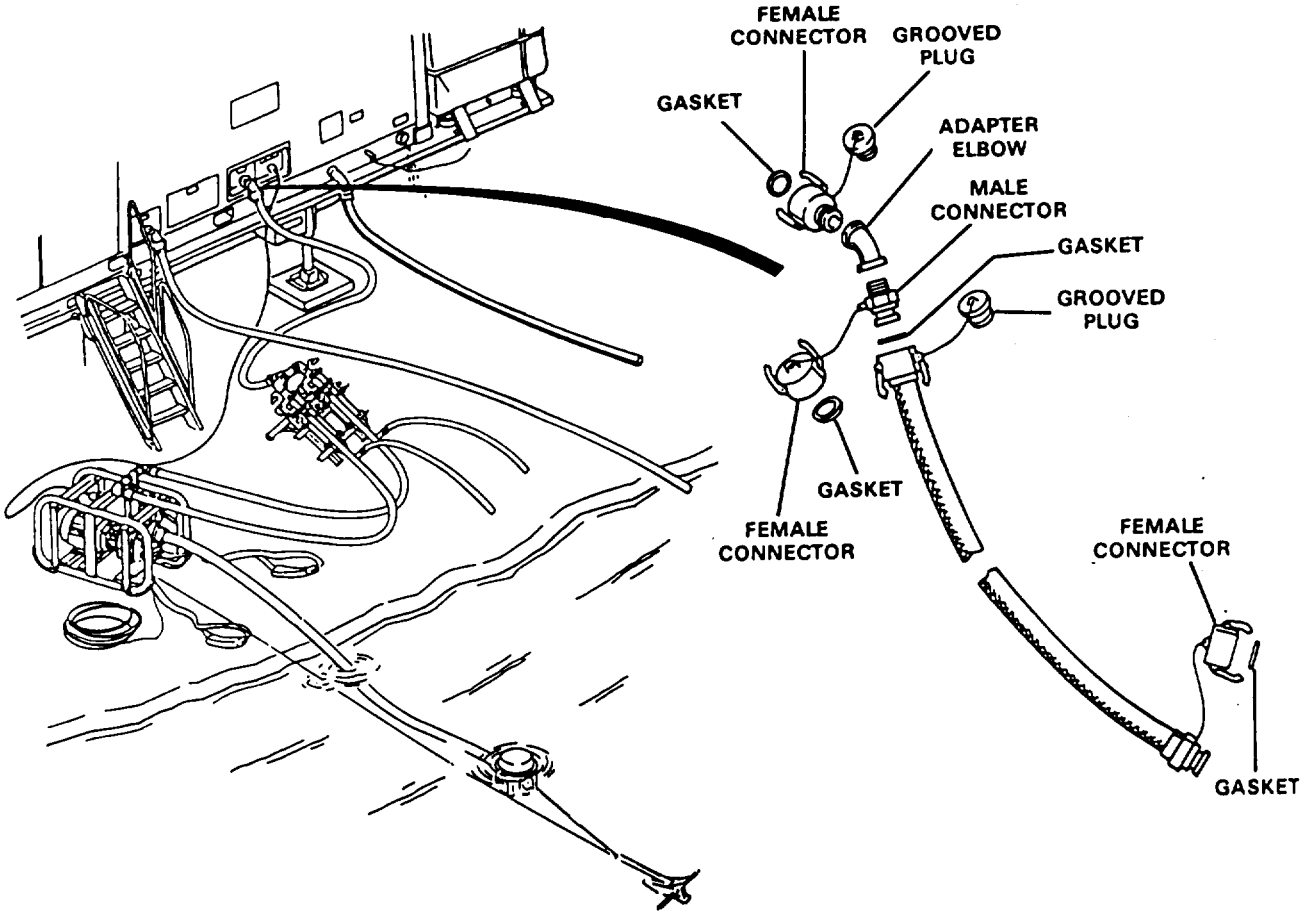


Figure 4-14. Raw Water System Hoses and Adapters **(Sheet 1 of 2)**
(MODEL WTA.O ONLY)

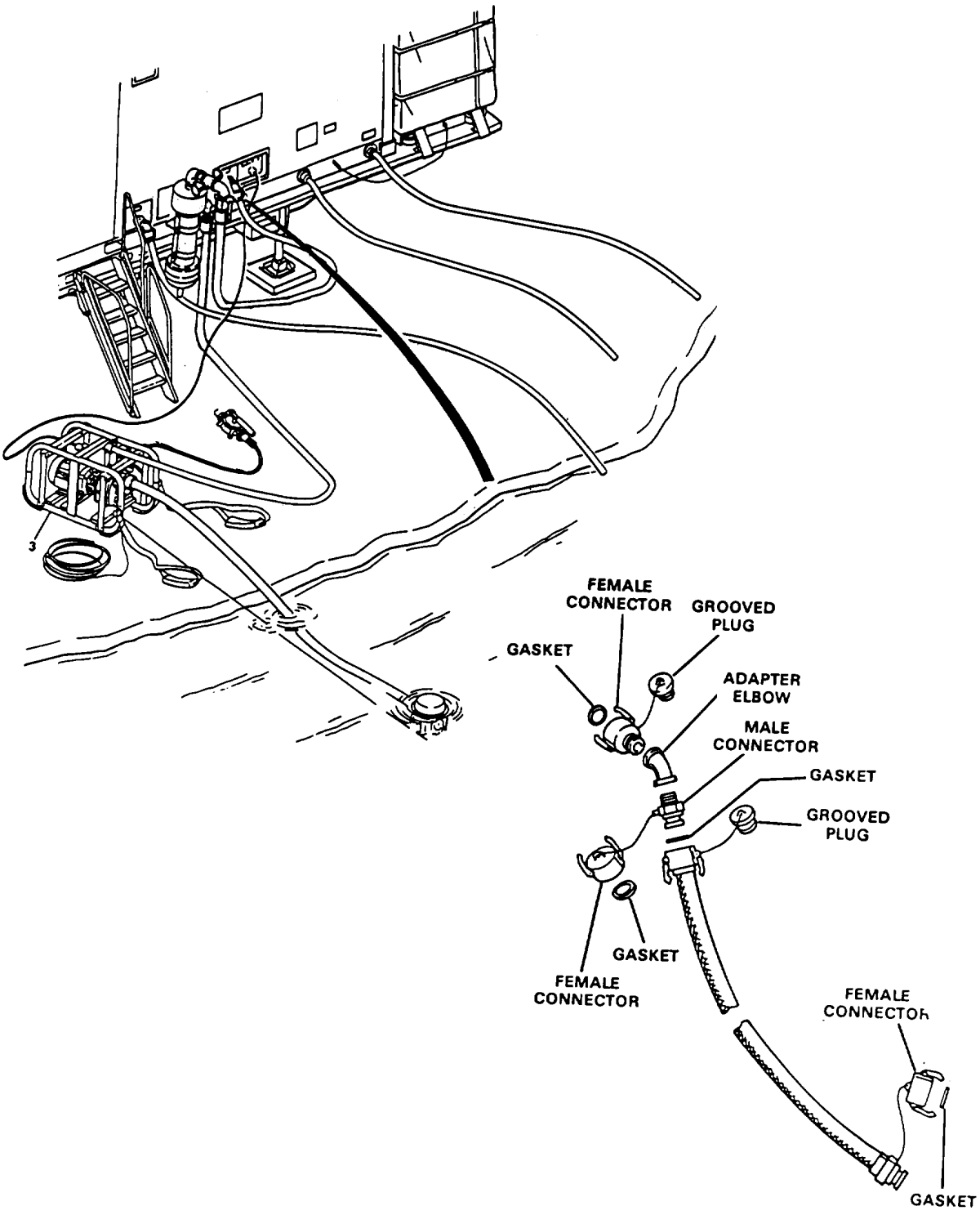


Figure 4-14. Raw Water System Hoses and Adapters **(Sheet 2 of 2)**
(MODEL ROWPU-1 ONLY)

4-13. RAW WATER PUMP POWER CABLE. This task covers:

a. Removal. b. Repair. c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III. Ref Code (No.):
Tool Kit, General Mechanics (1)
Riveter, Hand (2)
Drill Motor and Bits (2)
Multimeter (2)

Materials/Parts:
Rivets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

REMOVAL.

a. Refer to Figure 4-15 and disconnect cable by turning connector (1) 1/4 turn counterclockwise.

b. Install dust cap on ROWPU van connection.

REPAIR.

a. Remove strap (2) from cable (3) by drilling out the rivet (4) and removing flat washer (5) and clamp (6).

b. Remove dust caps (7) by prying open S-hook (8).

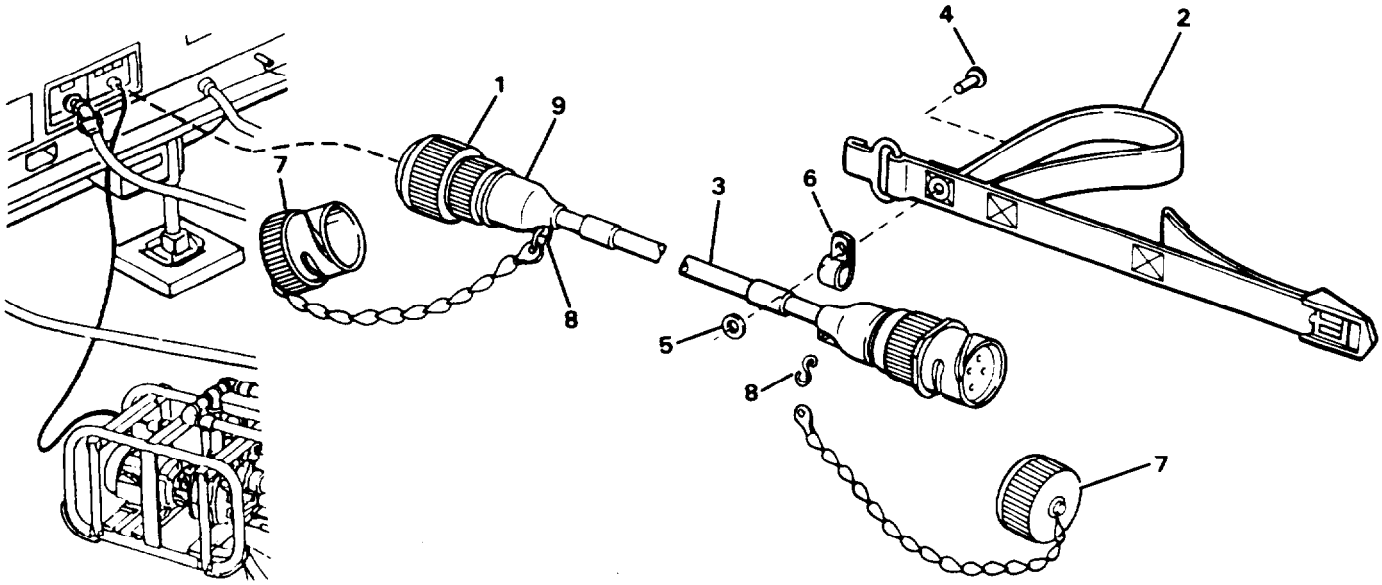


Figure 4-15. Raw Water Pump Power Cable

c. Replace any cable that is shorted, does not show continuity from end to end on any wire, has damaged connectors or cut insulation.

d. Install new dust caps and chain by inserting the S-hook (8) through the eyelet on the cap or plug and through the end link of the chain. Use a pliers to squeeze the S-hook closed.

e. Install another S-hook in the eyelet on the connector boot (9) and through the open link on the cap or plug chain Use a pliers to squeeze the S-hook shut.

f. Install the clamp (6) on the cable and install washer (5) and pop rivet (4) to secure strap (2) to cable (3).

INSTALLATION.

a. Remove dust cap from van connection or the other cable connection by turning the cap 1/4 turn counterclockwise.

b. Install cable on van connection by inserting it into the receptacle and turning the connector (1) nut 1/4 turn clockwise.

4-14. RAW WATER PUMP PIPING AND VALVES. This task covers. **(MODEL WTA-060 ONLY)**
a. Removal b. Repair c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Pipe

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition
ROWPU Shutdown.

REMOVAL.

NOTE
Remove each threaded item on Figure 4-16 by turning counterclockwise.

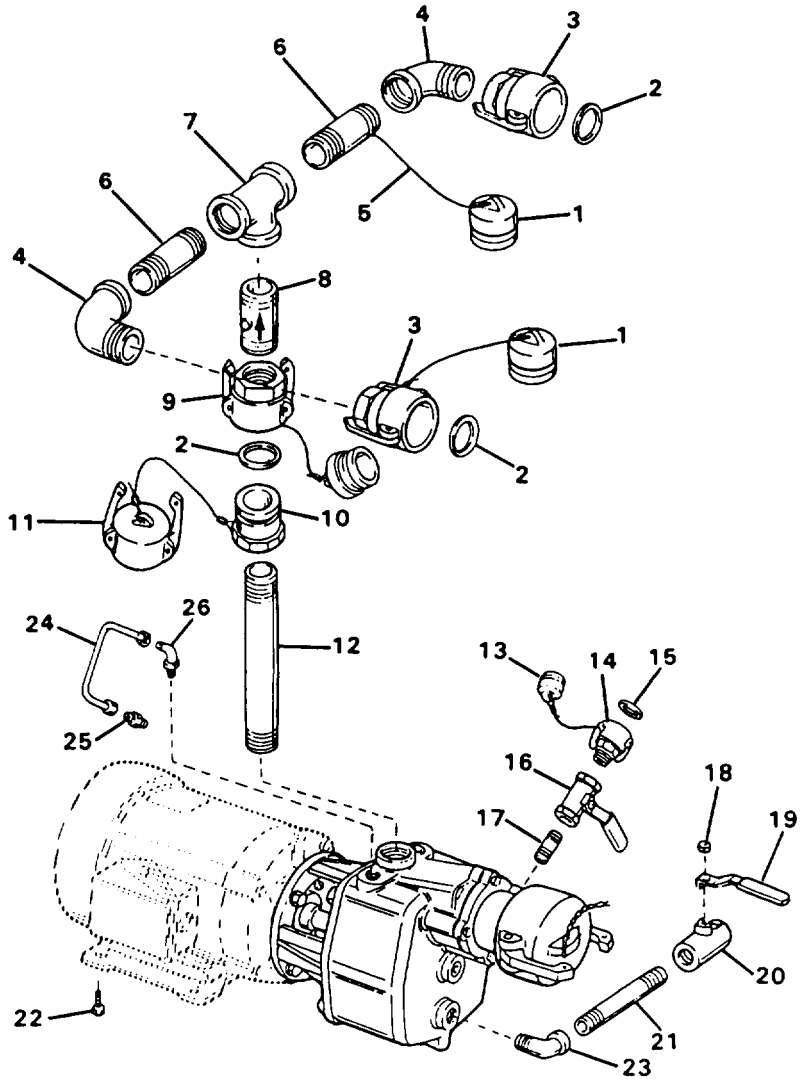


Figure 4-16. Raw Water Piping and Valves
(MODEL WTA-060 ONLY)

a. Remove plugs (1), gaskets (2) from connector (3).

b. Remove connectors (3) from elbows (4) and remove elbows (4).

c. Slide plug wires (5) off of nipples (6), and remove nipples from tee (7).

d. Remove tee from check valve (8).

e. Remove connector (9) from check valve (8).

f. Remove adapter (10) and cap (11) from nipple (12).

g. Remove nipple (12) from pump body.

h. Remove plug (13) and connector(14) and gasket (15).

i. Remove valve (16) and nipple (17).

j. Remove nut (18) and handle (19).

k. Remove valve (20) and nipple (21).

l. Loosen four bolts (22) on bottom of pump/motor assembly. Using a suitable wedge, raise the housing. Remove elbow (23).

m. Remove tube (24), adapter (25) and elbow (26).

R E P A I R .

a. Install antiseize tape on leaking fittings. Antiseize tape should be installed on male pipe threads in a clockwise direction as viewed when looking at the pipe end being repaired. All old tape should be removed from the fitting before installing new tape.

b. Replace any gaskets that are leaking or any damaged/leaking valves and pipe fittings

NOTE

There should be gaskets in all cam and groove fittings.

c. Repair by replacing any missing or damaged dust caps or plugs (para. 4-11).

d. Repair damaged dust plugs and caps on connectors by cutting the attaching chain and replacing plug or cap. (para, 4-11).

INSTALLATION.

NOTE

Make sure that antiseize tape is installed correctly on all male pipe threads before installation. Check that the flow check valve (6) is installed correctly if it has been removed; the valve must open when water flows into adapter (7). Tighten all fittings securely to ensure a leak free joint.

a. Install elbow (26), adapter (25), and tube (24).

b. Install elbow (23).

c. Remove wedge from pump housing and tighten bolts (22).

d. Install nipple (21) and valve (20).

e. Install handle (19) and secure with nut (18).

f. Install nipple (17) and valve (16).

g. Place gasket (15) into connector (14) and install onto valve (16).

h. Install nipple (12) into pump body.

i. Install adapter (10) and cap (11) to nipple (12).

j. Install connector (9) on check valve (8).

k. Install check valve into tee (7).

l. Install nipples (6). Slide plug wires (5) onto nipples and install elbows (4).

m. Install connectors (3), gaskets (2) and caps (1).

4-14.1. RAW WATER PUMP PIPING AND VALVES. This task covers: (**MODEL ROWPU-1 ONLY)**
a. Removal b. Repair c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Pipe

Equipment Condition:
ROWPU Shutdown.

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

REMOVAL.

NOTE
Remove each threaded item on Figure 4-16.1 by turning counterclockwise.

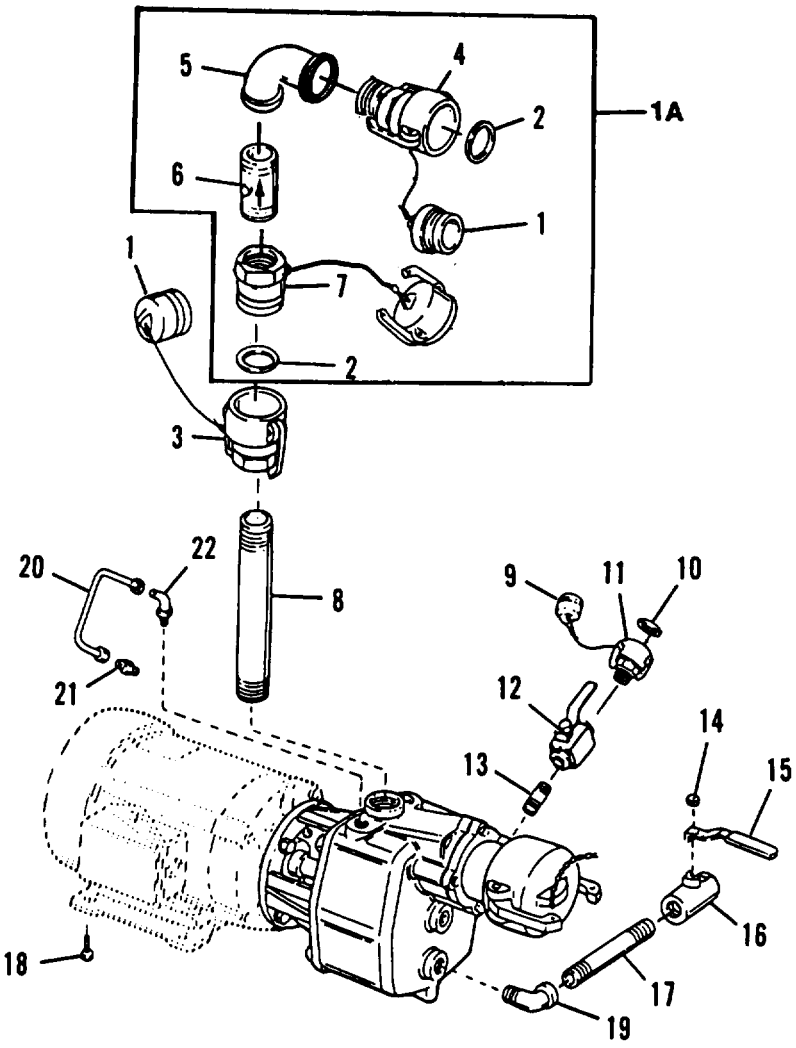


Figure 4-16.1. Raw Water Piping and Valves
(MODEL ROWPU-1 ONLY)

a. Remove pipe section (1A) from raw water pump.
b. Remove plug (1), gasket (2) from connector (4).
c. Remove elbow (5) from check valve (6).
d. Remove connector (7) from check valve (6).
e. Remove connector (3) from nipple (8).
f. Remove nipple (8) from pump body.
g. Remove plug (9), gasket (10), and connector (11) from valve (12).
h. Remove valve (12) and nipple (13) from pump body.
i. Remove nut (14) and handle (15) from valve (16).
j. Remove valve (16) and nipple (17) from pump body.
k. Loosen four bolts (18) on bottom of pump/motor assembly. Using a suitable wedge, raise the housing. Remove elbow (19).
l. Remove tube (20), adapter (21) and elbow (22).

REPAIR.

a. Install antiseize tape on leaking fittings. Antiseize tape should be installed on male pipe threads in a clockwise direction as viewed when looking at the pipe end being repaired. All old tape should be removed from the fitting before installing new tape.
b. Replace any gaskets that are leaking or any damaged/leaking valves and pipe fittings.

NOTE

There should be gaskets in all cam and groove fittings.

c. Repair by replacing any missing or damaged dust caps or plugs (para. 4-11).
d. Repair damaged dust plugs and caps on connectors by cutting the attaching chain and replacing plug or cap. (para. 4-11).

INSTALLATION.

a. Install elbow (22), adapter (21), and tube (20).
b. Install elbow (19).
c. Remove wedge from pump housing and tighten bolts (18).
d. Install nipple (17) and valve (16).
e. Install handle (15) and secure with nut (14).
f. Install nipple (13) and valve (12).
g. Place gasket (10) into connector (11) and install onto valve (12).
h. Install nipple (8) into pump body.
i. Install connector (3) onto nipple (8).
j. Install connector (7) on check valve (6).
k. Install check valve (6) into elbow (5).
l. Install connector (4), gasket (2), and plug (1) onto elbow (5).
m. Install pipe section (1A) onto raw water pump.

4-15. RAW WATER PUMP AND MOTOR ASSEMBLY. This task covers:

a. Removal. b. Disassembly. c Repair. d. Reassembly. e. Installation

INITIAL SETUP.

Tools, see Appx B. Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Stripper, Wire (16)
Crimper, Hand Terminal (16)

Materials/Parts:
Tape, Electrical (Appx E, Sec II, Item 68)
Twine (Appx E, Sec II, Item 72)
Suitable Tags
Varnish (Appx E, Sec II, Item 73)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Piping removed (para. 4-14).

Personnel Required: 2

General Safety Instructions:

WARNING

Observe specific Warning in text.

WARNING

To avoid injury. two people are required to lift the pump/motor assembly (11, Figure 4-17).

NOTE

If the pump and motor assembly is being replaced, do not remove seal flush tubing installed on the pump.

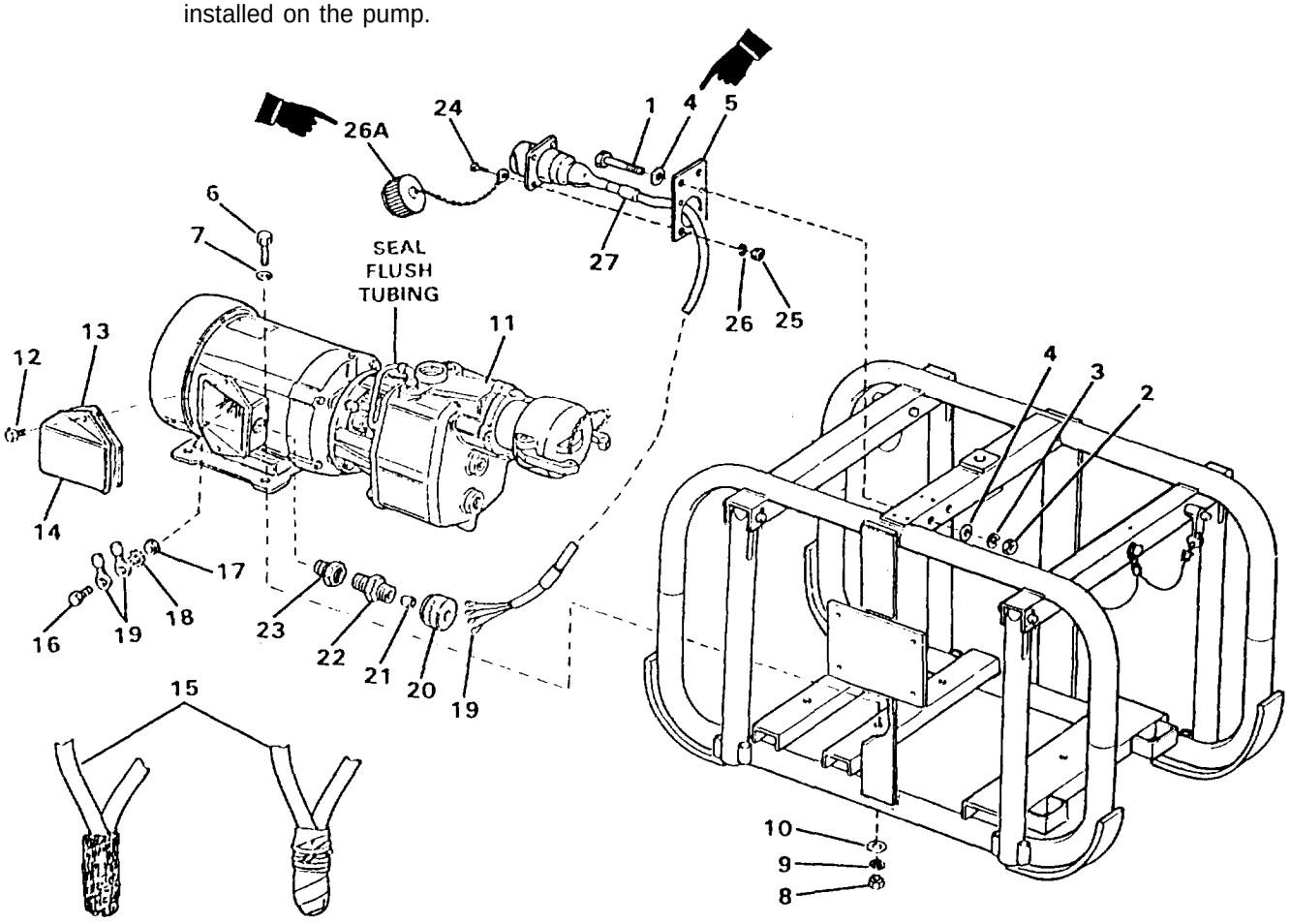


Figure 4-17. Raw Water Pump and Motor Assembly

REMOVAL.

a. Remove two screws (1, Figure 4-17), nuts (2), lockwashers (3) and washers (4), that hold the connector bracket (5) to the frame.

b. Remove four screws (6), washers (7), nuts (8), lockwashers (9) and washers (10).

c. Remove pump and motor assembly (11) from frame.

DISASSEMBLY.

a. Remove two screws (12); remove cover (13) and gasket (14) from the electrical box.

b. Remove twine and tape from wire ends as shown in (15).

c. Tag all wire ends (19) and disconnect by removing screws (16), nuts (17) and washers (18).

d. Loosen cable collar (20) and retainer (21). Slide collar and retainer back onto cable.

e. Carefully pull wires from cable bushing (22) and remove cable bushing adapter (23).

f. Remove screws (24), nuts (25) and washers (26). Remove dust cap (26A) and cable (27) from bracket (5).

REPAIR.

a. Replace cable if damaged.

b. Replace cable adapter (22) if damaged.

c. Replace any missing or damaged parts, including dust caps (para. 4-11) and wire markers (para. 4-10).

REASSEMBLY.

a. Install cable (27) into bracket (5). Position chain of dust cap (26A) on connector flange. Secure with four screws (24), washers (26) and nuts (25).

b. Install cable adapter (23) and bushing (22). Insert wire ends through cable bushing (22).

c. Slide retainer (21) and cable collar (20) to the adapter (22) and secure by tightening the collar (20).

d. Check tagged wire ends (19) and connect using screws (16), washers(18) and nuts (17).

e. Spray or brush with varnish conforming to MIL-V-173 before taping electrical connections. Use electrical tape and twine to wrap each connection.

f. Wrap each wire pair end with tape and secure with twine as shown in (15).

g. Replace electrical cover(13) and gasket (14). Secure with screws (12).

INSTALLATION.

a. Place pump and motor assembly (11) into frame.

b. Fasten pump and motor assembly to frame using four screws (6), washers (7), nuts (8), lockwashers (9) and washers (10).

c. Place connector bracket (5) into frame. Secure with screws (1), washers (2), lockwashers (3) and nuts (4).

NOTE

Check motor rotation when started. It must be clockwise when viewing the fan end of the motor. If rotation is not correct, reverse any two electrical leads.

4-16. RAW WATER PUMP. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown to standby (para. 2-18). Raw water suction hose disconnected at pump suction flange.

WARNING

Make sure electrical power is disconnected before working on equipment. Failure to do so could result in serious injury or death from electrical shock.

NOTE

The flapper valve prevents water from draining from the suction side of the raw water pump. It is important that this valve remain free to move so that the pump will retain its prime.

DISASSEMBLY.

a. Disconnect dust cap (1, Figure 4-18) and remove gasket (2) from dust cap (1).

b. Remove four screws (3) and remove suction flange (4).

c. Remove flapper valve assembly (5) from housing (8).

d. Remove plugs (6 and 7) if necessary.

e. Loosen nuts (9) and remove tube assembly (10).

f. Remove fitting (11) and elbow (12) from pump housing (8).

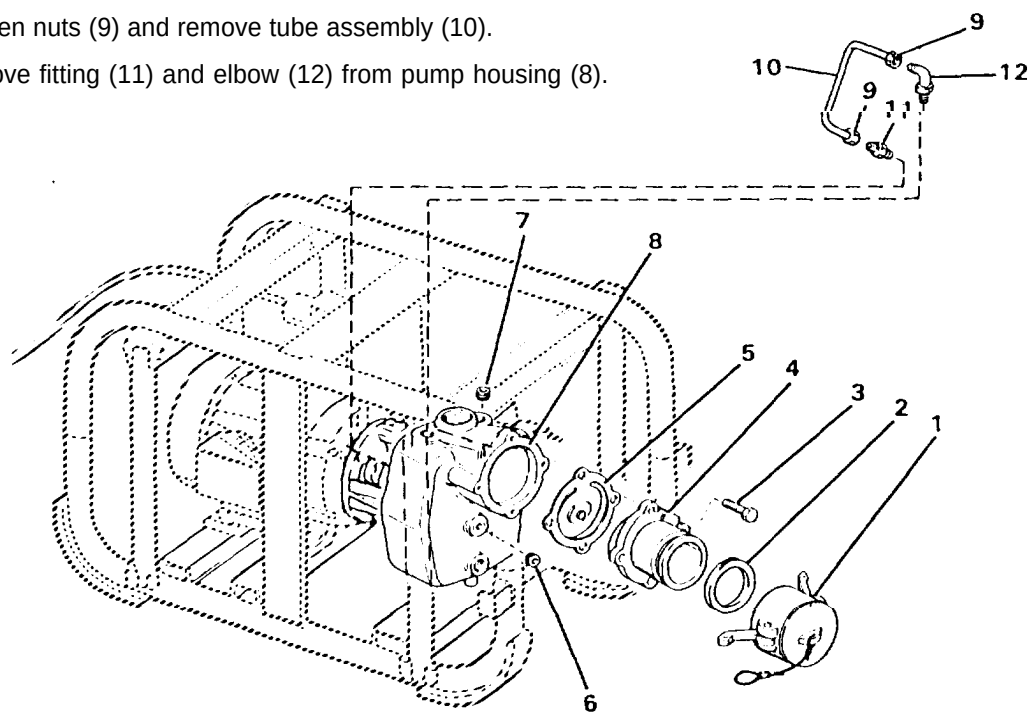


Figure 4-18. Raw Water Pump

REPAIR.

a. Check condition of flapper valve assembly (5). Replace if damaged or worn.

b. Clean any accumulated material out of suction flange (4) or pump housing (8) to ensure that the flapper valve is free to move in the housing (8) and that it seals the suction flange properly.

c. If dust cap(1) or attaching cable is damaged, repair or replace (para. 4-11).

d. Replace gasket (2) if necessary.

e. Repair plug leaks by using antiseize tape on threads.

REASSEMBLY.

CAUTION

Do not overtighten screws. Overtightening may crack the suction flange.

a. Place flapper valve assembly (5) on housing (8), Place suction flange (4) on flapper valve (5) and secure with four screws (3).

b. Install gasket (2) on dust cap (1) and position dust cap (1) on suction flange (4).

c. Wrap plugs (6 and 7) with antiseize tape and install the plugs, if removed.

d. Wrap threads of connectors with anti-seize tape and install elbow(12) and fitting (11) to pump housing (8).

e. Install tube assembly (10) on housing (8) (two places).

f. Tighten nuts (9) to secure tube assembly (10).

4-17. RAW WATER PUMP FRAME. This task covers:

a. Replace b. Disassembly c. Repair d. Reassembly

INITIAL SETUP.

Tools, see Appx B, Sec III. Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Riveter, Hand (2)

Equipment Condition:
ROWPU shutdown, piping removed (para. 4-14), pump and motor assembly removed (para 4-15)

Materials/Parts:
GAA Grease (Appx E, Sec II, Item 42)
Rivets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

NOTE
There is no specific order of removal or repair for these components.

REPLACE.

Replace raw water pump frame if beyond repair.

DISASSEMBLY.

a. Remove nut (1, Figure 4-19), lockwasher (2), washer (2A), and eyebolt (3).

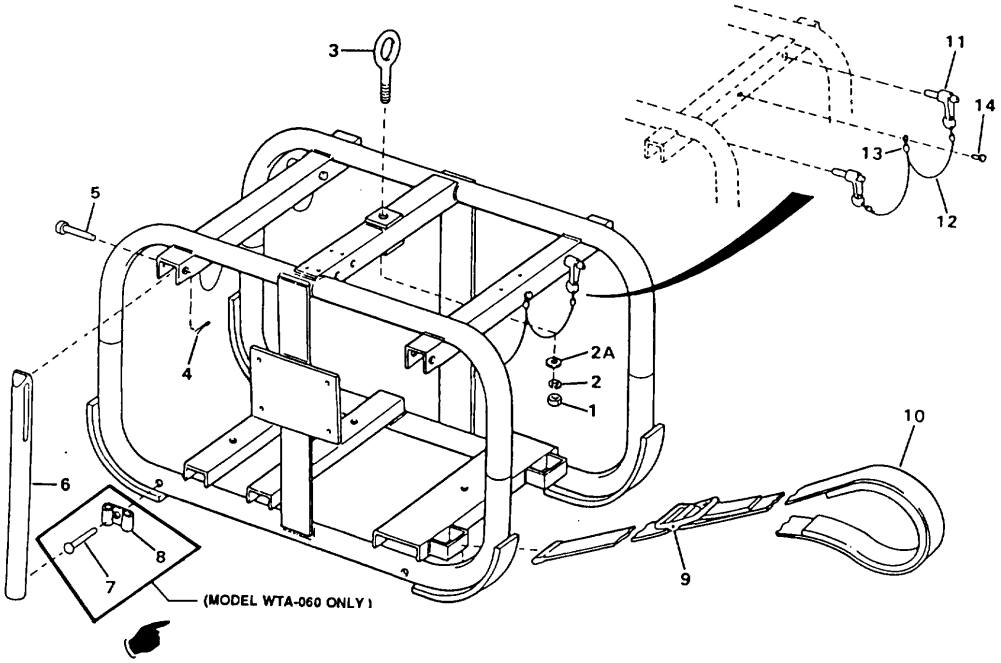


Figure 4-19. Raw Water Pump Frame Components

b. Remove cotter pins (4) and pins (5) and remove four lift arms (6).
c. Remove the four rivets (7) and arm retainer clips (8). (MODEL WTA-0 ONLY)
d. Loosen two straps (10) in buckles (9) and pull end of straps through buckles.
e. Depress the button on the end of the four quick release pins (1) and remove the pins. They are connected by cable (12) and clamp (13). It may be necessary to tap the buttons with a hammer if the button is corroded. Drill out center of pop rivet (14) and remove lock assembly.

REPAIR.

a. Replace missing or damaged components as necessary.
b. Replace nameplates as required (para. 4-10).
c. If necessary, cut cable (12) and replace. Crimp it on the ring of the quick release pin (11) using clamps (13).
d. Lubricate the button with grease, if corroded.

REASSEMBLY .

NOTE
Procedures for installing wire cable clamps are given in para. 4-11.

a. Install lock assembly to frame using pop rivet (14).
b. Depress the buttons and install pins (11) and cable (12).
c. Thread straps (10) through loops on frame and through buckle (9).
d. Install four lift arm retainers (8) with rivets (7). (MODEL WTA06 ONLY)
e. Position four lift arms (6) on frame and secure with pins (5) and cotter pins (4).
f. Install eyebolt (3) and secure with washer (2A), lockwasher (2) and nut (1).

4-18. RAW WATER PRIME ASSIST PUMP. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gasket (TM 10-4610-232-24P)

DISASSEMBLY.

a. Disconnect adapter (1, Figure 4-20) and assembled tubing assembly 1 thru 6) from pump 7).

b. Disconnect dust cap (2) with gasket (3) from connector (4).

c. Unscrew adapter (5) from connector (4).

d. Remove hose (6) from adapters (5 and 1) by loosening the tubing nuts.

e. Remove gasket (3) from dust cap (2).

REPAIR.

a. Use antiseize tape on adapters (1 and 5) to repair leaks at threaded ends.

b. Replace gasket (3) if damaged.

c. Replace tubing (6) if cut or damaged. Fittings (1 and 5) will need to be replaced if tubing (6) is replaced.

d. Repair dust cap (2) and connector (4), if required (para. 4-11). Replace if damaged.

e. Replace pump (7) if damaged or not working.

REASSEMBLY.

a. Install hose (6) in adapters (1 and 5) Tighten tubing nuts.

b. Connect adapter (5) to connector (4).

c. Install gasket (3) and dust cap (2) on connector (4).

d. Connect adapter (1) and assembled hose (1 thru 6) to pump (7).

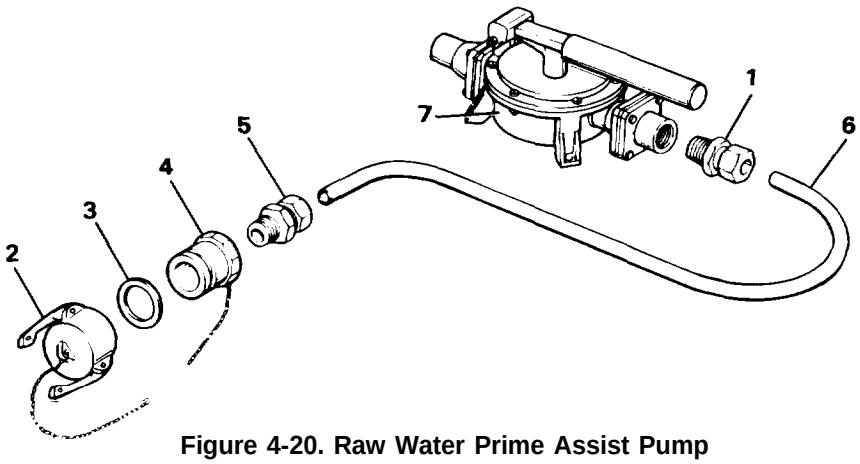


Figure 4-20. Raw Water Prime Assist Pump

4-19. SEPARATOR PIPING. This task covers: **(MODEL WTA-O6 ONLY)**

a. Removal **b. Repair** **c. Installation.**

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Vise (2)
Wrench, Pipe (5)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Cam and groove hoses disconnected from separator assembly.
General Safety Instructions.

WARNING

Make certain in-line pressure is relieved from hoses. Failure to do so could result in injury.

REMOVAL.

a. Loosen clamps (1, Figure 4-21) and remove waste hoses (2).
b. Disconnect two connectors (3) from separators (8). Slide separators apart.

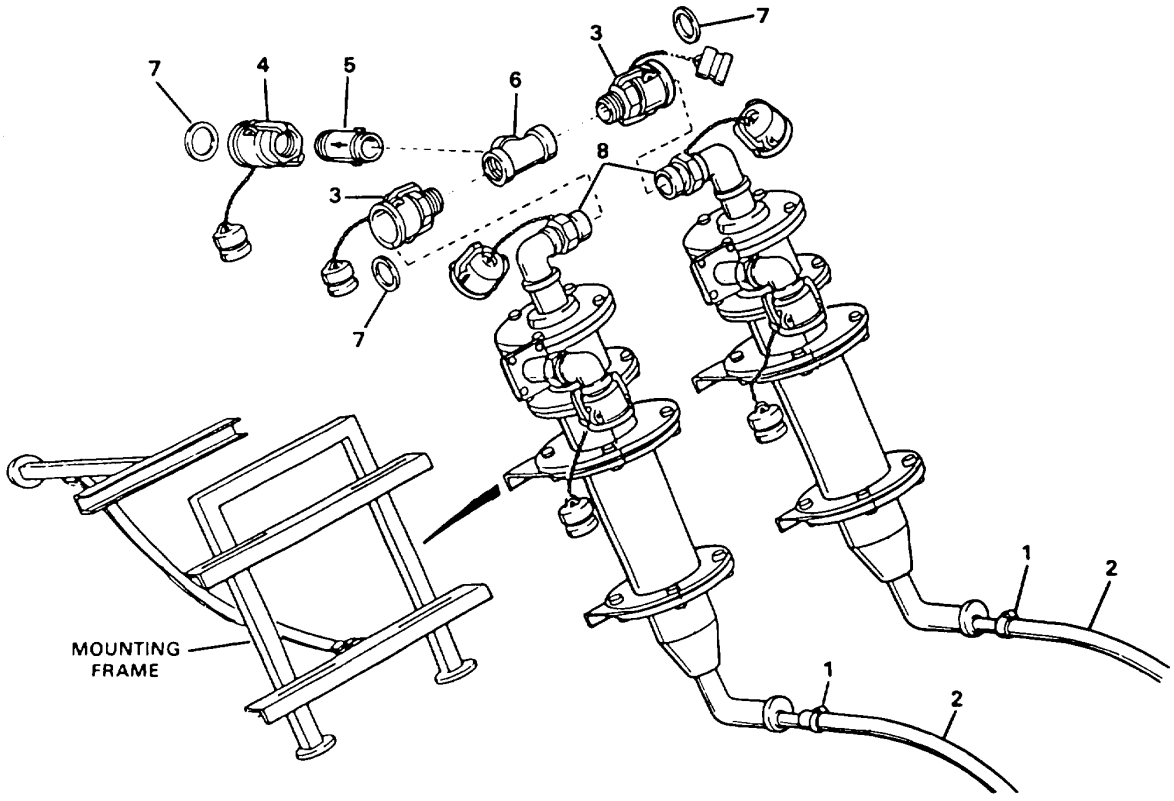


Figure 4-21. Separator Piping
☞**(MODEL WTA-060 ONLY)**

c. Remove assembled connectors (3 and 4), check valve (5) and tee (6) as a unit.
d. Remove connector (4) from check valve (5) and check valve (5) from tee (6).
e. Remove two connectors (3) from tee (6) and remove two gaskets (7) from connectors (3).

REPAIR.

a. If any leaks are noted, use antiseize tape to wrap male pipe connections prior to assembly.
b. Replace gaskets (7) if necessary.

NOTE

There should be gaskets in all cam and groove fittings.

c. Replace all damaged and worn parts.'
d. Repair damaged dust plugs and caps on connectors (3 and 4) by cutting the attaching chain and replacing plug or cap (para. 4-11).
e. Replace damaged waste hoses (2).

INSTALLATION.

a. Install two couplings (3) on tee (6).
b. Install outlet check valve (5) in tee (6).

NOTE

The arrow on the outlet check valve must point in the direction shown (away from the tee). This valve stops water from flowing from the ROWPU into the separator.

c. Install connector (4) on outlet check valve (5).
d. Install hoses (2) and secure with clamps (1).
e. Position assembled items (3 thru 7) to separators at connectors (3).
f. Push separators together and lock connectors (3) to separators.

4-19.1. SEPARATOR PIPING. This task covers**: (MODEL ROWPU-1 ONLY)**

a. Removal **b. Repair** **c. Installation.**

INITIAL SETUP.

Tools. see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Vise (2)
Wrench, Pipe (5) General Safety Instructions.

Materials/Parts
Tape. Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

WARNING

Make certain in-line pressure is relieved from hoses. Failure to do so could result in injury.

REMOVAL

Remove separator piping from the ROWPU unit by disconnecting all hoses attached to the separator piping and then disconnecting coupling half (1) from coupling half (2).

DISASSEMBLY

a. Remove two plugs (3), gasket (4), coupling half (5), reducer (6), check valve (7), and elbow (8) from coupling half (1).
b. Remove gasket (9) from coupling half (1).

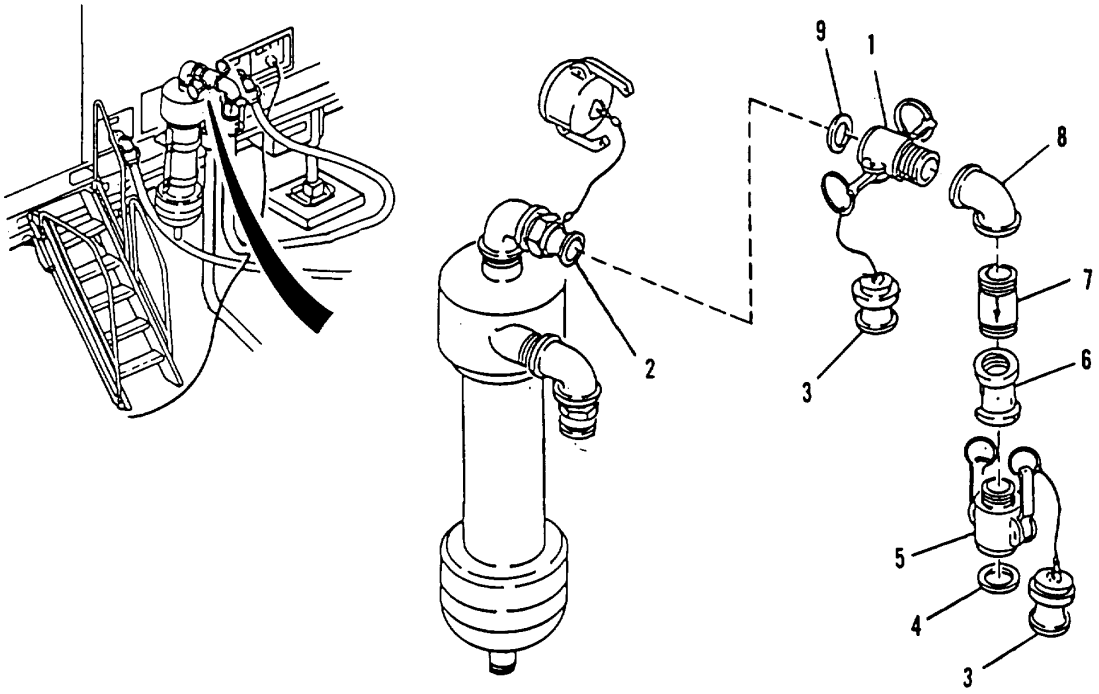


Figure 4-21.1. Separator Piping. (MODEL ROWPU-1 ONLY)

REPAIR

WARNING

Dry cleaning solvent, A-A-711, types I and II, used to clean parts is potentially dangerous to personnel. Use nonporous gloves when handling solvent or material wet with solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use open flame or excessive heat. Flash point of solvent is 100 F (38 C).

a. Apply dry cleaning solvent to exposed area near the entrance and exit threads of the cyclone separator.
b. Remove all dirt and debris from all metal parts.

REASSEMBLY

a. Install gasket (9) into coupling half (1).
b. Install elbow (8), check valve (7), reducer (6), coupling half (5), gasket (4) and two plugs (3) onto coupling half (1).

INSTALLATION

Install separator piping by connecting coupling half (2) onto coupling half (1) and then reconnect all hoses to the separator piping assembly.

4-20. SEPARATORS. This task covers: **(MODEL WTA-60 ONLY)**
a. Removal b. Disassembly c. .Repair d .Reassembly e. Installation

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Pipe (5)

Materials/Parts:
Sealant. Pipe Thread (Appx E, Sec II, Item 62)
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2
Equipment Condition:
Separator piping and hoses removed (para. 4-19).

General Safety Instructions:

WARNING
Observe specific Warning and Caution in text.

WARNING
To avoid injury, two people are required to lift each separator.

REMOVAL.

Lift separators off of separator frame, Figure 4-22.

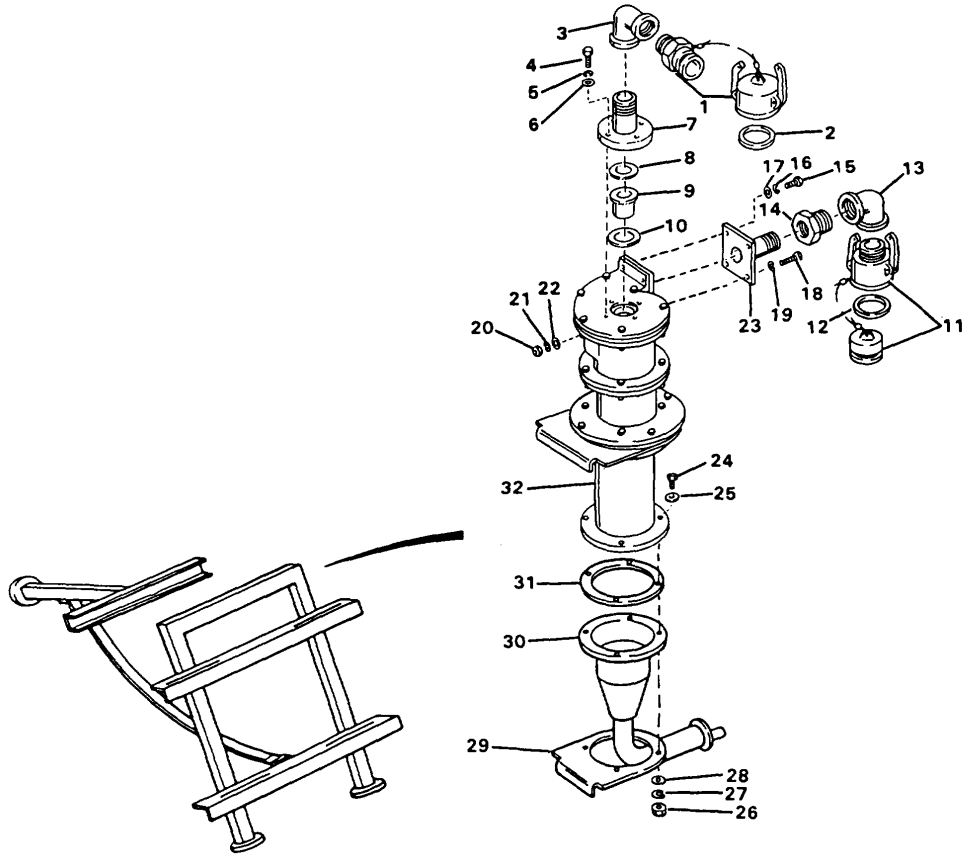


Figure 4-22. Separators
☞**(MODEL WTA060 ONLY)**

DISASSEMBLY.

a. Remove the connector (1) with assembled dust cap.
b. Remove the gasket (2).
c. Turn elbow (3) off outlet flange (7).
d. Remove four capscrews (4), lockwashers (5), washers (6) and outlet flange (7).
e. Remove gasket (8), vortex finder (9) and gasket (10).
f. Remove the connector (11) with assembled plug.
g. Remove the gasket (12).
h. Remove elbow (13) and bushing (14).
i. Remove two capscrews (15), lockwashers (16), washers (17), capscrews (18), lockwashers (19), nuts (20), lockwashers (21) and washers (22) and remove inlet flange (23).
l. Remove four capscrews (24), washers (25), nuts (26), lockwashers (27) and washers (28).
k. Remove bracket (29), waste housing (30) and gasket (31).

REPAIR.

a. Clean waste housings (30).
b. Replace any damaged gaskets (2, 8, 10, 12 or 31).
c. Replace any damaged components.
d. Replace any missing or damaged dust caps or plugs (para. 4-11).
e. Replace the separator assembly (32) if body of separator is cracked or if leaks occur at areas not covered in this procedure.
f. Apply antiseize tape to threaded fittings.

REASSEMBLY.

a. Install gasket (31), waste housing (30) and bracket (29) on separator and secure with four capscrews (24), washers (25), nuts (26), lockwashers (27) and washers (28).
b. Install flange (23) and secure with two capscrews (15), lockwashers (16), washers (17), capscrews (18). lockwashers (19), nuts (20), lockwashers (21) and washers (22).
c. Install bushing (14), elbow (13), gasket (12) and connector (11) with assembled dust plug.
d. Install gasket (10) place vortex finder (9) in the top of separator and install gaskets (8) in outlet (7).

CAUTION

Do not overtighten capscrews. The vortex finder may crack. Tighten capscrews evenly and alternately, to a maximum cross torque of 20 ft-lbs.

e. Install outlet flange(7)on top of vortex finder (9) and secure with capscrews (4), lockwashers (5), and washers (6). To prevent leaks, seal the threads of capscrews (4) with pipe thread sealant.

NOTE

It may be necessary to tighten these capscrews further to prevent leaks. Therefore, observe this area for leaks when the unit is restarted.

INSTALLATION.

NOTE
Brackets on the separators slide into grooves on the frame.

Lift the separators onto the mounting frame.

4-20.1. SEPRATORS. This task covers**: (MODEL ROWPU-1 ONLY)**

a. Removal b. Disassembly c. .Repair d .Reassembly e. Installation

INITIAL SETUP.

Tools, see Appx B., Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Pipe (5)
Materials/Parts:
Sealant, Pipe Thread (Appx E, Sec II, Item 62)
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2
Equipment Condition:
Separator piping and hoses removed (para. 4-19.1).

WARNING
Observe specific Warning and Caution in text.

REMOVAL.

Remove separator from the ROWPU unit by disconnecting all hoses attached to the separator and then lifting the separator assembly form the stake pocket on the ROWPU trailer.

DISASSEMBLY.

a. Remove coupling half (1) and elbow (2) from cyclone separator (3).
b. Remove gasket (4) from coupling half cap (5).
c. Remove coupling half cap (6) and gasket (7) from coupling half (8).
d. Remove coupling half (8) and elbow (9) from cyclone separator (3).
e. Remove clamp (10), hose (11), nipple (12), and reducer (13) from cyclone separator (3).
f. Remove four screws (14), four flat washer (15), four nuts (16), two brackets (17), and cyclone separator (3) from strap (18).

REPAIR.

WARNING

Dry cleaning solvent, A-A-711, types I and II, used to clean parts is potentially dangerous to personnel. Use nonporous gloves when handling solvent or material wet with solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use open flame or excessive heat. Flash point of solvent is 100 F (38 C).

a. Apply dry cleaning solvent to exposed area near the entrance and exit threads of the cyclone separator.
b. Remove all dirt and debris from all metal parts.
c. Clean exterior of cyclone separator housing thoroughly with dry cleaning solvent.

REASSEMBLY.

a. Place cyclone separator (3) into position on strap (18) and install two brackets (17), four nuts (16), four flat washers (15), and four screws (14).
b. Install reducer (13), nipple (12), hose (11), and clamp (10) onto cyclone separator (3).
c. Install elbow (9) and coupling half (8) onto cyclone separator (3).
d. Install gasket (7) and coupling half cap (6) onto coupling half (8).
e. Install elbow (2) and coupling half (1) onto cyclone separator (3).
f. Install gasket (4) and coupling half (5) onto coupling half (1).

INSTALLATION.

Install separator onto ROWPU by replacing separator into stake pocket of trailer and then reconnecting all hoses to the cyclone separator assembly.

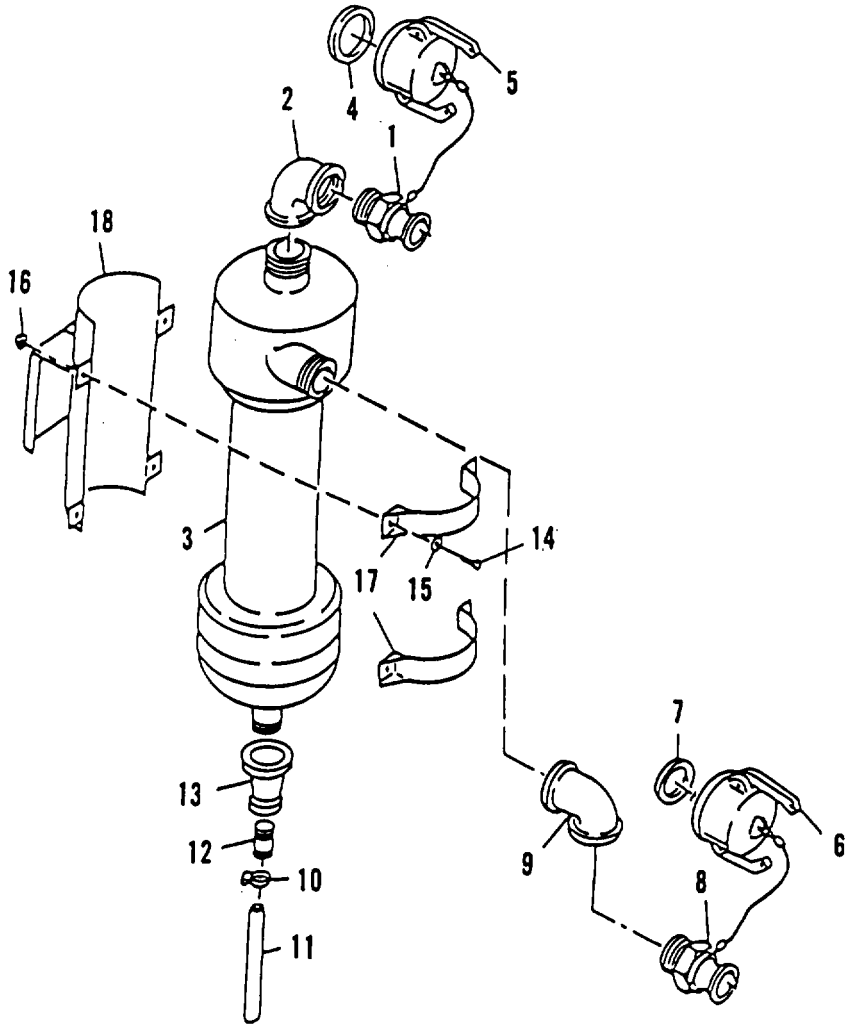


Figure 4-22.1. Separators
(MODEL ROWPU-1 ONLY)

4-21. SEPARATOR FRAME. This task covers**: (MODELWTA-060 ONLY)**

a. Removal **b. Disassembly** **c. Repair** **d. Reassembly**

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown, separator piping removed (para. 4-19), separators removed (para. 4-20).

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4G10-232-24P)

REPLACE.

Replace the separator frame if it is damaged beyond repair.

DISASSEMBLY.

a. Remove two screws (1, Figure 4-23), washers (2), nuts (3), washers (4), and strap retainer (5). Strap(6)will now be free from leg (7). Remove leg (7).
b. Remove two screws (8), washers (9), nuts (10), lock washers (11) and strap retainer (12). Remove strap (6).
c. Remove two screws (13), washers (14), nuts (15), lockwashers (16) and washers (17) from each channel (18). Remove two channels (18) from frame (25).
d. Remove three screws(19). lockwashers (20), nuts(21). lockwashers(22) and washers (23). Remove channel (24) from frame (25).

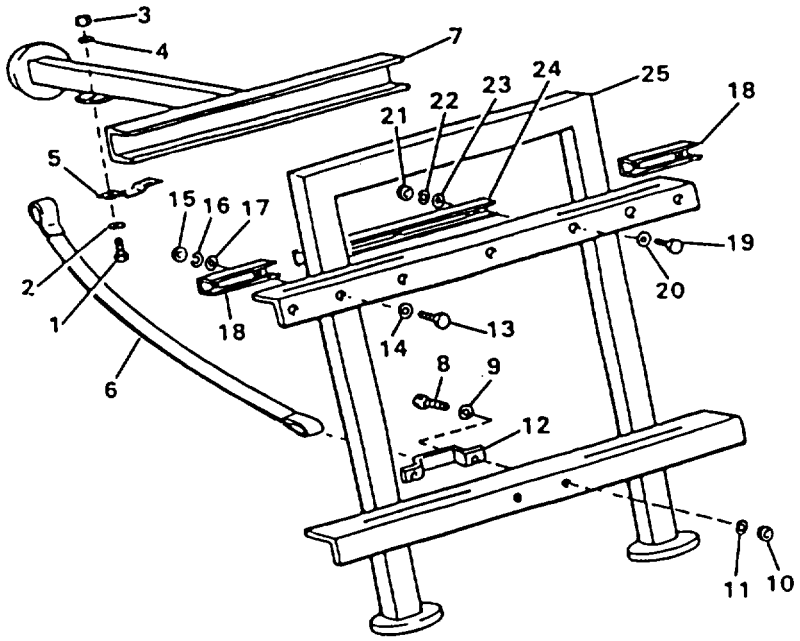


Figure 4-23. Separator Frame
(MODEL WTA-060 ONLY)

REPAIR.

a. Replace strap (6) if worn or damaged.

b. Straighten channels (18) and (24), leg (7) and frame (25).

c. Replace damaged parts.

REASSEMBLY.

a. Center the strap loop (6) in strap retainer (5) and install strap retainer (5) on leg (7) using two screws (1), washers (2), nuts (3) and washers (4).

b. Install two channels (18) using four screws (13), washers (14), nuts (15), lockwashers (16) and washers (17).

c. Install channel (24) using three screws (19), washers (20), nuts (21), lockwashers (22) and washers (23).

d. Center strap (6) loop in strap retainer (12) and install strap retainer (12) on frame (25) using two screws (8), washers (9), nuts (10) and lockwashers (11).

4-22. EYEWASH STATION. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Suitable Container

Materials/Parts:
Bacteriostatic Additive (Appx E, Sec II, Item 11)
Tape, Antiseize (Appx E, Sec II, Item 67)
Preformed Packing (TM 10-4610-232-24P)

Equipment Condition:
Normal operation of ROWPU may continue during eyewash station repair.

Personnel Required: 2

General Safety Instructions:

WARNING

Observe specific Warnings in text.

WARNING

Be careful to keep dirt and other foreign matter out of eyewash solution container.

WARNING

To avoid injury, two people are required to move when tank is full.

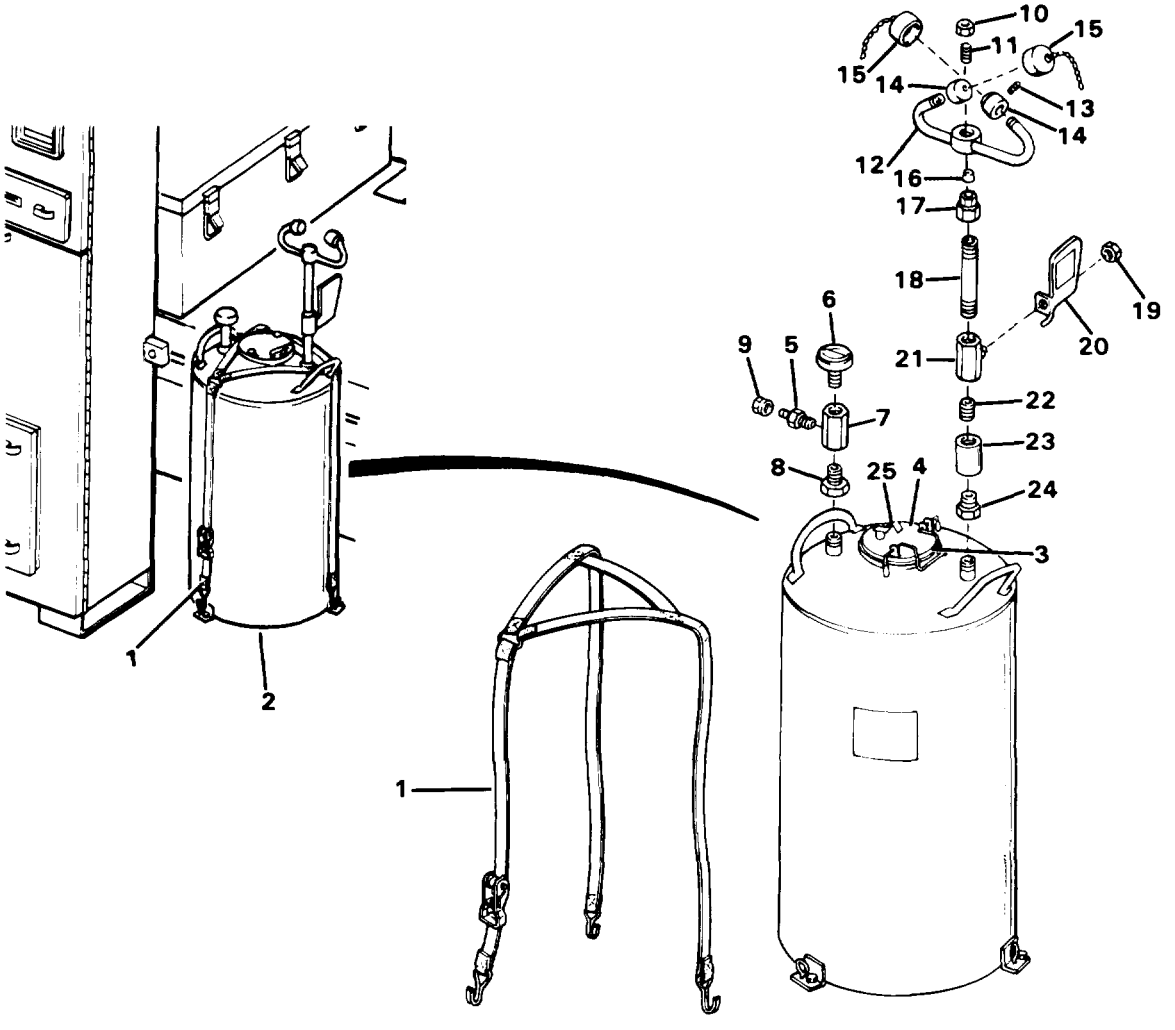


Figure 4-24. Eyewash Station

REMOVAL.

WARNING

To prevent injury, pressure gage must read 0 psig before any maintenance is performed.

a. Relieve tank pressure by opening the pressure relief valve (25) until gage (6) reads zero.

b. Using ratchet on strap (1), loosen strap.

c. Disconnect strap (1) from eyebolts on brackets on floor of van at three places and remove strap.

WARNING

If the tank assembly is to be removed while full, two people are required to lift the tank assembly. Each person uses one of the handles at the top of the tank to move it.

d. If the tank is to be drained prior to removal, lift bail (3) and remove cover (4) and preformed packing with pressure relief valve (25) installed.

e. Tip the tank to drain it into the sump in front of the RO vessels. Replace cover (4).

f. Remove tank assembly (2).

DISASSEMBLY.

a. Remove gage (6), tire valve (5), fitting (7), and adapter (8). Remove cap (9) from tire valve.

b. Remove nut (10) andscrew(11). Unscrew assembled tube (12 thru 15).

c. Remove two internal hex screws (13) and remove two spray nozzles (14). Do not remove dust covers(15) unless replacement is required.

d. Remove flow control (16), coupling (17), and pipe nipple (18).

e. Remove nut(19) and valve handle (20).

f. Remove valve (21).

g. Remove nipple (22), coupling (23) and adapter (24).

h. If necessary, remove pressure relief valve (25) from cover (4).

i. Remove cover (4) and preformed packing.

REPAIR.

a. Repair of the eyewash station is limited to removal and replacement of worn, missing or damaged parts. Replace any part in unserviceable condition.

b. Repair piping leaks with antiseize tape.

REASSEMBLY.

a. Install preformed packing on cover (4).

b. If removed, install pressure relief valve (25).

c. Install adapter (24), nut (23), nipple (22) and valve (21).

d. Install valve handle (20) and secure with nut (19).

e. Install pipe nipple (18), coupling (17), flow control (16) and turn tube (12) onto pipe nipple (18).

f. Install two spray nozzles(14) and secure with two internal hex screws (13).

g. Install dust covers (15), if removed.

h. Install screw (11) and nut (10).

i. Install adapter (8), fitting (7), tire valve (5), gage (6) and cap (9).

INSTALLATION.

a. Position eyewash station on floor of van and secure with straps (1).

b. Open bail (3), and open tank cover (4).

c. Add water to fill mark and add one four ounce packet of fungicide additive.

d. Position cover (4) and lock with bail (3).

e. Connect air supply tube to tire valve (5) and charge the tank to 85 psig.

4-23. FIRE EXTINGUISHER AND BRACKET. This task covers:

a. Removal **b. Installation**

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit. General Mechanics Automotive (1)

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

REMOVAL.

a. Remove fire extinguisher (1, Figure 4-25).
b. Remove two screws (2). lockwashers (3), flat washers (4) and bracket (5).

INSTALLATION.

a. Install bracket (5) and two screws (2), lockwashers (3) and flat washers (4).
b. Mount fire extinguisher (1) in bracket.

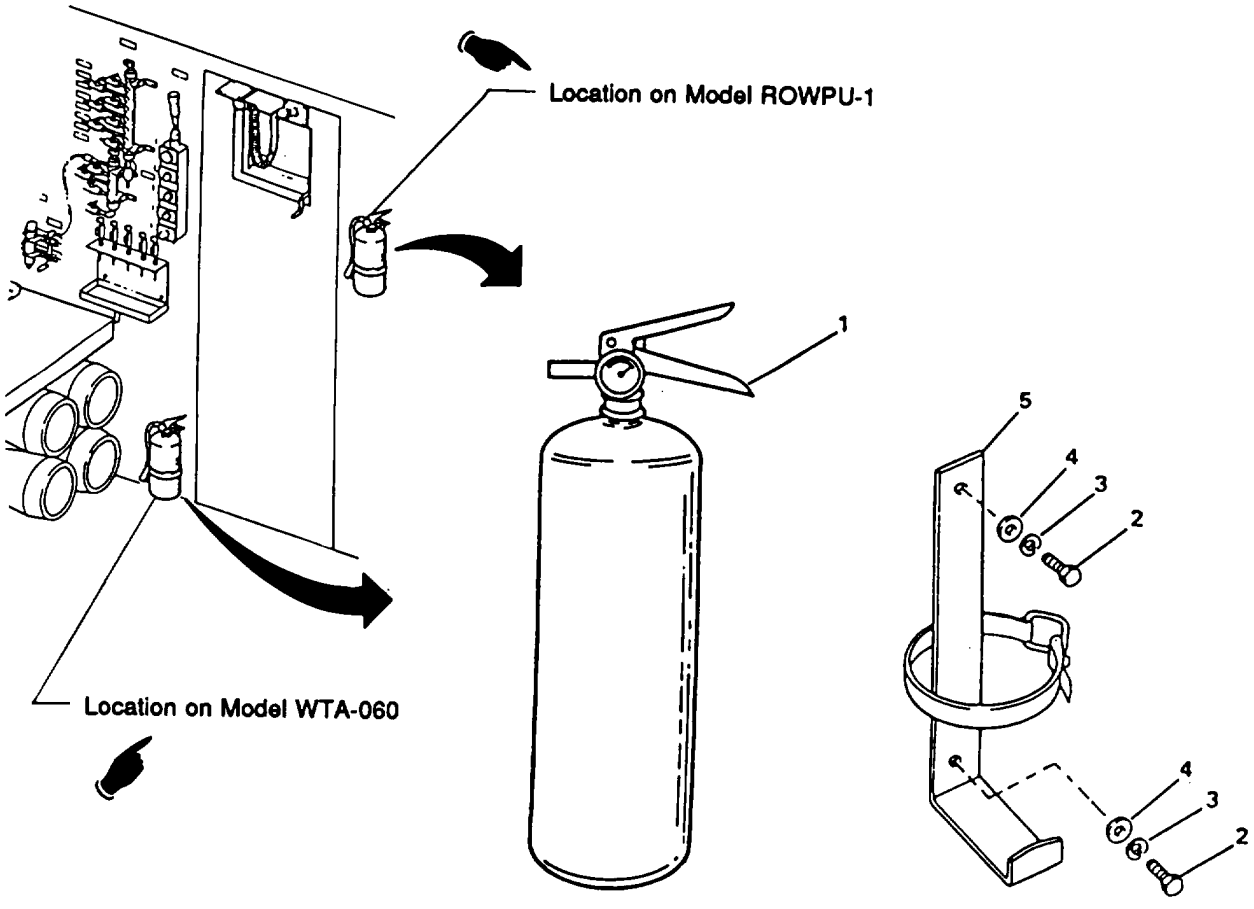


Figure 4-25. Fire Extinguisher and Bracket

4-24. LOW PRESSURE AIR TUBING. This task covers:

a. Inspection. b. Disassembly. c. Repair. d. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Heat Gun (16)

Materials/Parts:
Soap (Appx E, Sec II, Item 65)
Tape, Antiseize (Appx E, Sec II, Item 67)
Ties, Wire (Appx E, Sec II, Item 71)
Preformed Packings (TM 10-4610-232-24P)

General Safety Instructions:

WARNING

Observe specific Warning and Cautions in the text.

INSPECTION.

NOTE

This procedure is applicable to all inlet and outlet air tubing to:

- Air Block Valves, Fittings, Manifolds and Utility Air Connection (para. 4-68).
- Air Dryer (para. 4-67)
- Turbidity Meter Air Dryer (para. 4-58).
- Turbidity Meter (para. 4-49 and 4-50).
- Low Pressure Solenoid Valves (Figures 4-51)
- Media Filter (para. 4-53)
- Media Filter Air Blanket Level Indicator (para. 4-52).
- Safety Valve (para. 4-58).
- Butterfly Valve Actuators (Figure 4-26).

NOTE

Low pressure air system must be operational and under pressure for checking leaks in the system.

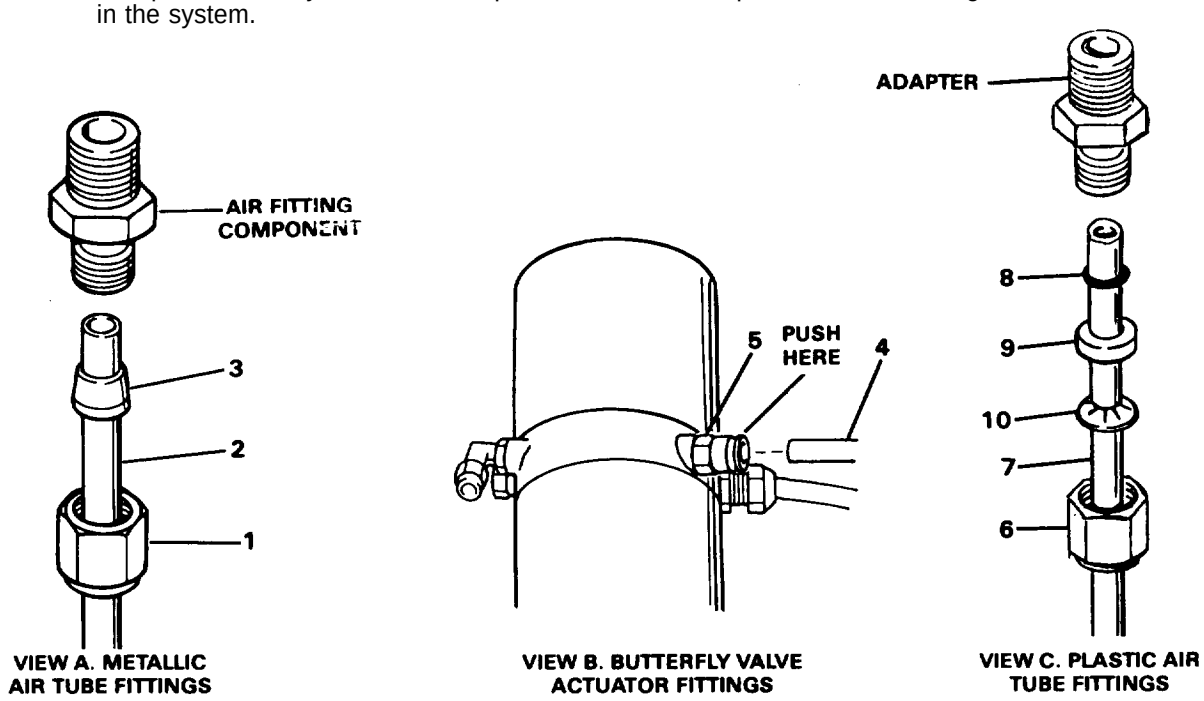


Figure 4-26. Low Pressure Air Tubing

a. Spray or brush on soap and water solution and check for leaks on the following parts: (Bubbles will form when there are leaks.)

(1) All tubing, valves and fittings at both air manifolds (para. 4-68).

(2) All tubing and fittings at both air dryers (para. 4-67).

(3) The regulator, flowmeter and fittings on the turbidity meter panel (para. 4-49 and 4-50).

(4) Tubing and fittings all three solenoid valves (para. 4-51).

(5) Air tubing connections and tubing on the media filter (para. 4-53).

(6) Air tubing connections and tubing on the media filter air blanket level indicator (para. 4-52).

(7) Tubing and fittings going to the safety valve (para. 4-58).

(8) Tubing and fittings to butterfly valve actuators (Figure 4-26, View B).

b. Check for damaged tubing by having everything quiet and listen for air leaks or by moving the back of your hand over tube line.

WARNING

Make certain in-line pressure is relieved from hoses. Failure to do so could result in injury. Close the air storage tank block valve and open the vents on both air manifolds to relieve air pressure before performing any maintenance.

DISASSEMBLY.

a. Metallic air tube fittings (Figure 4-26, View A).

(1) Loosen nuts (1).

(2) Remove tubing (2) with assembled nut (1) and compression fitting (3) from air fitting component.

(3) Remove compression fittings from tubing.

(4) Remove tubing assembly (1, 2 and 3) by cutting ties which secure it to wails and/or ceiling (para. 4-10).

b. Butterfly valve actuator tube fittings (Figure 4-26, View B).

(1) Push in on fitting (5) and pull out on tubing (4).

(2) Cut any wire ties securing tubing (4) to walls or ceiling and remove tubing (para. 4-10).

c. Plastic air tube fitting (Figure 4-26, View C).

(1) Loosen nuts (6).

(2) Remove tubing (7) with assembled preformed packing (8), spacer (9) and grab ring (10). Disassemble components from adapter.

(3) Remove tubing by cutting ties which secure it to walls and/or ceiling (para. 4-10).

REPAIR.

NOTE

If butterfly valve actuator fitting is leaking at the point marked “Push Here” in Figure 4-26, remove tubing from fitting and cutoff about 1/4 inch of the tubing. Remove any burrs on fitting. Reinsert the tubing in fitting making sure that it enters straight into the fitting without being strained to the side.

a. Remove old antiseize tape and install new antiseize tape on fittings.

b. Replace any damaged fittings or valves (see individual component procedures).

c. Replace damaged tubing. Tube fittings must also be replced because ferrules are not reusable.

d. Replace damaged or missing tube markers (para. 4-10).

e. Replace damaged or missing tie mounts (para. 4-10).

REASSEMBLY.

a. Metallic air tube fittings (Figure 4-26, View A).

(1) Install nuts (1) and compression fittings (3) on tubing (2) with tapered end of toward fittings.

NOTE

Compression fittings will tighten on tubing when nuts are tightened.

(2) Install assembled nuts (1), tubing (2) and compression fittings (3) on air fitting components by pushing tubing into fitting while leaving nuts loose on tubing.

CAUTION

Do not overtighten nuts, otherwise fittings may be damaged.

(3) Install new wire ties and secure tubing to wall and ceiling attachment points (para. 4-10).

(4) Tighten nuts (1).

(5) Perform inspection as described above in paragraph a.

b. Butterfly valve actuator tube fittings (Figure 4-26, View B).

NOTE

If butterfly valve actuator fitting (4) is leaking at the point marked “Push Here” in Figure 4-26, remove tubing (4) from fitting and cut off about 1/4 inch of the tubing. Remove any burrs on fitting (5). Reinsert the tubing in fitting (4) making sure that it enters straight into the fitting (5) without being strained to the side.

(1) Install tubing (4).

(2) Install new wire ties and secure tubing to wall and ceiling attachment points (para. 4-10).

(3) Perform inspection as described above in paragraph a.

c. Plastic air tube fitting (Figure 4-26, View C).

(1) Install nut (6), grab ring (10), spacer (9) and preformed packing (8) on tubing (7).

(2) Install assembled item into adapter. Tighten nut (6).

(3) Install new wire ties and secure tubing to walls and ceiling attachment points (para. 4-10).

(4) Perform inspection as described above in paragraph a.

4-25. LOW PRESSURE WATER TUBING. This task covers:

a. Inspection. b. Repair.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Bander (2)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Ties, Wire (Appx E, Sec II, Item 71)
Suitable Tags
Banding and Clamps (TM 10-4610-232-24P)
Preformed Packings (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Wire ties removed (para. 4-10).

INSPECTION.

WARNING

Be sure all pressure is released before working on any component. However, low pressure water tubing must be under pressure while checking for leaks in the system. If leaks are observed, repair is required.

NOTE

This procedure is applicable to all inlet and outlet tubing and hoses.

NOTE

When removing more than one low pressure tube and/or hose at a time, tag the clamps and hoses to simplify installation.

Check for leaks and repair as required.

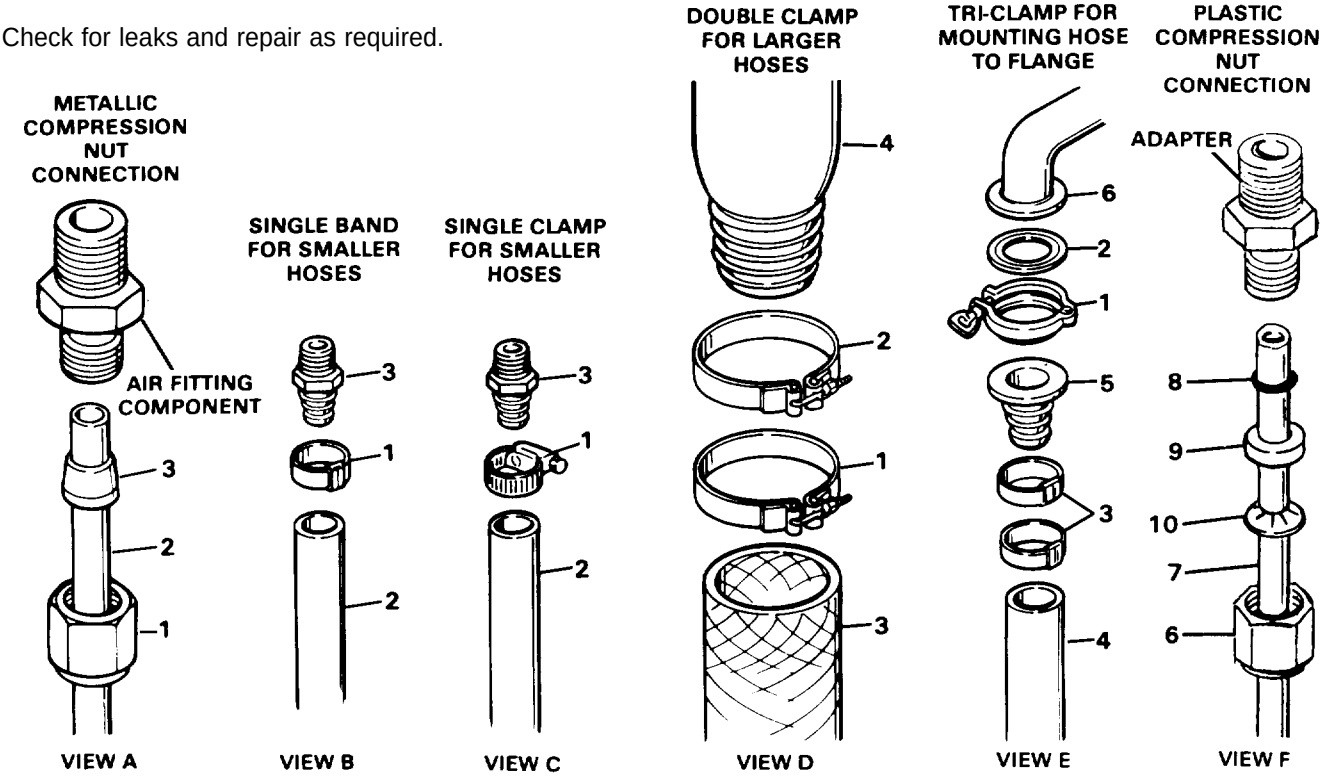


Figure 4-27. Low Pressure Water Tubing

REPAIR.

NOTE

In all cases, repair consists of replacing unserviceable components or tightening loose fittings. Replace fittings if tightening or antiseize tape to pipe threads will not stop leaking.

NOTE

All removal and installation instructions are keyed to the Views A through F which comprise Figure 4-27. Each method shown is typical of a specific kind of connection.

a. Refer to Figure 4-27, View A, and replace a compression nut connection as follows:

(1) Unscrew nut (1) and remove tube (2) from fitting. Compression fitting (3) will come off with tube (2).

(2) If necessary, cut off damaged portion of tube (2) or replace the tube.

(3) Slide nut (1) on tube (2) with threaded end of nut toward the fitting.

(4) Slide conical compression nut (3) on tube (2) with small (cone) end of compression nut toward fitting.

(5) Place antiseize tape on fitting.

(6) Insert tube (2) in fitting until tube is firmly against the internal shoulder of fitting.

(7) Tighten nut (1). This will push compression nut (3) to clamp tube (2) in fitting.

b. Refer to Figure 4-27, View B, and replace a band connection as follows:

NOTE

Larger hoses are sometimes connected with two bands. This does not change the replacement procedure.

(1) Carefully cut the hose (2) at a point beneath band(1) and just below the joint that fitting (3) reaches within the _ hose.

(2) Cut the band and the remaining hose off fitting (3).

(3) If sufficient hose remains, proceed with step 4. If not, replace the hose and proceed with step 4.

(4) Insert the “dart” end of fitting (3) in hose (2), making sure the fitting is fully inserted in the hose.

(5) Using a bander, place one or more bands over the hose, clamping the hose to the fitting. Position the bands about 1/2 inch down from the fitting flange.

c. Refer to Figure 4-27, View C, and replace a single clamp connection as follows:

(1) Loosen hose clamp (1) and slide it downward on hose (2).

(2) Remove fitting (3) from hose (2). It maybe necessary to cut hose (2) off, or to split the hose in order to get the hose off fitting (3).

(3) If hose is damaged, cut off damaged portion. If hose is now too short, replace hose.

(4) Slide band (1) over hose (2).

(5) Insert fitting (3) fully into hose (2), push clamp (1) over the hose and onto fitting (3) and tighten clamp (1), using a screwdriver. Position clamp about 1/2 inch down from fitting flange.

d. Refer to Figure 4-27, View D. The procedure for replacing a double clamp connection is identical to the procedure for replacing a single clamp connection except that two clamps are installed. See the procedure for View C.

e. Refer to Figure 4-27, View E, and replace a tri-clamp connection as follows:

(1) Loosen the clamp screw on tri-clamp (1) and remove clamp (1) and gasket (2).

(2) Cut off hose (4) beneath fitting (5) and banding (3).

(3) Cut banding (3) and remaining hose off fitting (5).

(4) If hose is now damaged or too short, replace hose.

(5) Insert fitting (5) in hose (4) and band in two places (the same number of bands should be applied as was removed).

(6) Place tri-clamp (1) and gasket (2) in position on the flanges of fittings (5 and 6) and tighten tri-clamp (1).

f. Refer to Figure 4-27, View F and replace compression nut fitting as follows:

(1) Unscrew nut (6).

(2) Remove tubing (7) with assembled preformed packing (8), spacer (9) and grab ring (10), Disassemble components from fitting.

(3) If necessary, cut off damaged portion of tube (7) or replace the fitting.

(4) Install nut (6), grab ring (10), spacer (9) and preformed packing (8) on tubing,

(5) Place antiseize tape on fitting.

(6) Insert tube (7) with assembled fitting into fitting.

CAUTION

Do not over tighten nuts, otherwise damage may occur.

(7) Tighten nut (6).

4-26. CHEMICAL TUBING. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Ties, Wire (Appx E, Sec II, Item 71)
Preformed Packings (TM 10-4610-232-24P)

Equipment Condition:
ROWPU Shutdown.

General Safety Instructions:

WARNING

Observe specific Warning in the text.

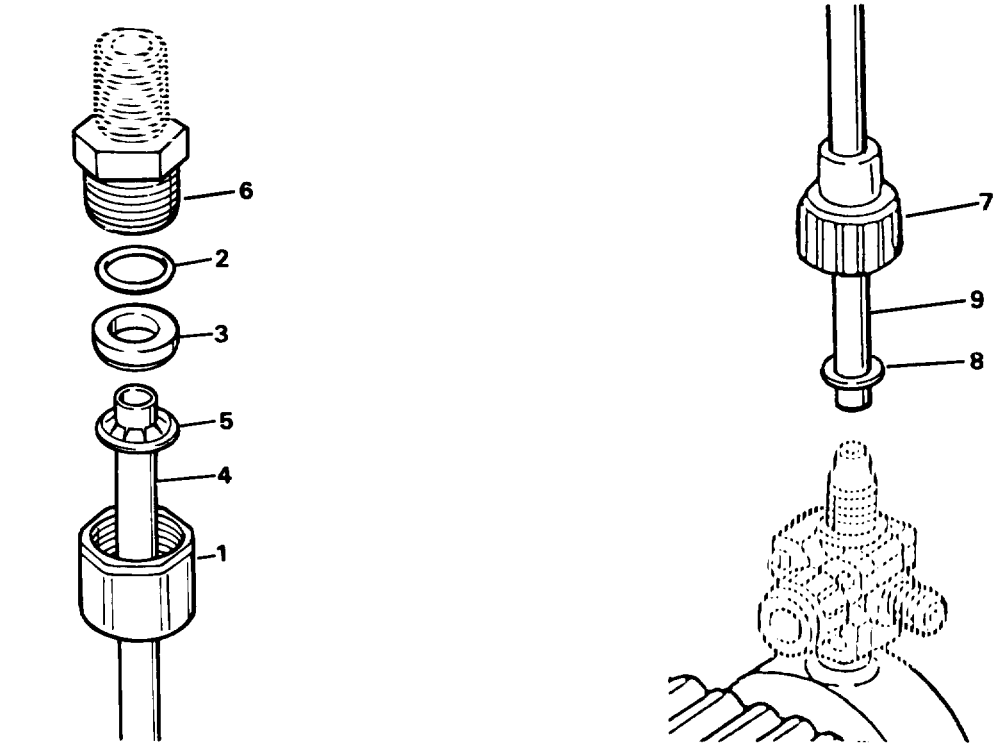
WARNING

Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

NOTE

This procedure is applicable to all inlet and outlet tubing to:

- Chemical Pumps and Injectors (para. 4-36).
- Hypochlorite Backwash Pump (para. 4-37).
- Chemical Tanks (para. 4-38 and 4-55).



VIEW A. STANDARD CHEMICAL TUBE FITTINGS

VIEW B. CHEMICAL PUMP CONNECTIONS

Figure 4-28. Chemical Tubing

DISASSEMBLY.

NOTE

Chemical tubing fittings are plastic and are to be loosened and tightened by hand. Make certain all preformed packings and other components are installed after repair procedures.

a. Standard tube fittings (Figure 4-28, View A).

(1) Unscrew nut (1) by hand.

(2) Cut any wire ties securing tubing (4) to walls or ceiling and remove tubing.

(3) Remove preformed packing (2) and spacer (3).

(4) Remove nut (1) and tubing (4), with compression fitting (5) attached, from fitting (6).

b. Chemical pump connections (Figure 4-28, View B).

(1) Unscrew nut (7) and pull out on tubing (9). Remove washer (8).

(2) Cut any wire ties securing tubing (9) to walls or ceiling and remove tubing (para. 4-10).

REPAIR.

a. Tighten all loose fittings (6) or use antiseize tape on male threads to stop leaks.

b. Replace damaged tubing (4 or 9).

NOTE

Preformed packings, compression fittings and spacers are not individually replaceable. When replacing tubing or fittings, these items are replaced as part of "kit" or subassembly. Sections of tubing with compression fittings must be cut off if tubing is to be repaired rather than replaced.

NOTE

Nuts and washers are supplied with the chemical pumps.

REASSEMBLY.

a. Standard tube fittings (Figure 4-28, View A).

(1) Install nut (1), new compression fitting (5), new spacer (3) and preformed packing (2) onto tube (4).

(2) Insert assembled tubing (1 thru 5) into fitting (6).

(3) Hand tighten nut (1) into fitting, compression fitting (5) will lock tubing in place.

(4) Install new wire ties to secure tubing to wall and ceiling attachment points (para. 4-10).

b. Chemical pump connections (Figure 4-28, View B).

(1) Install washers (8) on tubing (9).

NOTE

Preformed packings, compression fittings and spacers are not individually replaceable. When replacing tubing or fittings, these items are replaced as part of "kit" or subassembly. Sections of tubing with compression fittings must be cut off if tubing is to be repaired rather than replaced.

(2) Install tubing (9) by hand tightening nuts (7).

(3) Install new wire ties and secure tubing to wall and ceiling attachment points (para. 4-10).

4-27. ELECTRICAL INSTALLATION. This task covers:

a. Disassembly b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Electrical (Appx E, Sec II, Item 68)
Ties, Wire (Appx E, Sec II, Item 71)
Varnish, Electrical (Appx E, Sec II, Item 73)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Generator shutdown.
Auxiliary power input disconnected.

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Make sure electrical power is disconnected before working on equipment. Failure to do so could result in serious injury or death from electrical shock.

WARNING

Do not wear watches, rings or dog tags when working on electrical cables or components.

DISASSEMBLY.

NOTE

The cables of the electrical assembly are illustrated in Figure 4-29. Note that some cables are shown in phantom. The cables shown in phantom are not repairable at unit maintenance. Only those cables shown in heavy unbroken lines are repairable by unit maintenance.

NOTE

The following general procedure is applicable to all cables except two. The two cables to which this procedure does not apply are the 24 volt input power cable (sheet 3, Figure 4-29) and the valve actuator cables (sheet 5). Specific procedures for these cables are given after the general procedure below.

a. Use the following general procedure to remove all cables except the two mentioned above.

b. Refer to Figure 4-29 and find the cable to be removed.

c. Cut any cable tie wraps (para. 4-10).

d. If a cable clamp must be repaired, refer to the typical cable clamp illustration (Figure 4-29, sheet 2, View A) and disconnect the cable as follows:

(1) Remove locknut (1), screw (2) and washers (3).

(2) Slide clamp (4) out of channel (5) and remove clamp (4) from the cable to be removed.

(3) Do not remove channel(5) unless necessary. If necessary, remove capscrews (6), lockwashers (7) and washers (8).

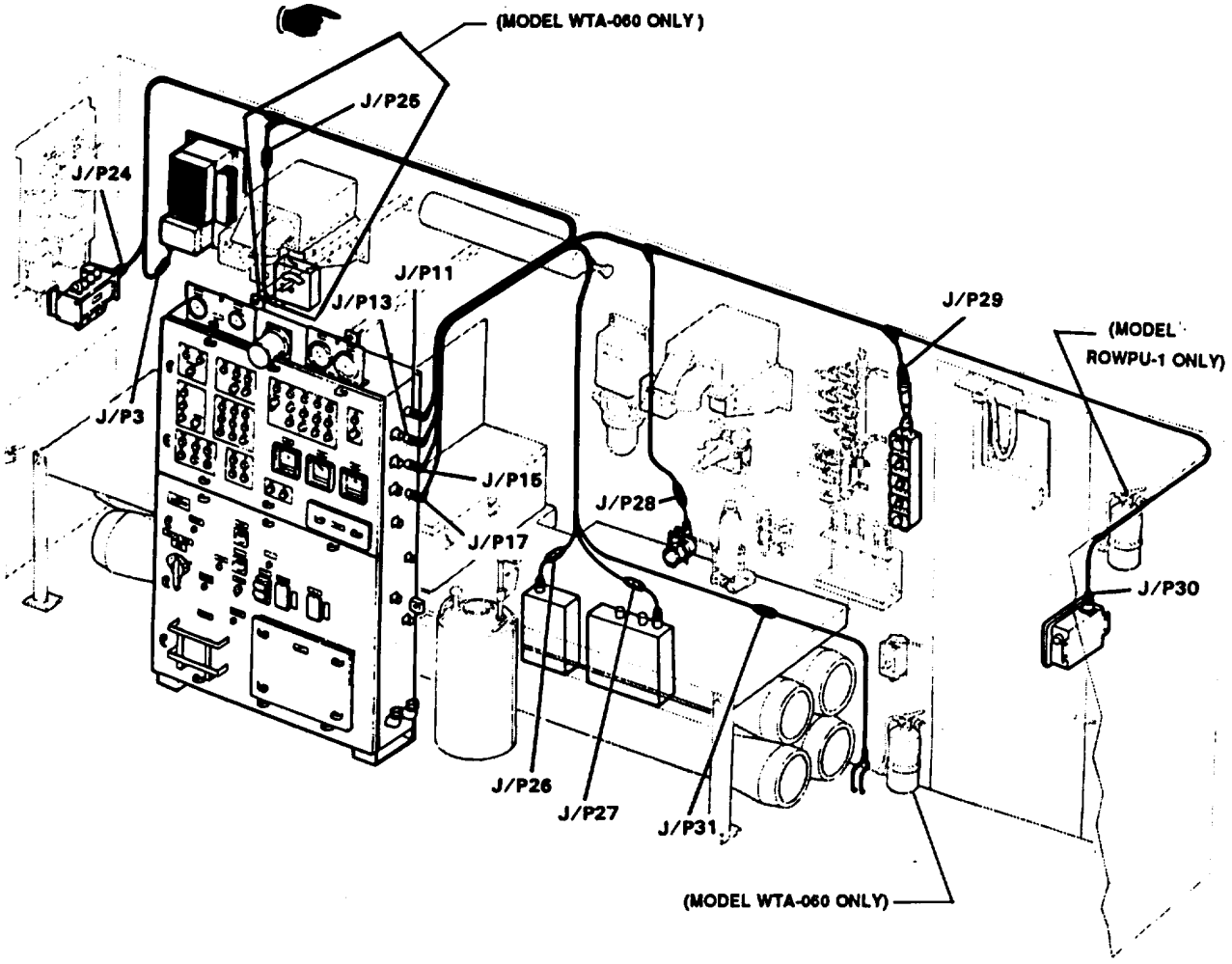


Figure 4-29. Electrical Installation (sheet I of 8) Primary Harness, Rear Wall, W-33

e. Disconnect the cable to be removed at-each end and remove the cable.
f. Refer to Figure 4-29, sheet 3, View, B and remove the 24 VDC input power cable as follows:
   (1) Remove cable tie wraps and disconnect cable (4) at the power supply on the ROWPU wall.
   (2) Remove nuts (1).
   (3) From outside the ROWPU, remove four screws (2) and dust cover (3).
   (4) Pull cable (4) into the ROWPU. Gasket (5) will now be free.

CAUTION

Valve actuator cable connectors are two piece connectors as shown in View C on sheet 5 of Figure 4-29. Do not pull on the male connector when disconnecting the cable for removal. Serious damage may be done to the valve connector. This damage will make it necessary to replace the entire valve. Always pull on parts as shown on View C when disconnecting the cable. Grasp cable as shown and pull connector apart.

g. Remove the desired valve actuator cable as described in the general cable removal procedure above, with the following exception. When pulling cable apart, grasp as shown in Figure 4-29, sheet 5, View C.

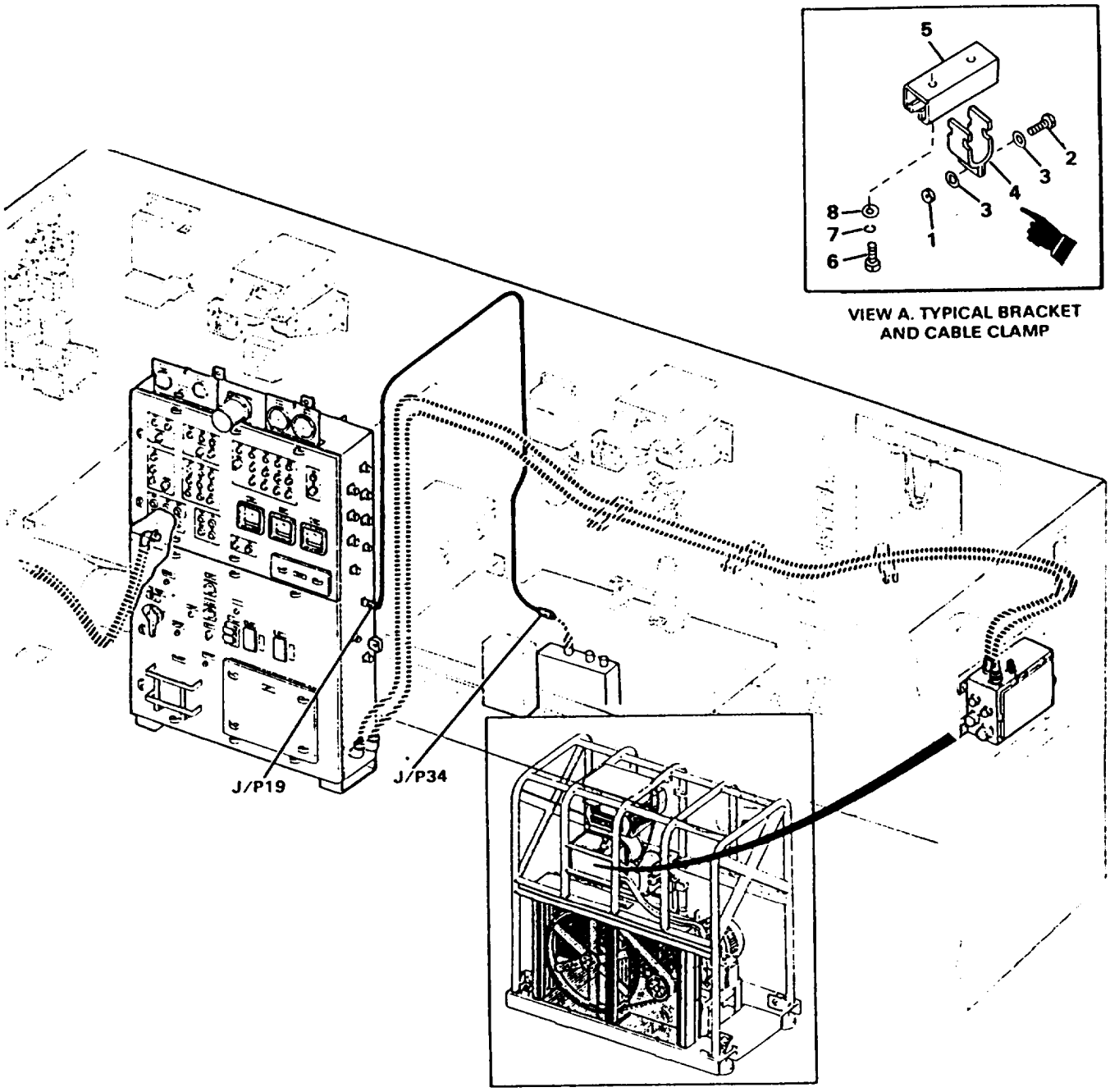


Figure 4-29. Electrical Installation (sheet 2 of 8) Primary Harness, Back Wall, W-33

h. Refer to Figure 4-29, sheet 8, View D and remove the three utility lights. Each light must be disassembled for removal. Proceed as follows:

NOTE

Two lights have two wires and one has one wire. Disassembly is the same for all.

(1) Unscrew globe (1).

(2) Remove gasket (2).

(3) Unscrew lamp (3).

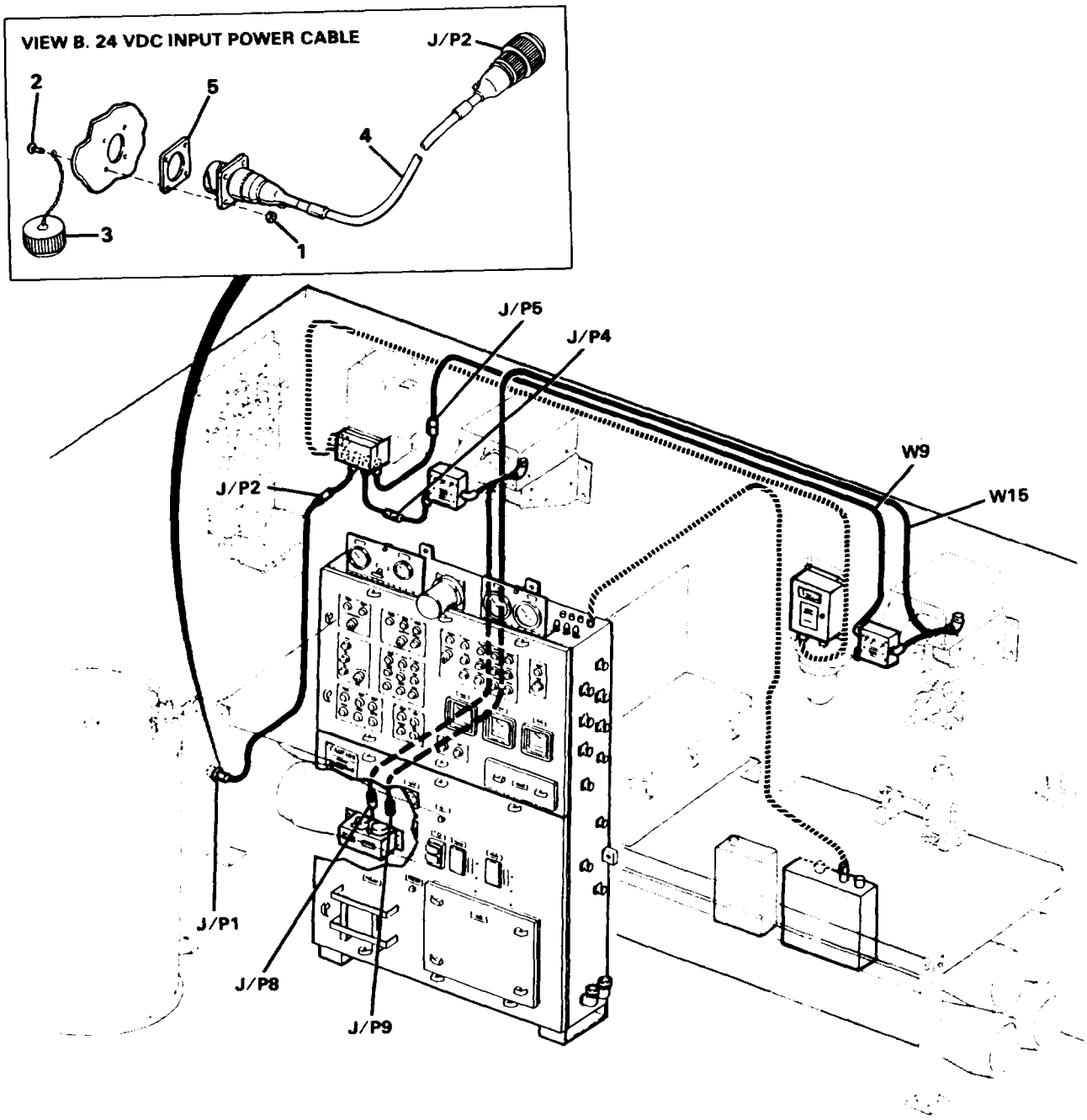


Figure 4-29. Electrical Installation (sheet 3 of 8) Primary Harness, Back Wall, W-33

NOTE

Bracket has “keyhole” shaped slots so that the heads of screws will pass through the larger portion of the slot when the bracket is turned.

(4) Loosen two screws (6) and turn socket (5) and bracket (7) slightly until they are free of screws (6). Pull socket and bracket forward to allow access to wiring harness(11).

(5) Tag and disconnect the two wires from harness (11) which connect to socket (5).

(6) Remove two screws (4). Socket (5) and bracket (7) are now free.

(7) Loosen two screws (8), turn housing (9) and remove the housing. Remove two screws (8) and gasket (10).

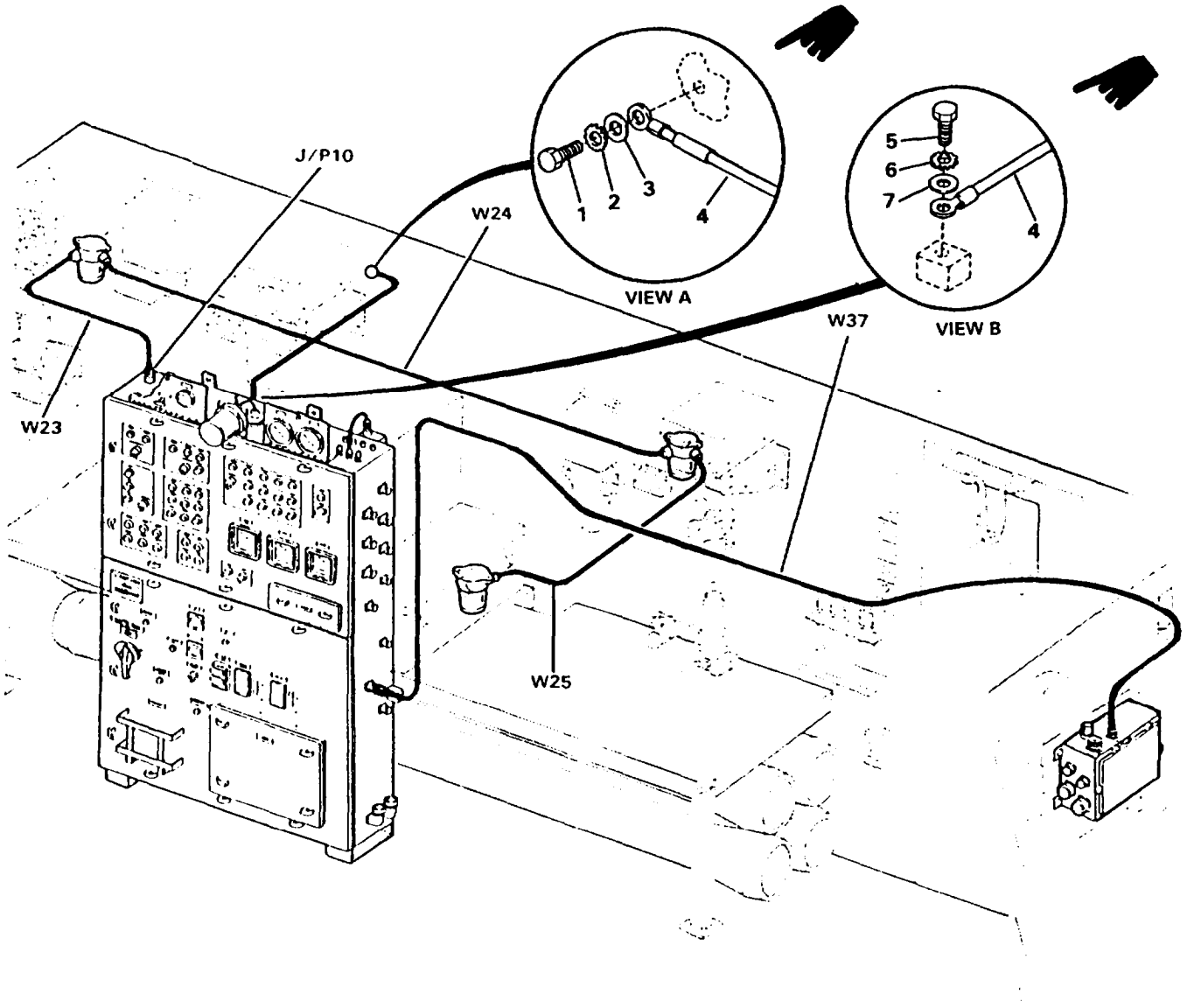


Figure 4-29. Electrical Installation (sheet 4 of 8) Primary Harness, Back Wall, W-33

(8) Loosen coupling nut (12), retainer (13), bushing (14), and slide them back on cable (11). Remove connector body (15) and slide nut (12), retainer(13) and bushing (14) off cable(11).

(9) Remove two screws (16), nuts (17), Iockwashers(18) and housing (19).

(10) If it is necessary to replace-cable (11), continue as follows:

(a) Refer to Figure 4-29, sheet 4 and disconnect the canon plug (at the top of the main control panel) which supplies power to the three ROWPU light fixtures.

(b) Refer to Figure 4-29, sheet 8, View D and disconnect the cable to be removed at both ends. If the cable to be removed is connected to a light fixture at each end, both fixtures must be disassembled as described above before the cable can be removed.

(c) Cut tie wraps and remove the selected cable.

i. Refer to Figure 4-29, sheet 4 of 8, View A and B, and remove grounding cable as follows:

(1) Remove capscrew (1), lockwasher (2), washer (3), and grounding cable (4) from wall.

(2) Remove capscrew (5), lockwasher (6), washer (7), and grounding cable (4) from wall.

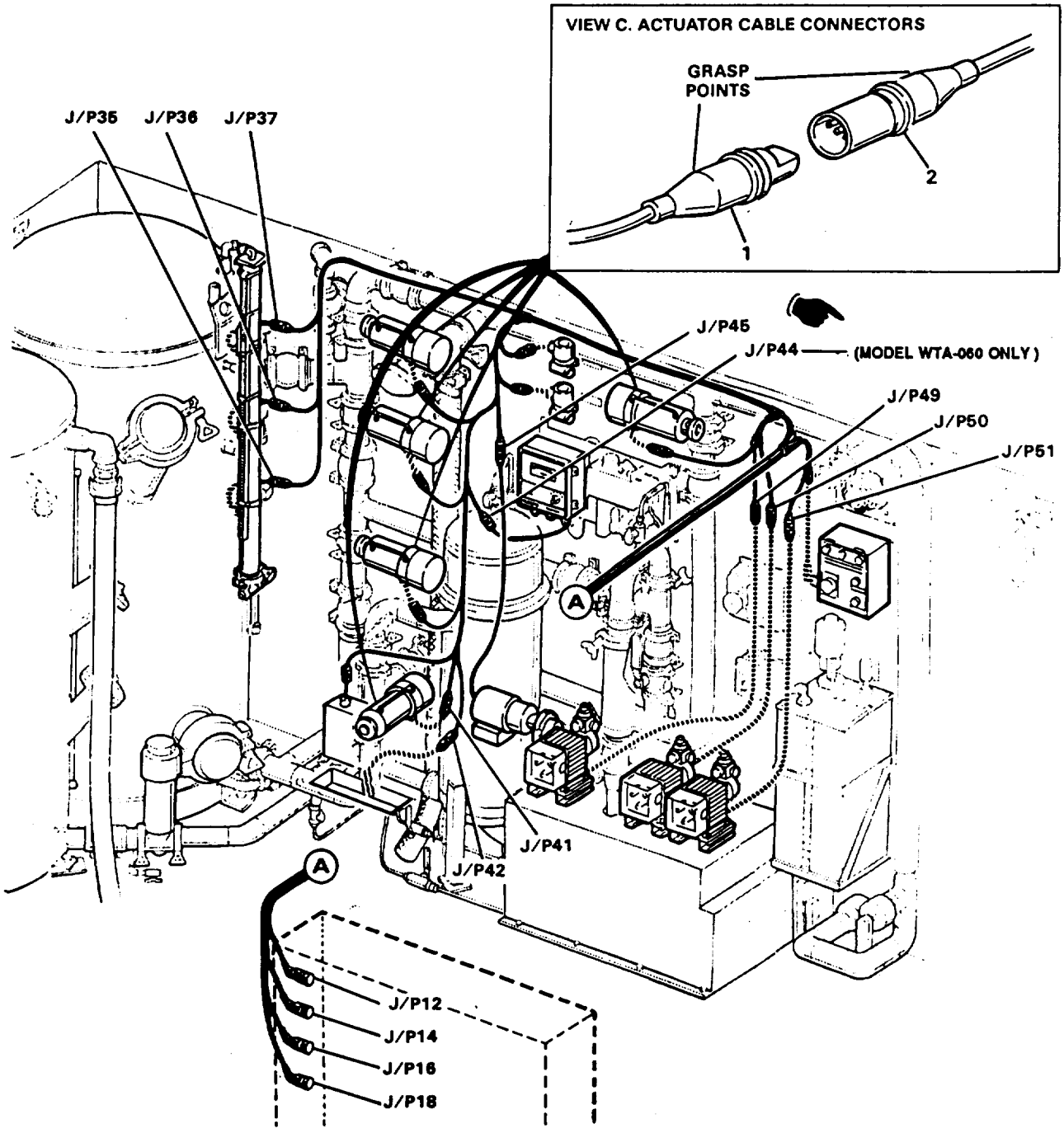


Figure 4-29. Electrical Installation (sheet 5 of 8) Primary Harness, Front Wall, W-33

REPAIR.

a. Replace damaged components as required.
b. Replace wire markers (para. 4-10).
c. Replace damaged cables as an assembly.

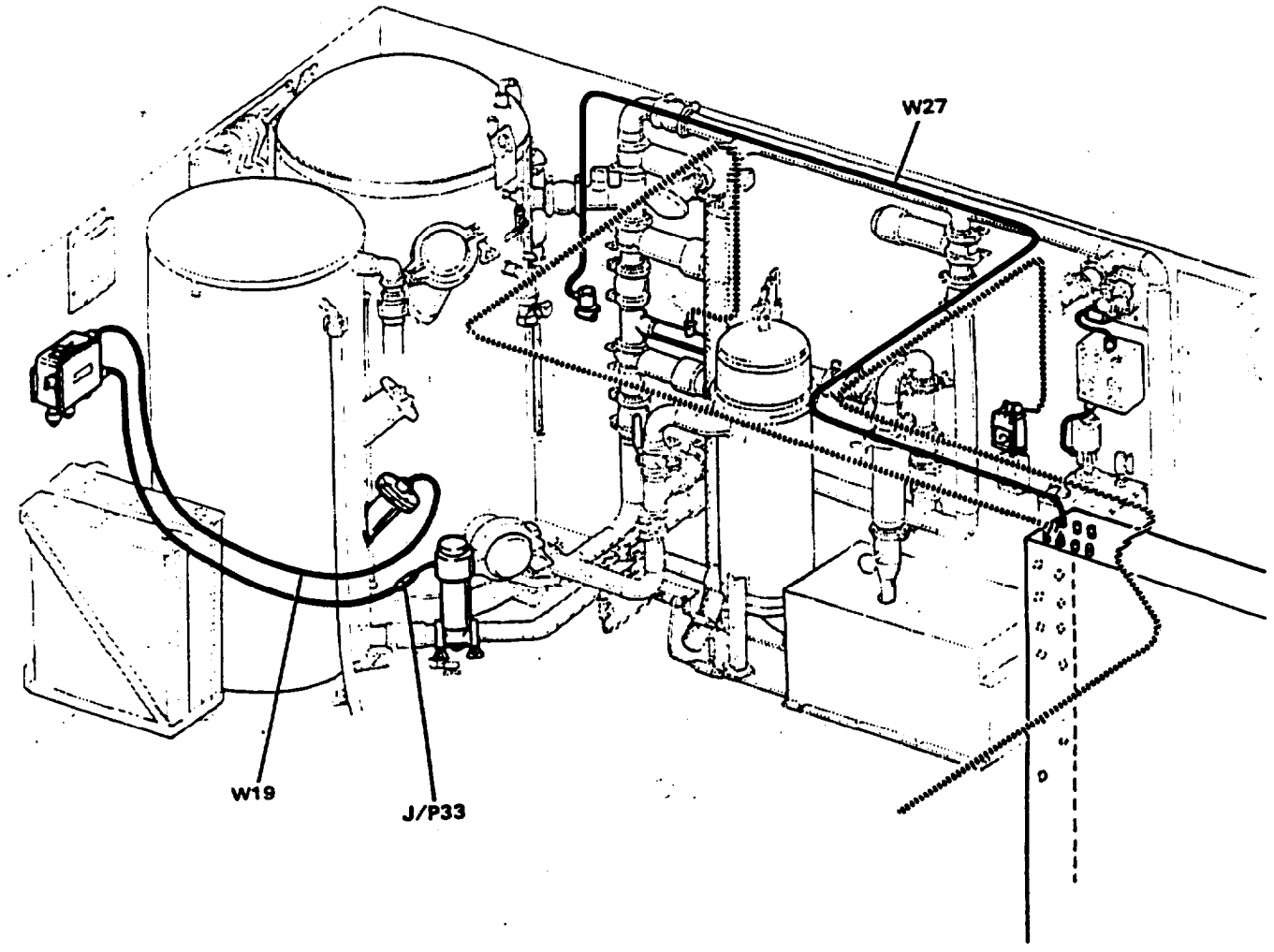


Figure 4-29. Electrical Installation (sheet 6 of 8) Primary Harness, Back Wall, W-33

REASSEMBLY.

a. If utility light cable (11, Figure 4-29, sheet 8, View D) was removed, proceed as follows:

(1) Install housing (19) with two capscrews (16), lockwashers (17) and washers (18).

(2) Place nut (12), retainer (13) and bushing (14) on cable (11).

(3) Install connector body (15) into housing (19).

(4) Insert cable (11) through body (15) and the hole in housing (19). Push enough wire to enable easy connection to socket (5).

(5) Place gasket (10) on housing (9).

NOTE

The holes in housing are slotted to allow some adjustment, if required.

(6) Install housing (9) on housing (19) using screws (8):

(7) Install socket (5) on bracket (7) using two screws (4).

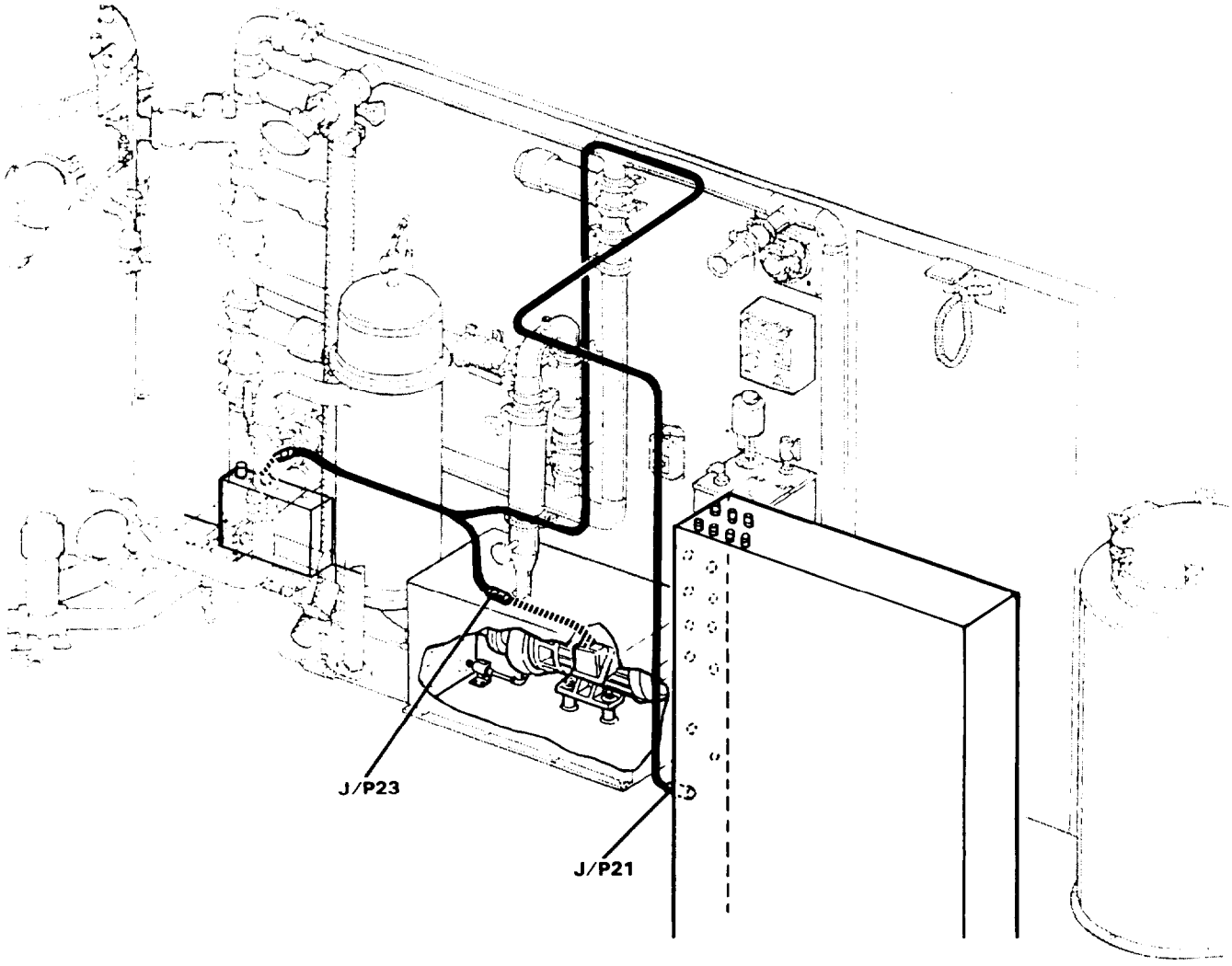


Figure 4-29. Electrical Installation (sheet 7 of 8) Primary Harness, Front Wail, W-33

(8) Connect the two wires from harness (11) to socket (5). Spray or brush on varnish conforming to MIL-V-173 on electrical connections.

(9) Install bracket (7) with socket (5) in housing (9) and secure with screws (6).

(10) Slide bushing (14), retainer (13) and nut (12) onto elbow (15) and tighten nut (12).

(11) Install lamp (3), gasket (2) and globe (1).

b. Install the 24 VDC power input cable (Figure 4-29, sheet 3, View B) as follows:

(1) Insert the connector of cable (4) through the ROWPU wall from inside the ROWPU with gasket (5) in place.

(2) From outside the ROWPU, insert four screws (2) through dust cap (3) chains, gaskets (5) and the flange of cable (4) connector and secure the cable connector to the wall of the ROWPU with nuts (1).

(3) Connect cable (4) to the power supply.

(4) Install tie wraps (para. 4-10).

c. Reinstall all cables except the 24 VDC input power cable (Figure 4-29, sheet 3) as follows:

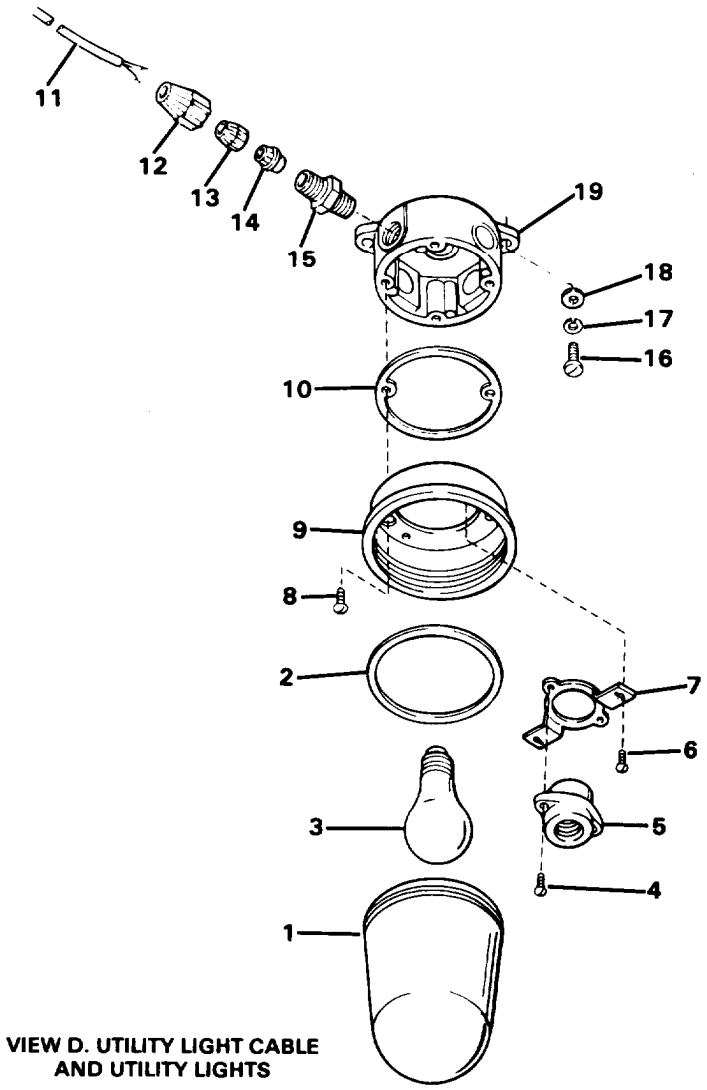


Figure 4-29. Electrical Installation (sheet 8 of 8) Utility Lights

NOTE

Valve actuator cable connector is installed in the same manner as other cables. Only removal procedure is different.

(1) Refer to Figure 4-29 and find the cable to be installed.

(2) Connect the cable at one end. Then, route the cable as shown, securing it with tie wraps and clamps at the points from which they were removed. See para. 4-10 for the method of replacing tie wraps. Replace cable clamps as follows:

(a) Refer to Figure 4-29, sheet 2, View A and place the cable being installed in clamp (6). If channel (7) has been removed, reinstall it using capscrews (8), lockwashers (9) and washers (10).

(b) If the cable clamp(6) was repaired, slide the cable into clamp (6) and secure it in the clamp using screws (1), washers (2), nuts (3), lockwashers (4) and washers (5).

(c) Slide clamp (6) into channel (7).

d. Refer to Figure 4-29, sheet 4 of 8, View A and B, and install grounding cable as follows:

(1) Install grounding cable (4) to control panel with capscrew (5), lockwasher (6) and washer (7).

(2) Install grounding cable (4) to wall with capscrew (1), lockwasher (2) and washer (3).

4-28. MAIN CONTROL PANEL LIGHT. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Terminal Strip Tool (16)

Materials/Parts:
Suitable Tags
Varnish (Appx E, Sec II, Item 73)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Auxiliary input power cable on outside of van, distribution side, disconnected.

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Do not wear watches, rings or dog tags when working on main control panel.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting.

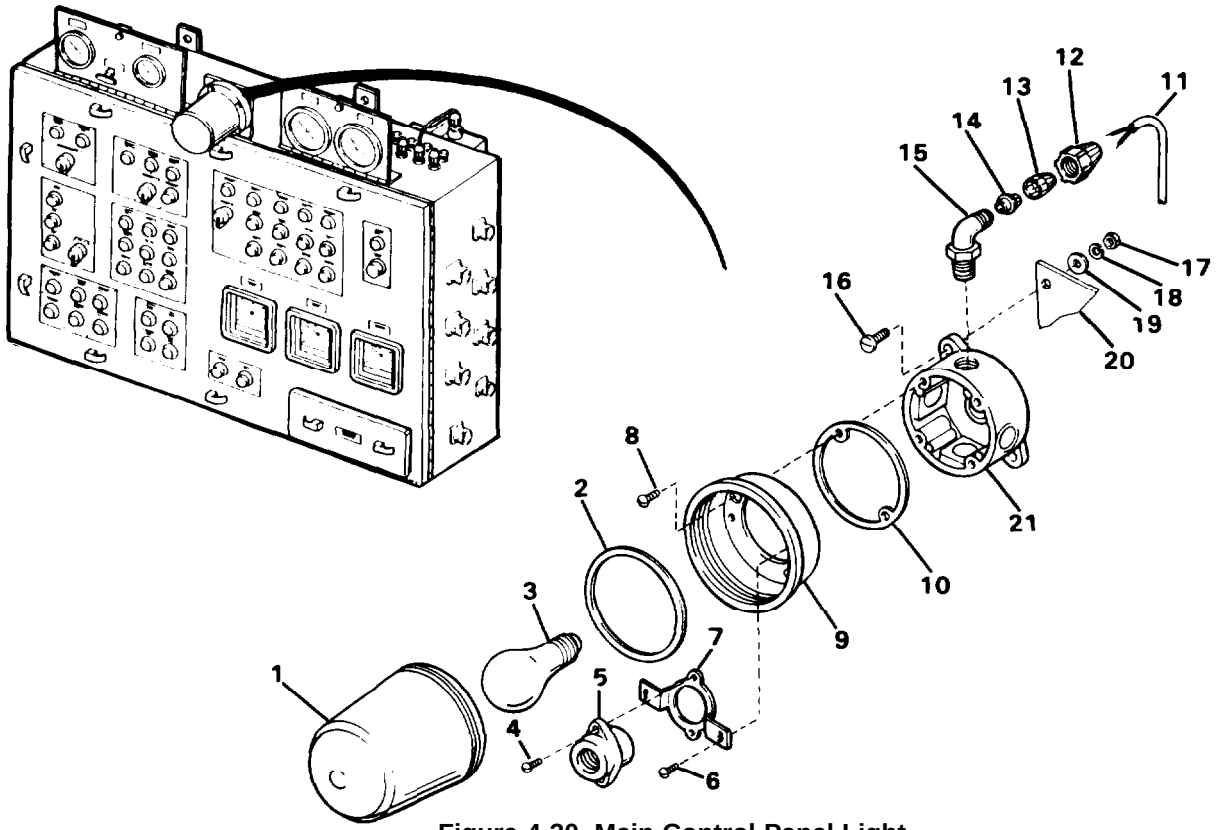


Figure 4-30. Main Control Panel Light

DISASSEMBLY.

NOTE

To remove the light, it must be disassembled. Proceed as follows in steps below.

a. Unscrew globe (1, Figure 4-30).

b. Remove gasket (2).

c. Unscrew lamp (3).

NOTE

Bracket has “key hole” shaped slots so that the heads of screws will pass through the larger portion of the slot when the bracket is turned.

d. Loosen two screws (6) and turn socket (5) and bracket (7) slightly until they are free of screws (6). Pull socket and bracket forward to allow access to wiring harness(11).

e. Disconnect and tag the two wires from harness(11) which connect to socket (5).

f. Remove two screws (4). Socket (5) and bracket (7) are now free.

g. Loosen two screws (8), turn housing (9) and remove the housing. Remove two screws (8) and gasket (1 0).

h. Loosen nut(12) and slide nut (12), retainer (13) and bushing (14) back on harness.

i. Remove harness and elbow (15).

j. Remove two screws (16), nuts (17), Iockwashers (18) and washers (19) from housing (21). Housing (21) will now be free.

REPAIR.

a. Replace damaged components as required.

b. Replace wire markers, as necessary (para. 4-10).

REASSEMBLY.

a. Install housing (21) on bracket (20) with twocapscrews(16), washers (19), Iockwashers (18), and nuts (17).

b. Install elbow (15).

c. Place nut (12), retainer(13) and bushing (14) on harness (11).

d. Insert harness (11) through elbow(15) and the hole in housing (21). Push enough wire through to enable easy connection to socket (5).

e. Install gasket (10) on housing (9) with two screws (8).

f. Install housing (9) on housing (21) and tighten using screws (8). The holes in housing (9) are slotted to allow some adjustment if required.

g, Install socket (5) on bracket (7) using two screws (4).

h. Connect the two wires from harness (11) to the socket (5). Spray or brush on varnish conforming to MIL-V-173 on electrical connector.

i. Install bracket (7) with socket (5) in housing (9) and secure with screws (6).

j. Slide bushing (14), retainer (13) and nut (12) onto elbow(15) and tighten nut (12).

k. Install lamp (3), gasket (2), and globe (1).

4-29. MAIN CONTROL PANEL DOORS, LATCHES AND GASKETS. This task covers:

a. Disassembly. b. Adjust. c. Repair. d. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Silicone Lubricant (Appx E, Sec II, Item 66)
Cleaning Solvent (Appx E, Sec II, Item 32)
Gasket Material (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

WARNING

Observe specific Warning in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

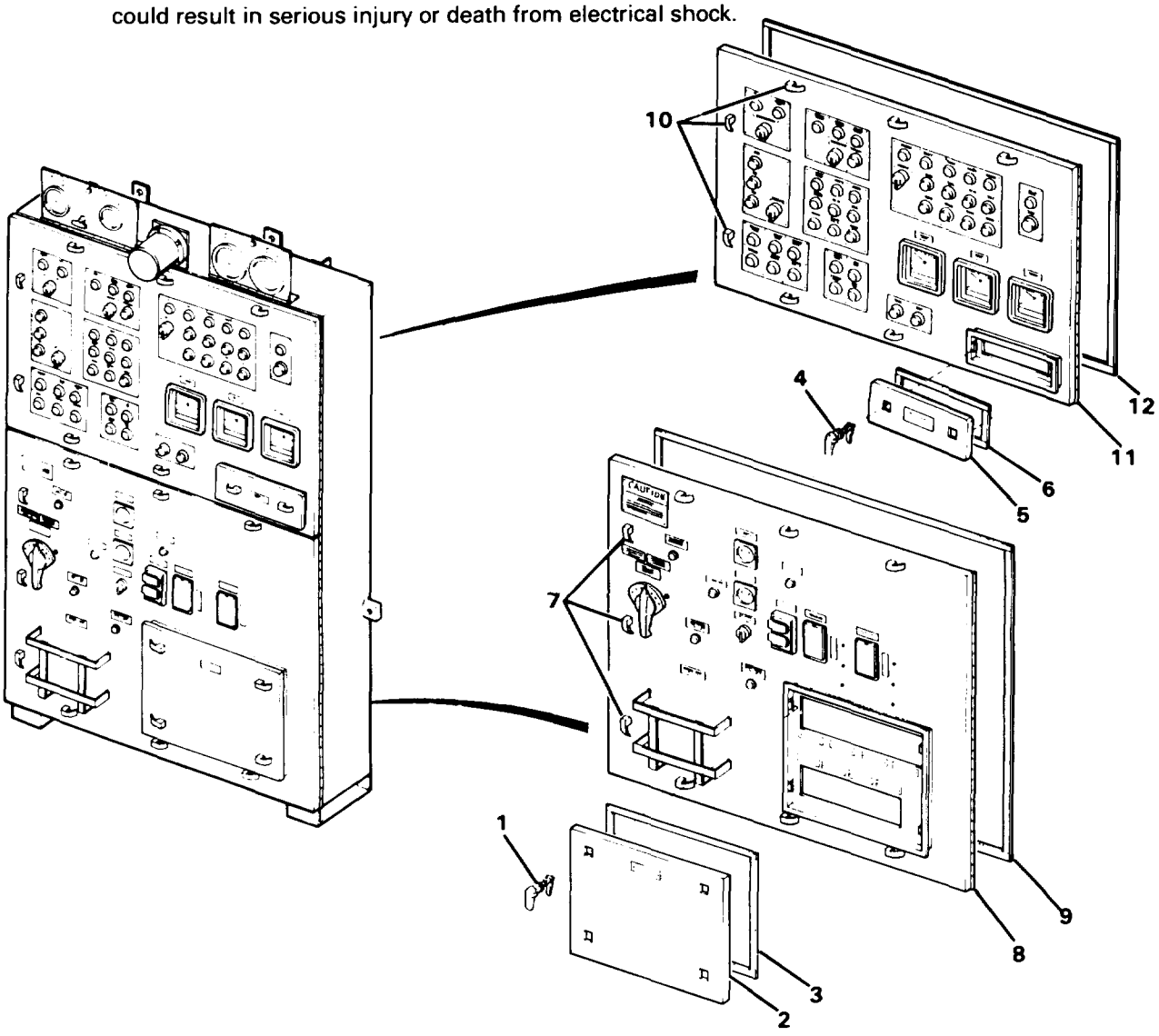


Figure 4-31. Doors, Latches and Gaskets (sheet 1 of 2)

DISASSEMBLY.

a. Lift and turn door latches 90° to unlatch (1, Figure 4-31, sheet 1) and remove door (2).

b. Remove gasket (3), if necessary.

c. Lift and turn two latches (4) and remove door (5).

d. Remove gasket (6), if necessary.

e. Lift and turn nine latches (7), open door (8), and remove gasket (9), if necessary.

f. Lift and turn seven latches (10), open door (11), and remove gasket (12), if necessary.

g. If door latches (1, 4, 7 or 10) require disassembly, refer to Figure 4-31, sheet 2 and proceed as follows:

(1) Remove nut (1), lockwasher (14), and pawl (15). Pawls maybe either straight or offset.

(2) Remove lockwasher (16).

(3) Remove nut (17), nut (18), lockwasher (19) and remove the balance of the latch (20) as an assembly.

ADJUST.

NOTE

Refer to Figure 4-31, sheet 2 to adjust door latches.

a. Minor adjustments can be accomplished by moving inside and outside jam nuts (13 and 17) in or out slightly to achieve a water tight seal on the control panel.

NOTE

Pawl may be straight on offset.

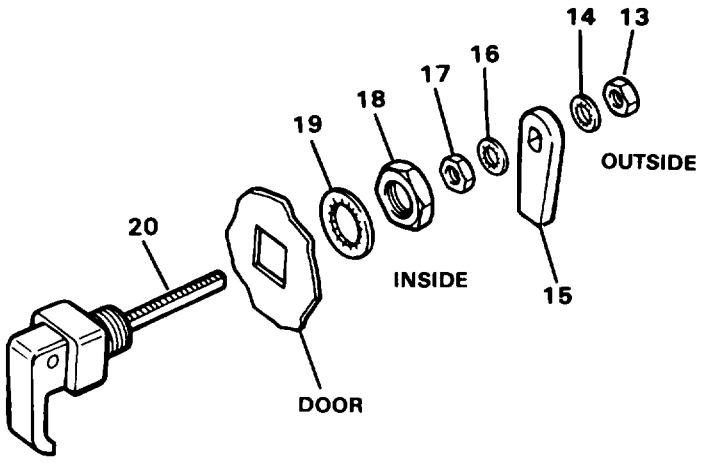


Figure 4-31. Doors, Latches and Gaskets (sheet 2 of 2)

b. If door latch does not close tight, turn inside jam nut (17) in on shaft (20). This will create room to push pawl (15) and two lockwashers (14 and 16) inward. Then tighten outside jam nut (13). Check if door is closed tight.

c. If door latch is hard to close or does not close, loosen outside jam nut (13) and slide pawl (15) and two lockwashers (14 and 16) out until door closes correctly. Then tighten inside jam nut (17) until pawl is secured.

REPAIR.

a. Repair consists of replacing damaged parts or lubrication of latches (1, 4, 7 or 10, Figure 4-31, sheet 1) if they become corroded or hard to turn. (Refer to LO 10-4610-232-1 2.)

b. Replace gaskets which are loose, torn or compressed beyond providing a good seal.

c. Lubricate latches by putting silicone lubricant on the shaft (8, Figure 4-31, sheet 2) where it passes through the latch body. Work latch handle up and down to work lubricant into latch body.

d. Replace damaged or missing nameplates (para. 4-10).

REASSEMBLY.

a. Install gaskets (3, 6, 9 and 12, Figure 4-31, sheet 1) if removed as follows:

WARNING

Drycleaning solvent AA 711, Types I and II, used to clean parts is potentially dangerous to personnel. Avoid nonporous gloves when handling the sovlent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

NOTE

Gasket material is furnished in preglued rolls. Be sure the gasket seating area is clean before installing new gaskets. Use dry cleaning solvent AA 711, Types I and II to clean gasket area.

(1) Cut top and bottom strips of gasket material for doors (2,5,8 and 11) and install these strips first. Strips should be long enough so that the two side strips fit inside the ends of the top and bottom strips to prevent any possibility of leaks.

(2) Cut side strips for doors (2, 5, 8 and 11) and install these strips.

(3) Close doors (8 and 11) and install doors (2 and 5) with latches (1 and 4).

b. Reassemble door latches as follows (Figure 4-31, sheet 2):

(1) Insert door latch (20) through door opening.

(2) Secure with Iockwasher (19) and nut (18). Install adjusting nut (17).

(3) Install washer (16), pawl (15), Iockwasher (14) and nut (13).

(4) Adjust as described above.

4-30. SWITCH PANEL NO. 1. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Electrical Repair Kit (16)

Materials/Parts:
Varnish (Appx E, Sec II, Item 73)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Do not wear watches, rings or dog tags when working on electrical components.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting.

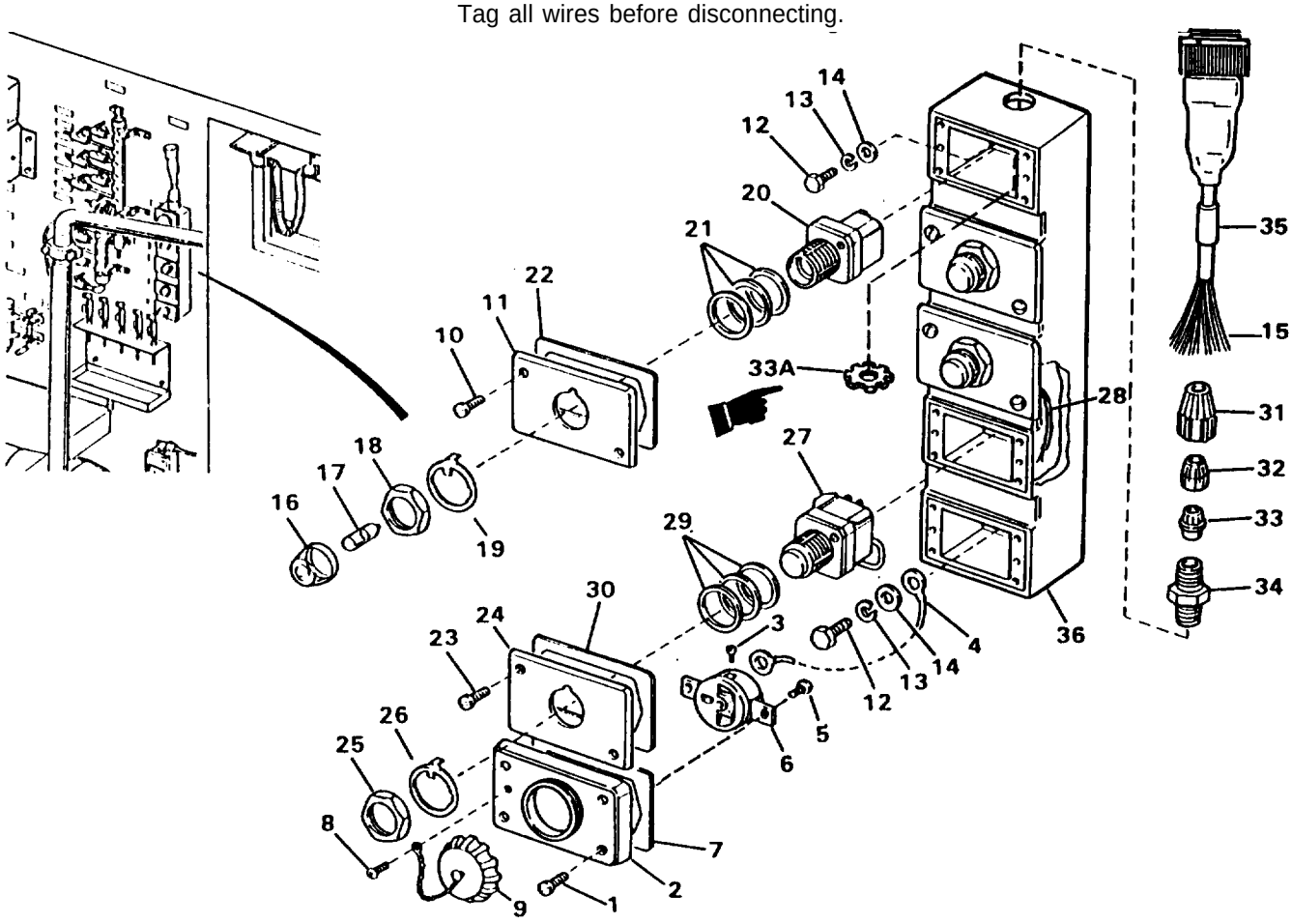


Figure 4-32. Switch Panel No. 1

REMOVAL.

a. Disconnect cable assembly connector P29 (Figure 4-32) from power source connector J29.

b. Remove four screws (1) and pull outlet box (2) (with receptacle (6) and wires attached) out of housing (36).

c. Remove two screws (10) and pull plate (11) out of housing (36).

d. Remove twocapscrews (12), two lockwashers (13) and two washers (14).

e. The entire assembly is now free and can be moved to a disassembly area. Ground wire (4) is also free of housing (36).

DISASSEMBLY.

a. Tag and disconnect three wires (15) and ground wire (4) from receptacle by removing four screws (3).

b. Remove assembled parts (2, 9, 5 and 6) and gasket (7). If necessary, remove screw (8) and dust cover (9).

c. Remove two screws (5) and receptacle (6).

d. Disconnect and tag wires leading to lamp housing (20).

e. Unscrew lens (16) and remove lamp (17) by turning it counterclockwise.

f. Remove locknut (18), lockwasher (19), lamp housing (20) and washers (21). Remove gasket (22).

NOTE

There are three pushbutton switches in housing. The procedure for removing each is the same with the following exception: One wire connects the top switch to the middle switch. This wire must be disconnected when removing the top two switch assemblies.

g. Remove two screws (23) and pull plate (24) forward. Disconnect and tag wires to pushbutton switch (27), including the jumper wire on the switch.

h. Remove locknut (25), lockwasher (26), switch (27), and washers (29). Gasket (30) is now free.

i. Remove the other two pushbutton switches as described above.

j. Loosen nut (31), retainer (32), sealing bushing (33) and locknut (33A), and remove connector (34).

k. Remove cable assembly (35) from the connector parts (31 thru 34).

l. Remove connector parts (31 thru 34) from cable assembly.

REPAIR.

a. Replace any damaged or unserviceable parts or wires.

b. Replace cable assembly (35) if it does not show continuity from end to end on any wire, or has damaged or cut insulation.

c. Replace wire markers (para. 4-10).

d. Replace loose or damaged ring tongue terminals (para. 4-10).

REASSEMBLY.

a. Install connector (34) in housing (36). Spray or brush varnish on each wire connection after installing wires.

a.1. Install connector (34) and secure with locknut (33A).

b. Slide nut (31), retainer (32), and sealing bushing (33) on cable assembly (35) and install cable assembly (35) in connector (34), securing with nut (31).

NOTE

There are three pushbutton switches in housing. The procedure for removing each is the same with the following exception: One wire connects the top switch to the middle switch. This wire must be disconnected when removing the top two switch assemblies.

c. Connect wires tagged during removal to pushbutton switch (27). Place washers (29) and gasket (30) over threaded end of switch (27) and insert the threaded end of switch (27) through plate (24).

d. Install lockwasher (26) by alining the tab on the lockwasher with the groove in the switch and the notch in plate (24). Install locknut (25) and secure the assembly to housing (36) using two screws (23).

e. Install the other two pushbutton switches in the same manner.

f. Place lockwasher (19) on threaded end of lamp housing (20) by alining the tab on the lockwasher with the groove in the switch and the notch in plate (11). Install nut (18), bulb (17) and lens (16).

NOTE

Do not install screws at this time.

g. Connect wires tagged during removal to lamp housing (20), place washers (21) and gasket (22) over threaded end of lamp housing (20) and insert the threaded end of lamp housing through hole in plate (11).

h. Install receptacle (6) with two screws (5) and connect wires (15)

INSTALLATION.

a. Place the connector on the grounding lead (4) over the end of capscrew (12).

b. Place the assembled housing (36) against the ROWPU wall and install two washers (14), lockwashers (13), and capscrews (12).

c. Place plate (11) with assembled lamp (16 thru 21) against housing (36), making sure gasket (22) is properly placed, and secure with two screws (10).

d. Connect assembled parts (2,5,9 and 6) to housing (36) using screws(1).

e. Install bulb (17) by aligning tabs on new bulb with slots in receptacle. Gently push bulb in and twist clockwise. Bulb will lock in place. Screw in lens (16).

4-31. SWITCH PANEL NO. 2. This task covers:

a. Removal b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Stripper, Wire (16)
Terminal Strip Tool (16)
Crimper, Hand Terminal (16)

Materials/Parts:
Suitable Tags
Varnish (Appx E, Sec II, Item 73)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
MAIN CIRCUIT BREAKER (CB1) OFF

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

WARNING

Do not wear watches, rings or dog tags when working on electrical components.

NOTE

Tag all wires before disconnecting.

NOTE

Remove or install terminal board connections and components as described in para. 4-10.

REMOVAL

NOTE

The internal components of the switch panel enclosure are shown on Figure 4-34. They are omitted in Figure 4-33 for clarity.

a. Unscrew connectors (1, 2 and 3, Figure 4-33).

b. Loosen eight capscrews (4) and cover clips (5) and open cover (6).

c. Tag and remove wiring harness (7) from terminal strip (17) (para. 4-10).

d. Unscrew connector nut (8). Retainer (9) and bushing (10) are now loose on wire (7).

e. Remove wire (7) with items (8, 9 and 10).

f. Remove cable adapter with sealing washer (11) by removing conduit nut (12).

g. Remove fourcapscrews(13), lockwashers (14) and washers (15) and remove panel assembly (16).

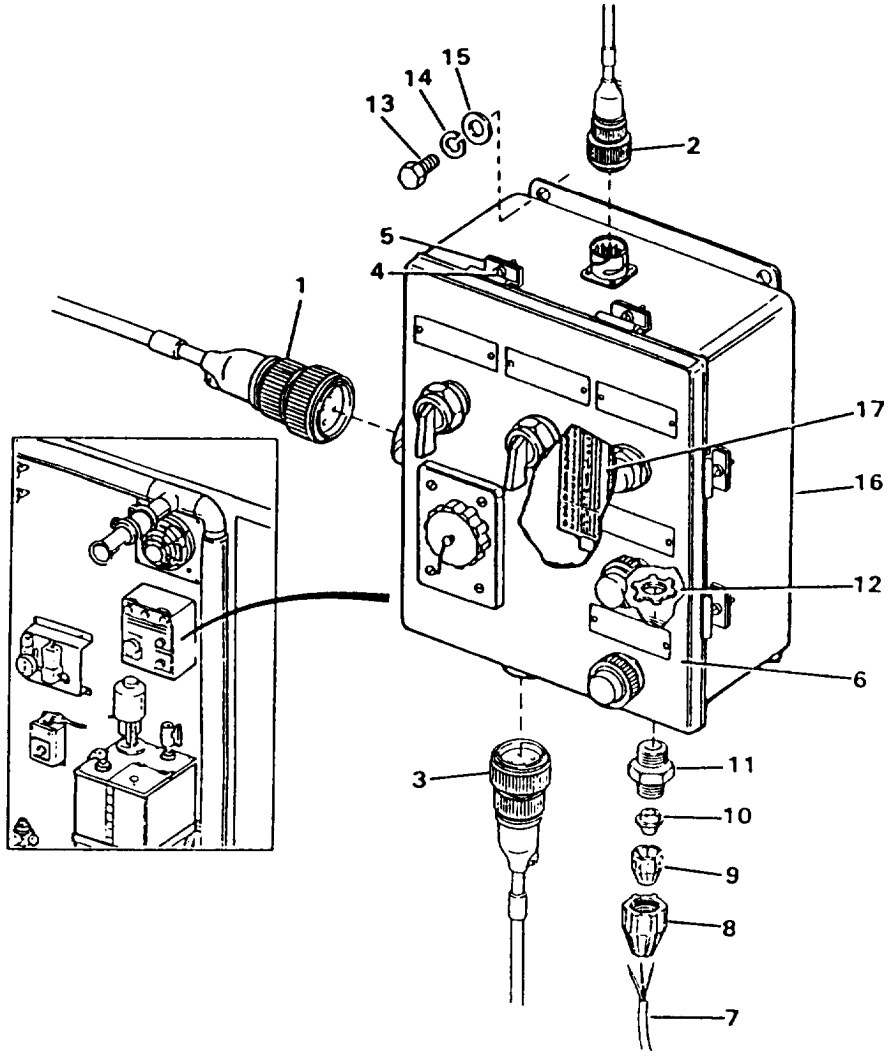


Figure 4-33. Switch Panel No. 2

DISASSEMBLY.

a. Tag and disconnect all wires to fan and mixer switches (4, Figure 4-34), light switch (9), two alarms (20) and receptacle (18) at the component end and at the terminal board (36).

b. Remove handles with nuts (1), lock ring (2), switch (4), and spacers (5).

c. Remove nut (6), lock ring (7), switch (9), three spacers (10) (11) DELETED.

d. Remove capscrew (12) and dust cap (13).

e. Remove four capscrews (14), nuts (15), lockwashers (16), washers (17) and remove receptacle (18).

f. Remove two nuts (19), two washers (19A), six spacers (19B) and two alarms (20).

g. Remove wiring harness (21) as follows:

(1) Tag and disconnect wires to terminal board (36).

(2) Remove four capscrews (22), nuts (23), lockwashers (24) and washers (24A).

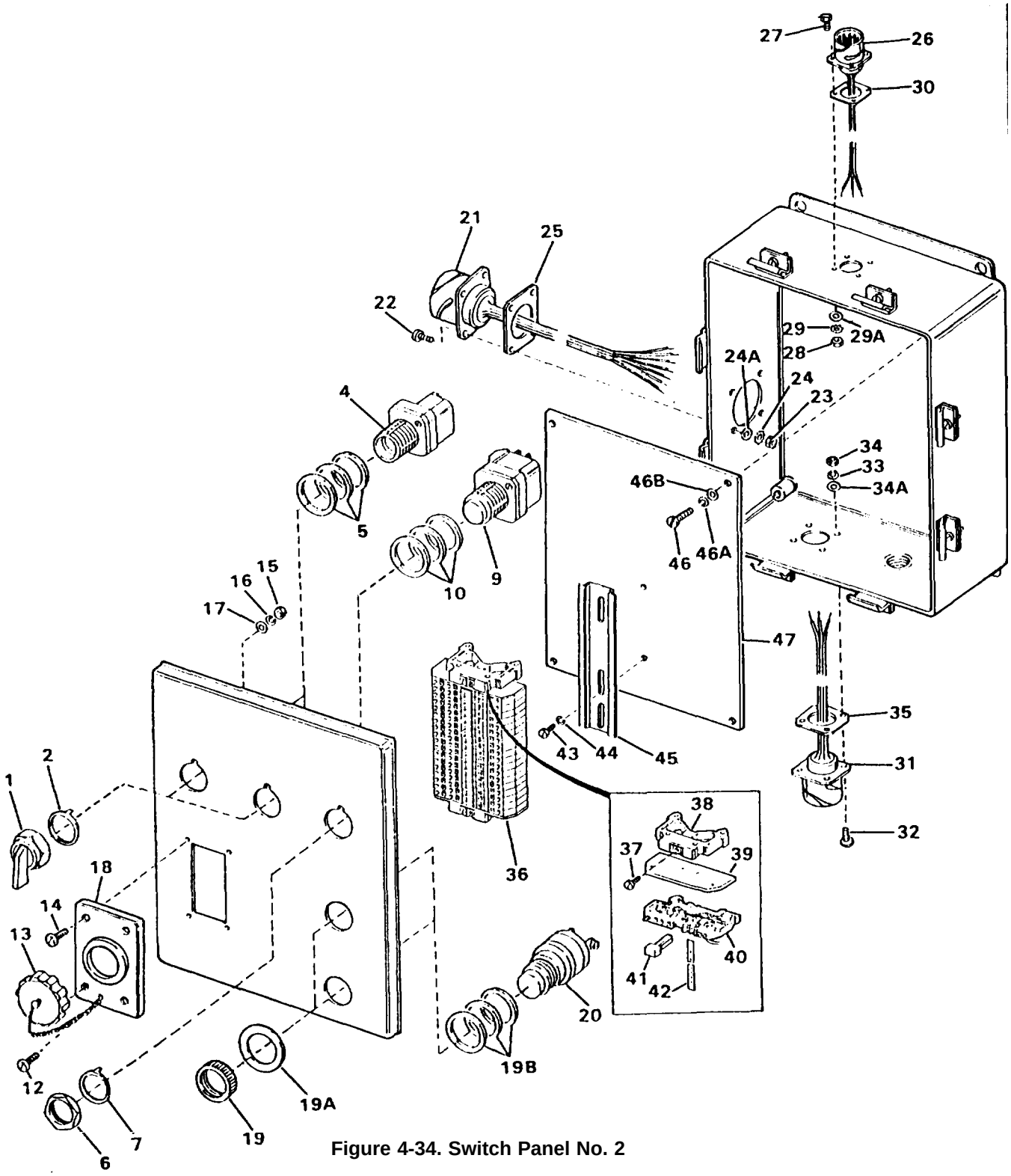


Figure 4-34. Switch Panel No. 2

(3) Remove wiring harness (21) and gasket (25).

h. Remove wiring harness (26) as follows:

(1) Tag and disconnect wires to terminal board (36).

(2) Remove four capscrews (27), nuts (28), washers (29A) and lockwashers (29).

(3) Remove wiring harness (26) and gasket (30).

i. Remove wiring harness (31) as follows:

(1) Tag and disconnect wires to terminal board (36).

(2) Remove four capscrews (32), nuts (33), lockwashers (34) and washers (34A).

(3) Remove wiring harness (31) and gasket (35).

NOTE

Be sure to note the location of jumper.

j. Loosen capscrew (37) and remove retainer (38), end plate (39), terminal strip (40) and jumpers (41).

k. Remove eighteen terminal strips (40), if required. Refer to para. 4-10 for terminal board procedures.

NOTE

If terminal strips are being replaced, unsnap the terminal marker for use on the replacement terminal.

l. If necessary, remove two capscrews (43), lockwashers (44) and rail (45).

m. If necessary, remove four capscrews (46), lockwashers (46A) and washers (466). Remove sub panel (47).

NOTE

If tags have been lost during disassembly, refer to wiring Table 4-3 for point to point location.

Table 4-3. Wiring Table

Wire No.	From	Wire To	No.	From	To
288	J52A	TB6-1	264	TB6-2	SS4-1A3
264	J52B	TB6-2	323	TB6-14	SS4-1A4
324	J52C	TB6-3	288	TB6-1	HN1+
341	J52D	TB6-4	407	TB6-6	HN2+
342	J52E	TB6-5	2A	HN1-	HN2-
2A	J52J	TB6-11	2A	TB6-10	HN1-
423	J52K	TB6-12	324	TB6-3	PB19-1B1
2E	J52L	TB6-13	324	PB19-1B1	PB19-2A4
GND	J52M	TB6-18	324	PB19-2A4	SS7-1A3
407	J52N	TB6-6	414	TB6-7	SS7-1A4
415	J52R	TB6-8	415	TB6-8	PB19-182
417	J52W	TB6-9	417	TB6-9	PB19-2A3
414	J53A	TB6-7	423	TB6-12	SR2-B
2A	J53B	TB6-10	2E	TB6-13	SR2-S
GND	J53C	TB6-17	GND	TB6-17	SR2-G
323	J54A	TB6-14	324	LSL4	TB6-3
2A	J54B	TB6-10	341	LSL4	TB6-4
GND	J54C	TB6-17	342	LSL4	TB6-5

REPAIR.

a. Replace unserviceable parts.

b. Replace nameplates, wire markers, and wire ties that were removed during disassembly (para. 4-10), if necessary.

c. Repair damaged or loose ring tongue terminals by replacement (para. 4-10).

REASSEMBLY.

a. Install subpanel (47, Figure 4-34). Secure with capscrews (46), lockwashers (46A) and washers (46 B).

b. Install rail (45) and secure with lockwasher (44) and capscrew (43).

c. Refer to para. 4-10 and install terminal strips. Install end plates, retainers (38) on rail (45) and secure with capscrew (37). Install jumpers (41) as tagged during removal and replace markers (42) if removed.

d. Install wiring harness (31) and gasket (35) and secure with capscrews (32), nuts (33) and washers (34) and washers (34A). Connect wires to terminal board (36) in accordance with markings.

e. Install wiring harness (26) and gasket (30) and secure with capscrews (27), nuts (28) and lockwashers (29) and washers (29A). Connect wires to terminal board (36) in accordance with markings.

f. Install wiring harness (21) and gasket (25) and secure with capscrews (22), nuts (23) and lockwashers (24) and washers (24A). Connect wires to terminal board (36) in accordance with markings.

g. Install two alarms (20) and secure with two ring nuts (19), two washers (19A) and six spacers(19B),

h. Install receptacle(18) and secure withcapscrews(14), nuts (15), lockwashers(16) and washers (17). Install dust cap (13) and secure with capscrew (12).

i. Install spacers (10) on switch (9), and secure the switch with lock ring (7) and nut (6). (11) DELETED.

j. Install spacers (10) on switch (9) and secure switch with lock ring (2) and handle (1).

k. Connect wires to fan and mixer switch (4), light switch (9), two alarms (20) and receptacle (18) in accordance with markings made during disassembly. Spray or brush varnish on the wire connections.

l. Install the other ends of the wires to the terminal strip (36) as tagged during disassembly (para. 4-10).

a. Refer to Figure 4-33 and install switch panel No. 2 as follows:

(1) Install panel assembly (16) on wall by securing with washers (15), lockwashers(14) andcapscrews(13).

(2) Install cable adapter with sealing washer (11) and secure with conduit nut (12).

(3) Slide connector nut (8), retainer (9) and bushing (10) on wiring harness (7). Insert wiring harness through cable adapter (11). Tighten connector nut (8).

(4) Connect wires from wiring harness (7) to terminal strip(17) as tagged during disassembly (para. 4-10).

(5) Install cover (6) on enclosure (16). Secure with clips (5) and screws (4).

(6) Install connectors (1, 2 and 3).

4-32. JUNCTION BOX NO. 3. This task covers:

a. Removal b. Disassembly. c. Repair. d. Reassembly. e. installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Stripper, Wire (16)
Terminal Strip Tool (16)

Materials/Parts:
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
washers (TM 10-4610-232-24P)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
MAIN CIRCUIT BREAKER (CB1) OFF

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Mavke sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

WARNING

Do not wear watches, rings or dog tags when working on electrical components.

NOTE

Tag all wires before disconnecting.

NOTE

Refer to para. 4-10 to remove or install terminal board connections and components.

REMOVAL.

a. Unscrew connectors (1 and 2, Figure 4-35).

b. Loosen four capscrews (3) and cover clips (4) and remove cover (5).

c. Tag and disconnect the wires from terminal board (19).

d. Loosen four nuts(7) and slide retainers (8)and bushings (9)down on harness assemblies (10, 11, 12 and 18). Pull the harness assemblies out of enclosure(17) and remove four cable fittings with seal washers (13) by removing conduit nuts (6).

e. Remove four capscrews (14), Iockwashers(15) and washers (16) and remove enclosure (17).

DISASSEMBLY.

a. Refer to Figure 4-36 and disassemble junction box No. 3 as follows:

(1) Tag and disconnect remaining connections from terminal board (11)

(2) Remove wiring harness (1) by removing capscrews (2), nuts (3) and Iockwashers (4). Remove gasket (5).

NOTE

If terminals are being replaced, unsnap the terminal marker(17) for use on replacement terminals.

(3) Remove wiring harness (6) by removing capscrews (7), nuts (8) and Iockwashers (9). Remove gasket (10).

(4) Tag the position of jumpers (16).

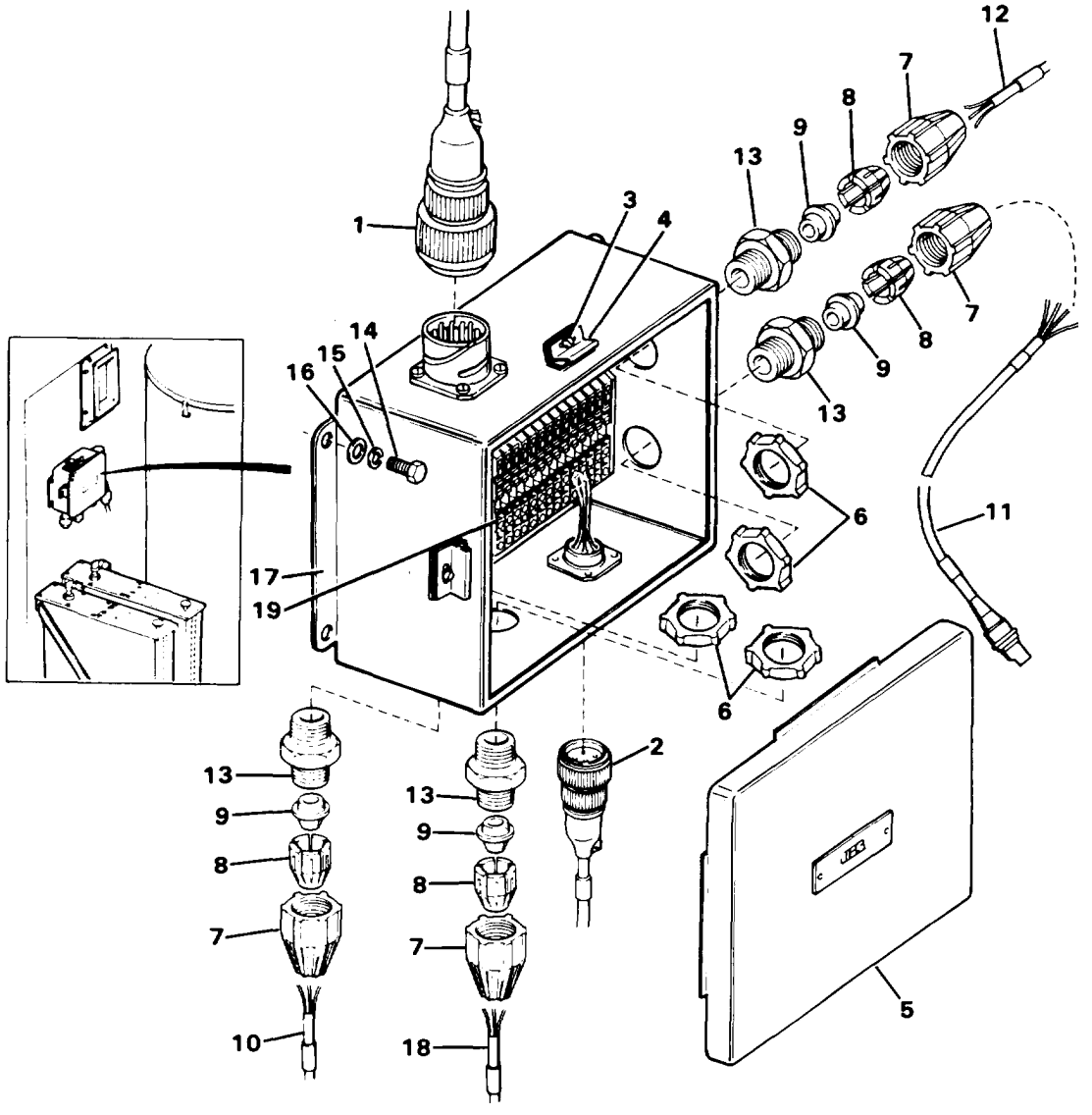


Figure 4-35. Junction Box No. 3

(5) Disassemble terminal board (11) by loosening capscrew (12). Slide retainer (13) down rail (19)and remove end plate (14). Remove fourteen terminal strips (15) and jumpers (16) as required.

(6) If necessary, removecapscrews(18) and lockwashers (19) and remove rail (20).

(7) If necessary, remove capscrews (21) and subpanel (22). Enclosure (23) is now free.

REPAIR.

a. Replace unserviceable parts.

b. Replace damaged nameplates and wire markers (para, 4-10).

c. Repair damaged wire ends by cutting the end of wire off, strip off insulation and reinsert into terminal blocks.

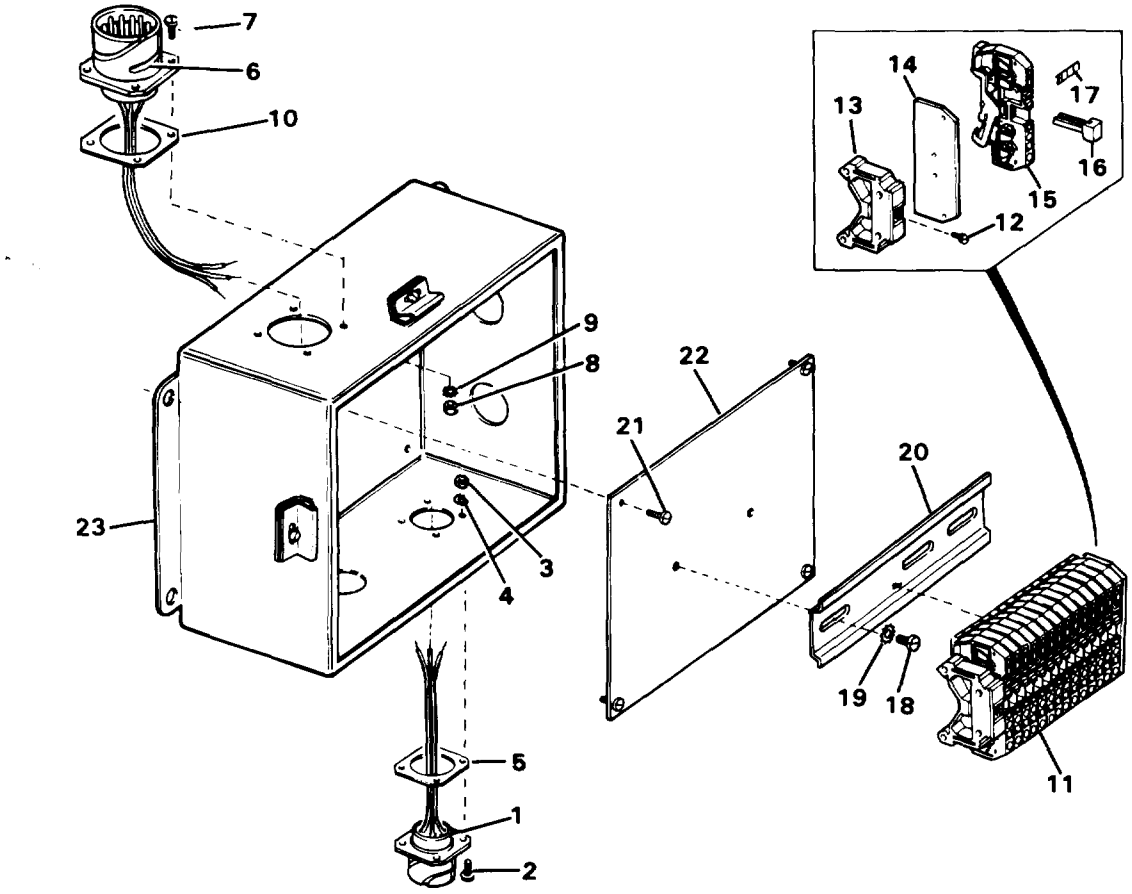


Figure 4-36. Junction Box No. 3

a. Refer to Figure 4-36 and install plate (22). Secure with capscrews (21).

b. Install rail (20) and secure with capscrews(18) and lockwashers (19).

c. Refer to para. 4-10 and assemble terminal board (11) by installing fourteen terminal strips (15), end plate (14), retainer (13) and secure with screw (12). Install jumpers(16) being sure to place them as shown and replace markers (17) if removed.

d. Place gasket(10) on cable harness (6) and install harness(6) in enclosure (23). Secure with capscrews (7), nuts(8) and lockwashers (9).

e. Connect wires to terminal board (11) as tagged (para, 4-10). Refer to Table 4-4 for wire connections, if tags were lost.

f. Place gasket (5) on cable harness(1) and install harness(1) in enclosure (23). Secure with capscrews (2), nuts (3) and lockwashers (4).

g. Connect wires to terminal board(19, Figure 4-35) as tagged (para. 4-10). Refer to Table 4-4 for wire connections if tags were lost.

INSTALLATION.

a. Refer to Figure 4-35 and install enclosure (17). Secure with four capscrews (14), Iockwashers (15) and washers (16).

b. Install four cable fittings with seal washers (13) on enclosure (17) and secure with conduit nuts (6).

c. Slide nuts (7), retainers (8) and bushings (9) on harness assemblies (10, 11, 12 and 18). Push harness assemblies into the enclosures through fittings (13) and tighten four nuts (7) on fittings (13).

d. Connect wires from cables (10, 11, 12 and 18) to terminal board (11) as tagged (para. 4-1 0). Refer to Table 4-4 for wire connections if tags were lost.

e. Screw connectors (1 and 2) onto their respective connectors.

f. Install cover (5) and secure with clips (4) and capscrews (3).

Table 4-4. Junction Box Wire List

Wire No.	From	To
324	J30A	TB7-1
342	J30B	TB7-3
346	J30C	TB7-6
344	J30D	TB7-7
348	J30E	TB7-5
305	J30F	TB7-8
2A	J30G	TB7-9
264	J30H	TB7-10
306	J30I	TB7-11
421	J30J	TB7-12
2D	J30K	TB7-13
GND	J30L	TB7-14
305	J33D	TB7-8
2A	J33E	TB7-9
264	J33A	TB7-10
306	J33C	TB7-11
421	J31A	TB7-12
2D	J31B	TB7-13
Jumper	TB1	TB2
Jumper	TB3	TB4
324	10*	TB7-1
344	10*	TB7-7
342	10*	TB7-4
324	18*	TB7-2
346	18*	TB7-6
342	18*	TB7-3
324	12*	TB7-1
348	12*	TB7-5
342	12*	TB7-3

*Reference is to item number on Figure 4-35.

4-33. UTILITY CABLE EXTERNAL ELECTRICAL PANEL ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Electrical Repair Kit (16)

Materials/Parts:
Suitable Tags
Varnish, Electrical (Appx E, Sec II, Item 73)
Lockwashers (TM 10-4610-232-24P)
washers (TM 10-4610 -232-24P)

Personnel Required: 2

Equipment Condition:
ROWPU shutdown. Storage box removed (para.4-64).
Accessory table panel, item 13 removed (para. 4-73).

General Safety Instructions:

WARNING

Observe specific Warning in the text,

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting to make installation easier.

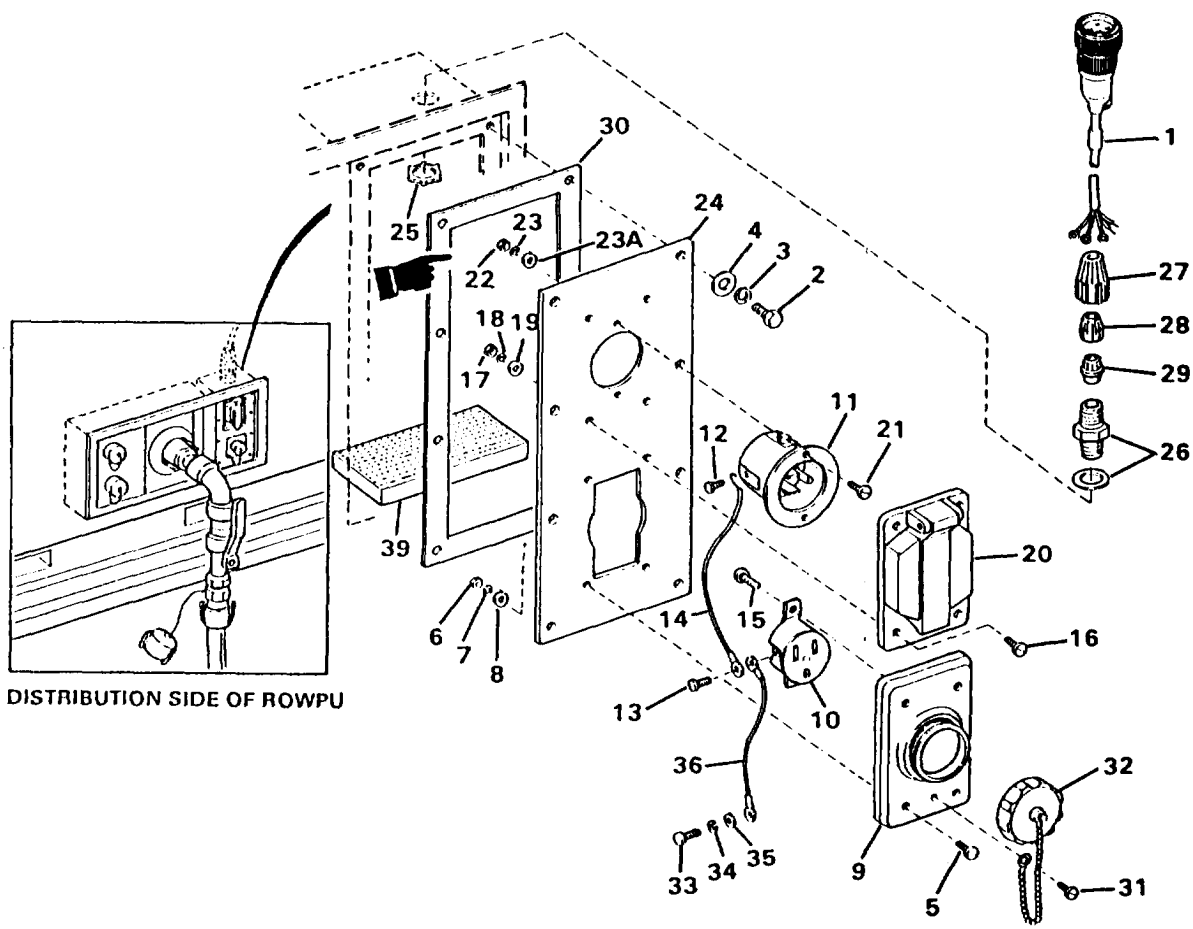


Figure 4-37. Utility Cable External Electrical Panel Assembly

DISASSEMBLY.

a. Refer to Figure 4-37 and disconnect the plug of cable (1) from power cable.

b. Remove eight capscrews (2), lockwashers (3) and washers (4) and pull panel (26) away from the side of the ROWPU.

c. Remove four screws (5), nuts (6), lockwashers (7), washers (8) and remove receptacle assembly (9).

d. Tag and disconnect wires from cable (1) to female plug (10) and male connector (11). Remove screws(12 and 13) to disconnect ground wire (14).

e. Remove screws(15) and female plug (10).

f. Remove four screws (16), nuts (17), lockwashers (18), washers(19) and cover (20).

g. Remove two screws (21), nuts (22), lockwashers (23), washers (23A) and male connector (11). Panel (24) is now free.

h. Remove conduit nut (25) and pull connector with sealing washer (26) and harness(1) out of the enclosure. Loosen nut (27) and remove retainer (28), bushing (29) and connector with sealing washer (26). Remove gasket (30).

i. Remove screw (31) and dust cap (32), if necessary.

j. Remove ground wire (36) by removing capscrew (33), lockwasher (34) and flat washer (35).

REPAIR.

a. Replace cable (1) if damaged or connector has loose or burned pins.

b. Replace gasket (30) if there is evidence of water leaks.

c. Replace all damaged or missing components.

d. Replace wire markers, if necessary (para. 4-10).

e. Replace damaged rivnuts, if necessary (para. 4-10).

f. Replace desiccant cannister (37) if desiccant color has changed from pink to blue.

REASSEMBLY.

a. Install ground wire (36) and secure it to the wall of the ROWPU enclosure with flat washer (35), lockwasher (34) and capscrew (33).

b. If removed, install dust cap (32) on receptacle (9) and secure with screw (31).

c. Install gasket (30).

d. Place connector with sealing washer (26) in the enclosure inside the ROWPU and secure with conduit nut (25).

e. Slide nut (26), retainer (28) and bushing (29) on cable (1) and insert the cable through connector (26) into the enclosure.

f. Install male connector (11) on panel (24) and secure with screws (21), nuts (22), lockwashers (23) and washers (23A).

g. Install cover (20) and secure with screws (16), nuts (17), lockwashers(18) and washers (19).

h. Install female plug (10) and secure to receptacle (9) using screws (15). Install receptacle assembly (9) with four screws (5), nuts (6), lockwashers (7) and washers (8).

i. Connect wires from cable (1) to female plug (10) and male connector (11).

j. Connect ground wire(14) and ground wire (36) to female plug (10) using screw (13). Connect ground wire(14) to male plug (11) using screw (12). Varnish all connections.

k. Place assembled panel (24) against gasket (30) and secure with washers (4), lockwashers (3) and capscrews (2).

l. Reconnect cable(1) to the input power connector.

4-34. RAW WATER PUMP EXTERNAL ELECTRICAL PANEL ASSEMBLY. This task covers:

a. Disassembly, b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Stripper, Wire (16)
Crimper, Hand Terminal (16)

Materials/Parts:
Suitable Tags
Corrosion Inhibitor (Appx E, Sec ll, Item 45)
Varnish, Electrical (Appx E, Sec ll, Item 73)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

WARNING

Observe specific Warning in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting to make installation easier.

DISASSEMBLY.

NOTE

All electrical connections to the raw water pump external electrical panel are disassembled in Figure 4-38, sheets 1 and 3. Disassembly of components is covered on sheet 2.

a. Refer to Figure 4-38, sheet 1 and disconnect incoming power at the plugs of wiring harnesses (47 and 48).

NOTE

Hereafter in this paragraph, references will be to sheet number only.

b. Refer to sheet 2 and remove fourteen capscrews (1), lockwashers (2) and washers (3) and prop assembled panel (44) with all wires attached against the van.

c. Remove screws (4) and remove outlet (5).

d. Refer to sheet 1 and tag and disconnect two wires (6 and 7) and ground wire (8) from outlet (5) by removing screws (9, 10 and 11).

e. Tag and disconnect power input wires from cables (47 and 48) to MOVs by removing screws (12), lockwashers (13) and nuts (14) as shown in the "'Typical Connection" view.

f. Remove capscrew (15) and lockwasher (16). Panel assembly (44] and gasket (45, sheet 2) are now free. Refer to sheet 1 and remove capscrew (17), lockwasher(18) and washer(19) and remove ground wire (20).

g. Refer to sheet 3 and tag and remove remaining wires from MOVs by removing screws(12), lockwashers(.13) and nuts (14).

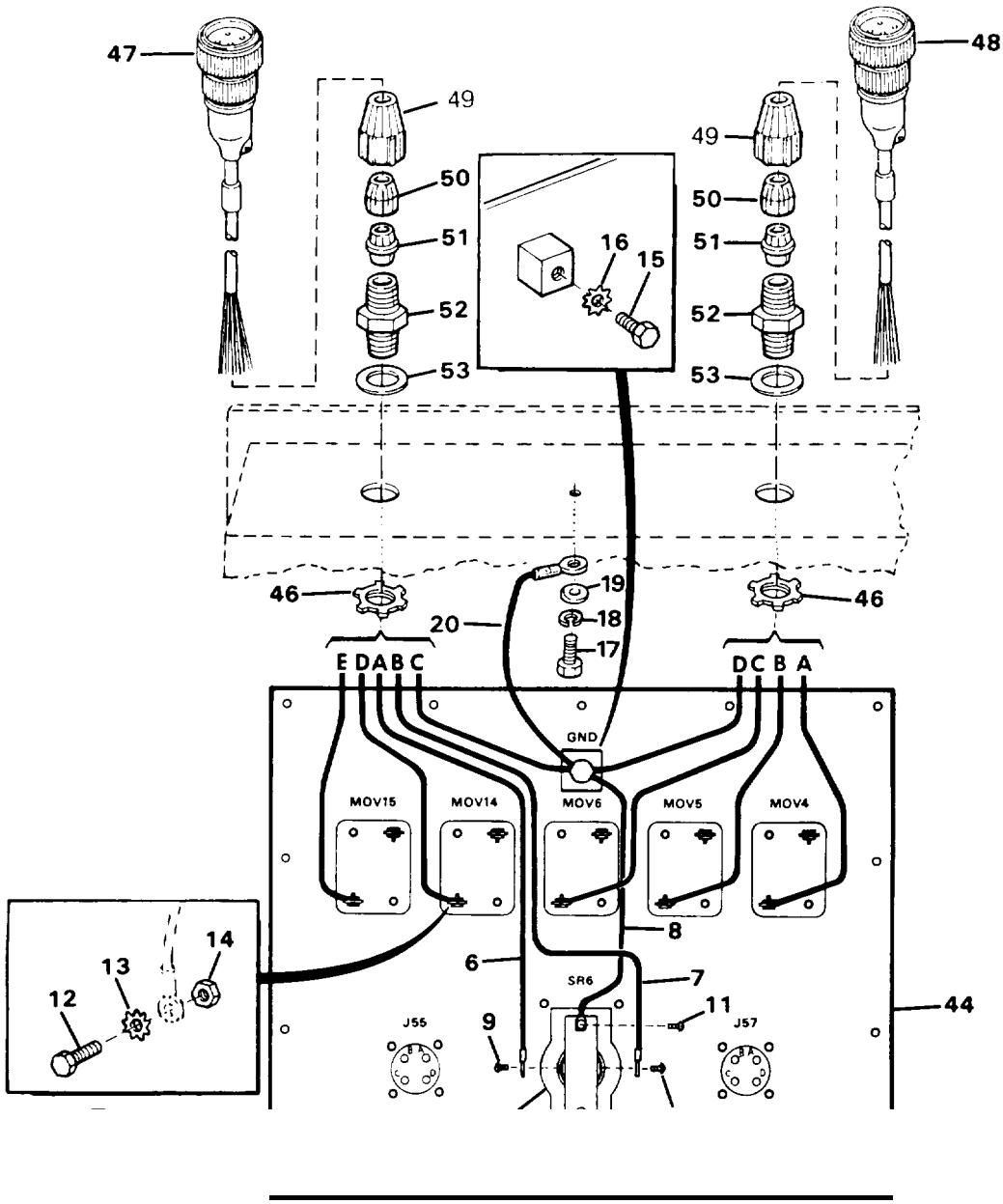


Figure 4-38. Raw Water Pump External Electrical Panel Assembly (sheet 1 of 3) Connections

NOTE

Two of the MOVs are different from the rest. Be sure to mark and return the MOVs to the location from which they were removed.

h. Refer to sheet 2 and remove ten screws (21), acorn nuts (22), lockwashers (23), sealing washers (24) and five MOVs (25).

i. Remove four screws (26), dust cap (27), nuts (28), washers (29) and harness assembly. Gasket (31) is now free.

j. Remove four screws (32), dust cap (33), nuts (34), washers (35) and harness (36). Gasket (37) is now free.

k. Remove screw (38) and dust cap (39).

I. Remove four screws (40), nuts (41), lockwashers (42) and receptacle (43). Panel (44) is now completely disassembled.

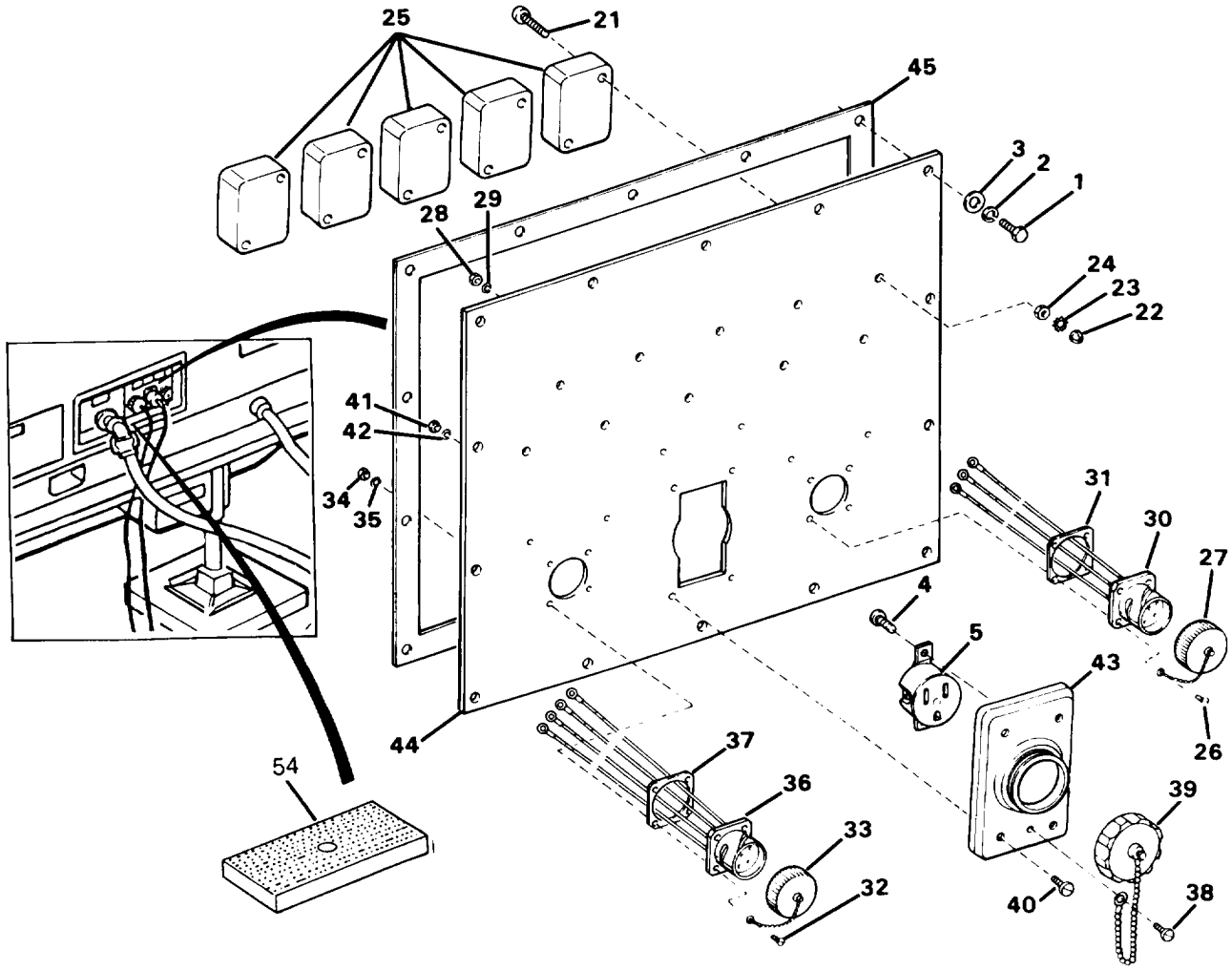


Figure 4-38. Raw Water Pump External Electrical Panel Assembly (sheet 2 of 3) Components

m. Refer to sheet 1 and remove two conduit nuts (46).

n. Pull harness assemblies (47 and 48) out of the box with nuts (49), retainers (50), bushings (51), bodies (52) and sealing rings (53) attached.

o. Loosen nut (49) and slide items (49 thru 53) off harnesses (47 and 48).

REPAIR.

a. Replace any damaged or missing components.

b. Replace damaged ring tongue connectors (para. 4-10).

c. Replace damaged nameplates (para. 4-10).

d. Replace missing or damaged wire markers (para. 4-10).

e. Replace damaged rivnuts (para. 4-10).

f. Replace gaskets showing signs of leakage.

g. Replace desiccant cannister (54) if desiccant has changed from pink to blue.

REASSEMBLY.

a. Refer to sheet 1 and slide nuts (49), retainers (0), bushings (51), bodies (52) and sealing rings (53) on cables (47 and 48). Place the cable wires through the internal hole in the ROWPU box, so the wires extend into the box. Slide conduit nuts (46) over the cable wires and secure the cables to the box with the conduit nuts. Tighten nuts (49).

b. Refer to sheet 2 and assemble panel (44) as follows:

(1) Secure receptacle (43) to panel (44) with screws (40), nuts (41) and lockwashers (42).

(2) Install dust cap (39) and secure with screw (38).

(3) Place gasket (37) on harness (36) and insert wires of harness (36) through panel (44). Install dust cap (33) on harness (36) and secure both with screws (32).

(4) Place gasket (31) on harness (30) and insert wires of harness (30) through panel (44). Install dust cap (27) on harness (30) and secure both with screws (26).

(5) install MOVs (25) being careful to install each in the location from which it was removed. Secure with screws (21), nuts (22), lockwashers (23) and sealing washers (24).

(6) Refer to sheet 2 and install gasket (45).

WARNING

This box contains both 440 VAC and 120 VAC. Serious danger to personnel and damage to equipment may occur if this wiring is not connected correctly and tightly. If there is any doubt as where to connect wires, refer to the interconnection diagram in Appendix I or contact your supervisor.

c. Prop the panel up against the side of the ROWPU, Refer to sheet 3 and install all wires from harnesses J55 (30) and J57 (36) to MOVs and all wires from cables (47 and 48, sheet 1) to MOVs using screws (12), lockwashers (13) and nuts (14).

NOTE

Coat ground boss on panel and ground capscrews with corrosion inhibitor paste.

d. Install ground wire (20) and secure withcapscrew (17), lockwasher (18) and washer (19).

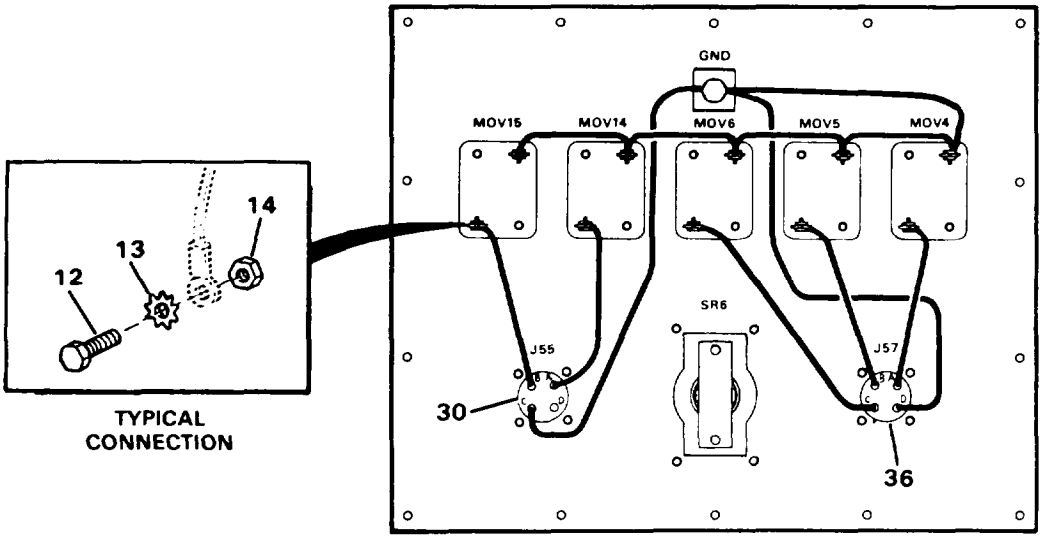


Figure 4-38. Raw Water Pump External Electrical Panel Assembly (sheet 3 of 3) Connections

e. Connect all ground wires from cables (47 and 48) and receptacle SR6 (5) on sheet 1, and harnesses (30 and 36, sheet 2) and MOV4 (sheet 3)to the ground lug on panel (44, sheet 1)and secure all ground leads with lockwasher(16) and capscrew (5),

f. Connect ground wire (8) and wires (6 and 7) to receptacle (5) and secure with screws (9, 10 and 11).

g. Install outlet (5, sheet 2) on receptacle (43) and secure with screws (4).

h. Install assembled and wired panel (44) on the ROWPU. Secure with washers(3), lockwashers(2) and capscrews (1).

i. Connect cables (47 and 48, sheet 1) to input power jacks.

Table 4-5. Connection Charts

Harness W49 -47, Figure 4-38, Sheet 1		
Wire No.	From	To
448	P43E	MOV15
443	P43D	MOV14
423	P43A	SR6
GND	P43C	GND BOSS
2E	P43B	SR6

Harness W42 - 48, Figure 4-38, Sheet 1		
Wire No.	From	To
3T1	P22A	MOV4
3T2	P22B	MOV5
3T3	P22C	MOV6
3T0	P22D	GND BOSS

Harness J57 -36, Figure 4-38, Sheet 2		
Wire No.	From	To
3T1	J57A	MOV4
3T2	J57B	MOV5
3T3	J57C	MOV6
GND	J57D	GND BOSS

Harness J55 -30, Figure 4-38, Sheet 2		
Wire No.	From	To
443	J55A	MOV14
448	J55B	MOV15
GND	J55C	GND BOSS

4-35. DISTRIBUTION PUMP EXTERNAL ELECTRICAL PANEL ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec lll, Ref Code (No.)
Tool Kit, General Mechanics Automotive(1)
Rivnut Repair Kit(15)
Stripper, Wire (16)
Terminal Strip Tool (16)
Crimper, Hand Terminal (16)

Materials/Parts:'
Inhibitor, Corrosion (Appx E, Sec ll, Item 45)
Varnish, Electrical (Appx E, Sec ll, Item 73)
Suitable Tags
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2

Equipment Condition:
ROWPU shutdown. Storage box removed (para. 4-64). Accessory Table item 18 removed (para. 4-73).

General Safety Instructions:

WARNING

Observe specific Warning in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting to make installation easier.

NOTE

Refer to para. 4-10 for procedures involving terminal strip wire removal and disassembly.

DISASSEMBLY.

a. Refer to Figure 4-39, sheet 1 and disconnect connectors (1 and 2) from power cable.

b. Remove twelve capscrews (3), lockwashers (4) and flat washers(5) from panel (6) and prop assembled panel (6), with all wires attached, against van.

c. Remove cable marked W29 from terminal strip assembly (7) (para. 4-10).

d. Tag and disconnect power cables from MOVs (8) by removing screws(9), lockwashers (10), nuts (11) and washers (12).

e. Remove capscrew(l 3) and Iockwasher (14) from ground connectional 5). Assembled panel (6) and gasket (1 6) are now free.

f. Tag and disconnect all remaining wires(17, 18 and 19) by removing screws (9), Iockwashers (10), nuts(11) and washers (12).

g. Cut cable ties (para. 4-10). Tag and disconnect wires to terminal board (7) from harness (20) (para. 4-10).

h. Remove screws(21), acorn nuts (22), Iockwashers (23) and washers (24). MOVs (8) are now free.

i. Disassemble terminal board (7) as follows, referring to para. 4-10 for methods of disassembly.

(1) Loosen screw (25) and remove retainer (26), end plate (27), terminal strips (28) and markers (29).

(2) Remove all terminal strips if necessary.

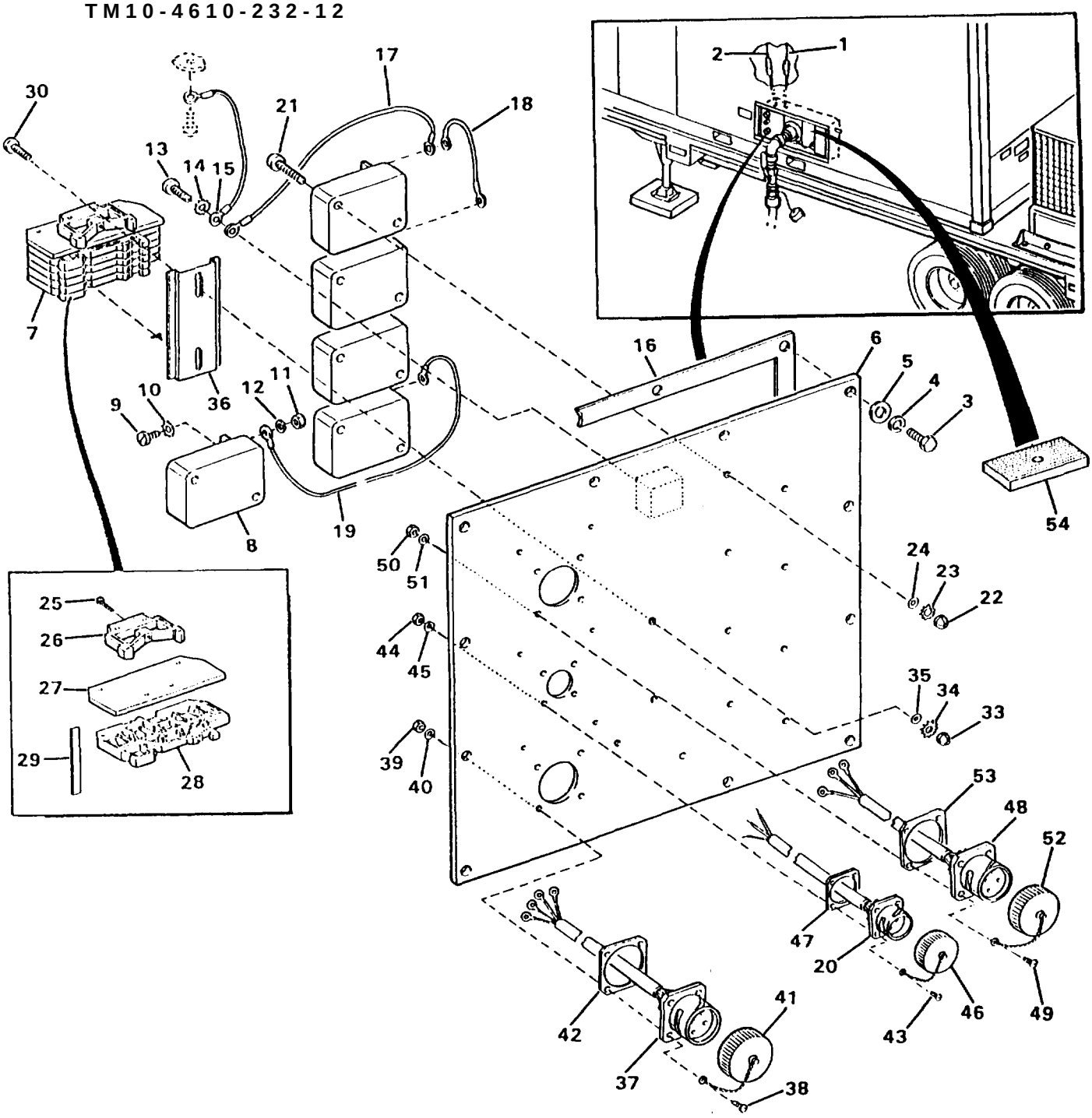


Figure 4-39. Distribution Pump External Electrical Panel Assembly (sheet 1 of 2)

NOTE

If terminal strips are being replaced, unsnap the terminal markers for use on the replacement terminal strip.

j. If necessary, remove screws (30), (31 and 32 DELETED), acorn nuts (33), lockwashers (34) and sealing washer (35). Rail (36) is now free.

k. Remove harness assembly (37) as follows:

(1) Remove screws (38), nuts (39), washers (40) and dust cap (41).

(2) Harness (37) and gasket (42) are now free.

l. Remove harness assembly (20) as follows:

(1) Remove screws (43), nuts (44), washers (45) and dust cap (46).

(2) Harness (20) and gasket (47) are now free.

m. Remove harness assembly (48) as follows:

(1) Remove screws (49), nuts (50), washers (51) and dust cap (52).

(2) Harness (48) and gasket (53) are now free.

n. Tag wires of cables (1 and 2), loosen nuts (55, Figure 4-39, sheet 2) and slide the nuts (55), retainers, bushings (57), connector bodies (58) and sealing nuts (59) onto cables (1 and 2).

o. Remove conduit nuts (60) and cables (1 and 2) and pull cables (1 and 2) through ROWPU wall.

p. If necessary, remove ground screws (61) and lockwashers (62) and ground wires (63 and 64).

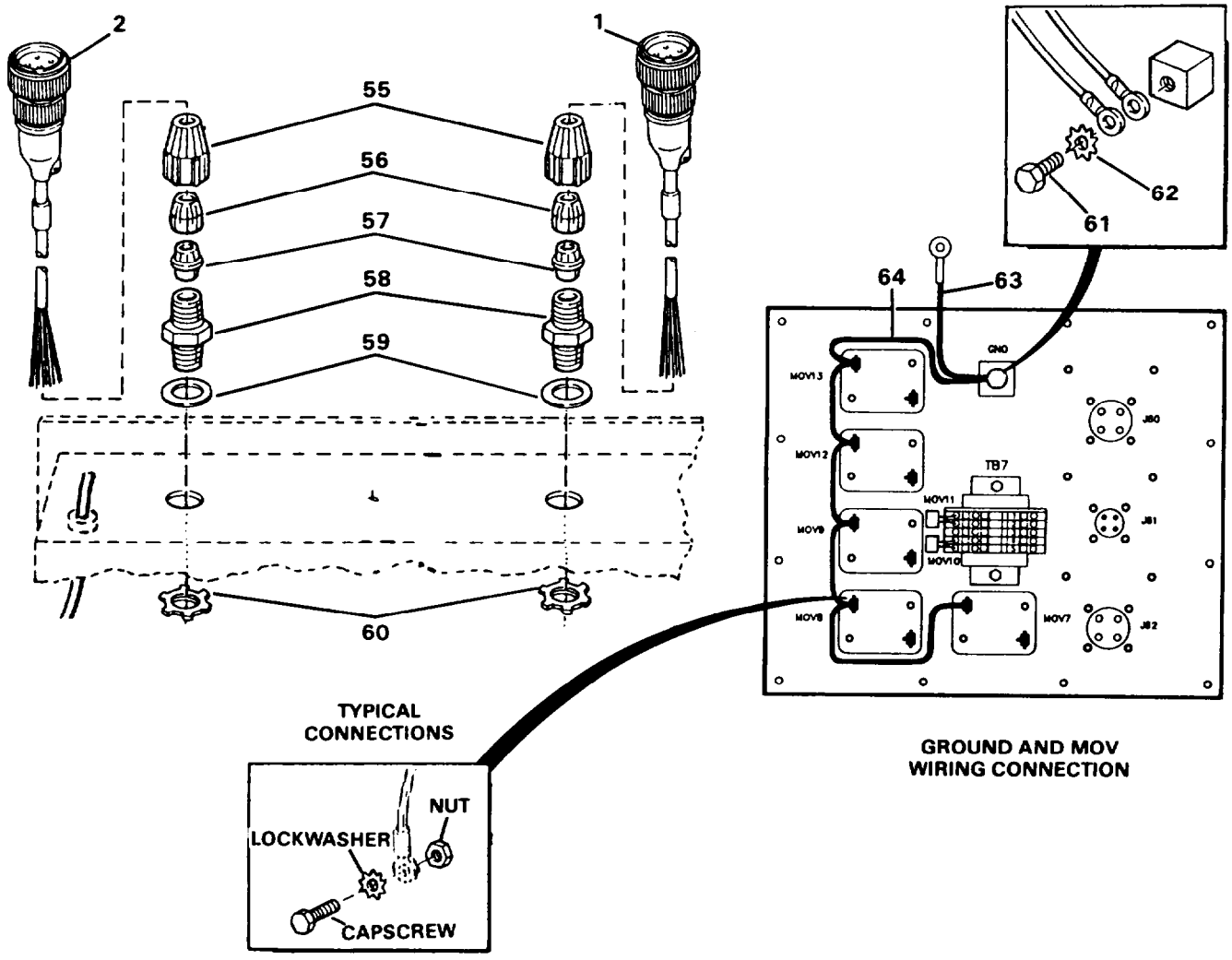


Figure 4-39. Distribution Pump External Electrical Panel Assembly (sheet 2 of 2)

REPAIR.

a. Replace any damaged or missing components.

b. Replace damaged ring tongue terminals (para. 4-10).

c. Replace damaged nameplates (para. 4-10).

d. Replace missing or damaged wire markers (para. 4-10).

e. Replace damaged rivnuts (para. 4-10).

f. Remove and replace desiccant cannister (54) if desiccant had changed color from pink to blue.

REASSEMBLY.

a. Install rail {36, Figure 4-39, sheet 1) and secure with screws (30), (31 and 32 DELETED), acorn nuts (33), lockwashers (34) and sealing washers (35).

b. Refer to para. 4-10 for procedures and assemble terminal board (7) by assembling terminal strips (28), plates(27) and retainers (26) on rail (36) and secure with screws (25). If removed, install markers (29).

c. Install MOVs (8), making sure to install them at the points from which they were removed, and secure with screws (21), acorn nuts (22), lockwashers (23) and washers (24).

d. Install wires 17, 18 and 19, sheet 1) per the typical connection sketch (Figure 4-39, sheet 2). Install the panel end of wire (63, Figure 4-39, sheet 1) and secure with screws (61) and lockwashers (62).

e. Install wiring harness (37) as follows:

(1) Pass wires through hole in panel (6), with gasket (42) in place.

(2) Install dust cap (41) and secure wiring harness and dust cap with screws (38), nuts (39) and washers (40).

(3) Connect wires to MOVs (8) as tagged. Refer to Table 4-6 if marks are missing.

f. Install wiring harness (20) as follows:

(1) Pass wires through hole in panel (6) with gasket (47) in place,

(2) Install dust cap (46) and secure wiring harness and dust cap with screws (43), nuts (44) and washers (45).

(3) Connect wires to terminal strip (7). Refer to para. 4-10 for the procedure.

g. Install wiring harness (48) as follows:

(1) Pass wires through the hole in panel (6) with gasket (53) in place.

(2) Install dust cap (52) and secure wiring harness and dust cap with screws (49), nuts (50) and washers (51).

(3) Connect wires to MOVS (8) in accordance with the typical connection sketch.

h. Install gasket (16).

i. Place nuts (55, Figure 4-39, sheet 2), retainers, bushings (57), connector bodies (58) and sealing washers (59) on cables(1 and 2). Put the cables(l and 2) through the holes in the ROWPU wall, install conduit nuts (60), tighten nuts (55) and connect the cable wires as tagged

j. Connect wires from cables (1 and 2) to MOVs (8) and secure in accordance with the typical connection sketch.

k. Coat ground screws (61) with corrosion inhibitor paste and install ground wires (63 and 64) with screws (61) and lockwashers (62).

l. Apply varnish to all connections except terminal strip connections.

m. Install panel (6, Figure 4-39, sheet 1) and secure with capscrews (3),lockwashers (4) and washers (5).

Table 4-6. Distribution Pump External Electrical Panel Assembly Connections

	Wire No.	From	To
W44	446	W44	MOV12
	447	W44	MOV13
	—	W44	GND

	From	To	Color
W29	W29	TB4-1	White
	W29	TB4-5	Black
	W29	TB4-3	Shrink Tube

	Wire No.	From	To	Color
W36	2T3	W36	MOV9	Red
	2T2	W36	MOV8	White
	2T1	W36	MOV7	Black
	2T0	W36	GND	Green

	Wire No.	From	To
W64	446	J60A	MOV13
	447	J60B	MOV12
	GND	J60C	GND
W63	BLK	J61A	TB4-5
	WHT	J61B	TB4-1
	GND	J61C	GND
W62	2T1	J62A	MOV7
	2T2	J62B	MOV8
	2T3	J62C	MOV9
	2T0	J62D	GND

4-36. CHEMICAL INJECTION PUMPS. This task covers

a. Removal. b. Disassembly. c. Repair. d Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Multimeter (2)
Stripper, Wire (16)
Crimper, Hand Terminal (16)
Insertion Tool Kit (16)
Extraction Tool Kit (16)
Guide Pin Kit (16)
Crimper, Hand, Connector (16)
Chemical Pump Repair Kit from ROWPU Storage Box No. 2

Materials/Parts:
Ties, Wire (Appx E, Sec II, Item 71)
Detergent (Appx E, Sec II, Item 15)
Container for Chemicals
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

WARNING

Observe specific Warnings in the text

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock or moving parts.

WARNING

To avoid injury, always wear protective clothing when working on or near the chemical metering pump. Make sure all tubing connections are secure before pumping.

NOTE

Tag tubing before disconnecting from pump.

NOTE

Power cable P51 connects to hypochlorite pump, power cable P50 connects to the polyelectrolyte pump, and power cable P49 connects to sequestrant pump.

a. Cut tie wraps that secure cable to wall (para. 4-10).

b. Disconnect power cable connector (1, Figure 4-40, sheet 1) from main harness.

c. Disconnect chemical tubes (2 and 3) by unscrewing nuts (4 and 5).

d. Remove four screws (6), washers (7), two brackets (6A), four nuts (8), washers (9A), and lockwashers (9).

e. Remove chemical pump assembly (10).

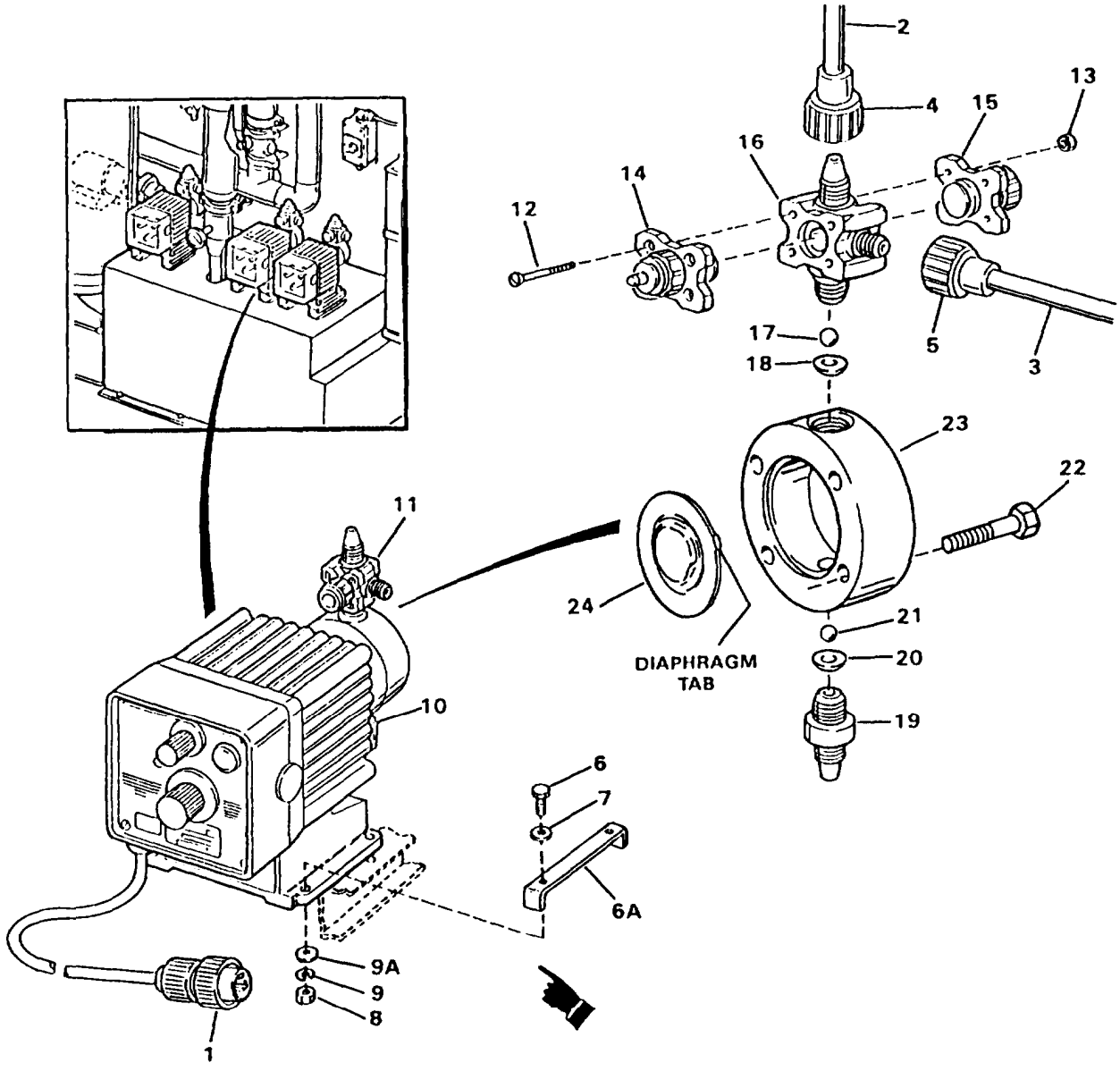


Figure 4-40. Chemical Injection Pumps (sheet 1 of 2)

DISASSEMBLY.

NOTE

Tubes are labeled with the same number at the pump and at the injection point.

a. Turn anti-siphon valve (11) off head (23).

b. Disassemble anti-siphon valve (11) by removing four screws (12) and nuts (13). Valve components (14,15 and 16) are now free.

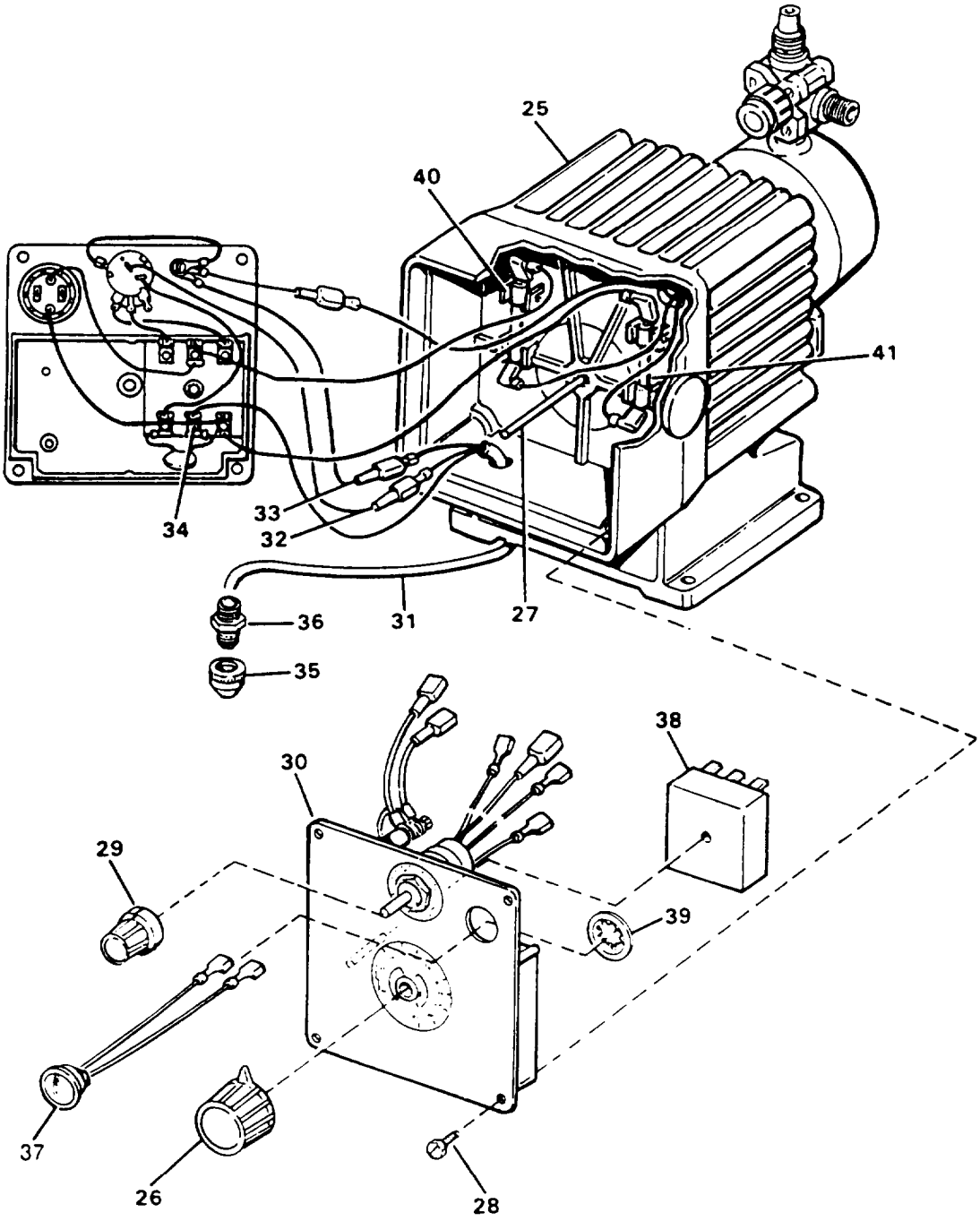


Figure 4-40. Chemical Injection Pumps (sheet 2 of 2)

c. Remove ceramic ball (17) and seal (18) from head (23).

d. Disassemble suction valve by removing body (19), seal (20) and ceramic ball (21).

e. Remove four screws (22) and remove head (23) from chemical pump (10).

f. Remove diaphragm (24) from chemical pump (10).

g. Disassembly of chemical housing (25, Figure 4-40, sheet 2) is as follows:

(1) Remove stroke knob (26) from stroke shaft (27).

(2) Remove four screws (28).

CAUTION

Carefully remove cover to avoid damage to wires and cover.

(3) Gently pull on speed control knob (29) to remove cover (30) from housing (25).

(4) Tag and remove power cable (31) from connectors (32 and 33) and spade (34).

(5) Remove nut (35) and connector (36) from chemical pump housing (25) and remove power cable (31).

(6) Tag and remove two yellow wires from light unit (37) at pulser (38).

(7) Pry retaining ring (39) from light unit (37) and remove light.

(8) Remove two fuses (40 and 41).

REPAIR.

Replace all damaged components.

REASSEMBLY.

a. Reassembly of chemical housing (Figure 4-40, sheet 2) is as follows:

(1) Install fuses (41 and 40) if necessary.

(2) Install light unit (37) in cover (30) and secure with retaining ring (39). Connect two yellow wires to pulser (38).

(3) Install power cable (31) through housing (25). Secure with connector (36) and nut (35).

(4) Connect power cable wires to connectors (32 and 33) and spade (34).

(5) Install cover (30) to housing (25) and secure with screws (28).

(6) Install stroke knob (26) onto stroke shaft (27).

b. Install diaphragm (24, Figure 4-40, sheet 1) on chemical pump (10).

c. Install head (23) into chemical pump wiring four screws (22).

d. Install ceramic ball (21), seal (20) and suction valve(19) into suction head (23).

e. Into head, install seal(18) and ceramic ball (17).

NOTE

Aline diaphragm notch to the notch in valve in valve body when assembling.

f. Reassemble anti-siphon valve (11) by installing valve components (14, 15 and 16). Secure with screws (12) and nuts (13).

g. Install anti-siphon valve (11) into head (23).

INSTALLATION.

a. Install chemical pump assembly (10) onto booster pump cover assembly and secure with two brackets (9B), four screws (6), washers (7), washers (9A), lockwashers (9) and nuts (8).

CAUTION

Hand tighten tube fittings to avoid damage.

b. Connect tubing (2 and 3) by tightening nuts (4 and 5).

c. Connect power cable and secure with ties (para. 4-10).

4-37. BACKWASH HYPOCHLORITE PUMP ASSEMBLY. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU Shutdown.

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock or moving parts.

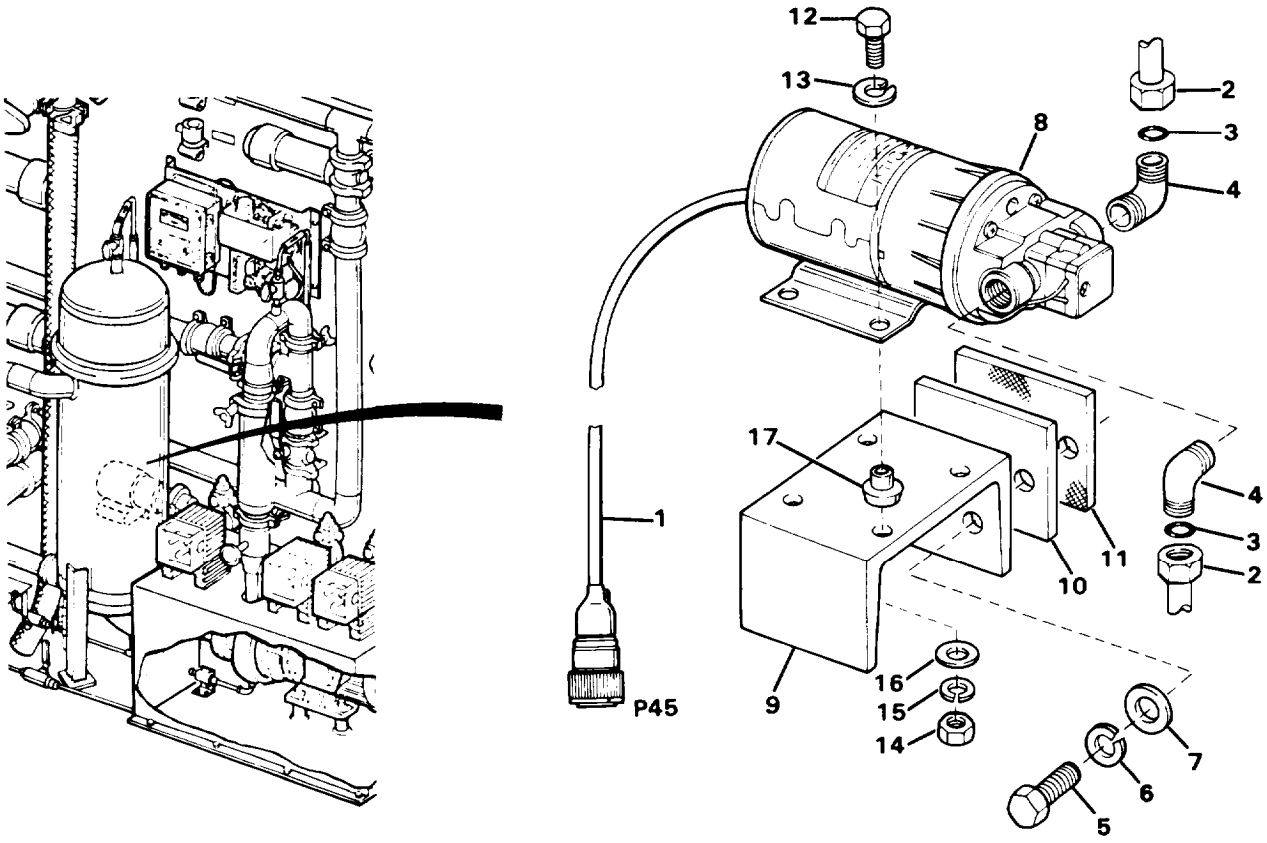


Figure 4-41. Backwash Hypochlorite Pump

REMOVAL.

a. Disconnect electrical cable (1, Figure 4-41) at main harness. Cut wire ties (para. 4-10).

b. Loosen nuts (2) and disconnect tubing (para. 4-26).

c. Remove two screws (5), lockwashers (6) and washers (7) and remove pump (8) and bracket (9). Remove spacers (10)and(11)

DISASSEMBLY.

a. Remove elbows (4).

b. Remove four screws (12), washer (13), nut (14), lockwasher (15) and washer (16).

c. Remove pump (8) and four grommets (17) from bracket (9).

REPAIR.

a. Replace any damaged or missing hardware or spacers.

b. Replace damaged tube fittings (para. 4-26).

REASSEMBLY.

a. Install new grommets(17) and pump (8) on bracket (9) and secure with four screws (12), washers 13), nuts (14), lockwashers(15) and washers (16).

b. Install two elbows (4),

INSTALLATION.

a. Position spacers (10 and 11) and install pump (8) and bracket (9) on wall of van. Secure with two screws (5), lockwashers (6) and washers (7).

b. Connect tubing using nuts (2) (para. 4-26).

c. Connect electrical cable(1) at main harness and install wire ties (para. 4-10).

4-38. HYPOCHLORITE TANK ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Terminal Strip Tool (16)

Materials/Parts:
Suitable Container
Suitable Tags
Tape, Antiseize (Appx E, Sec II, Item 67)
Wire Ties (Appx E, Sec II, Item 71)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU Shutdown. Fan and level switch. Electrical cables to Switch Panel No. 2 disconnected (para. 4-31).

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

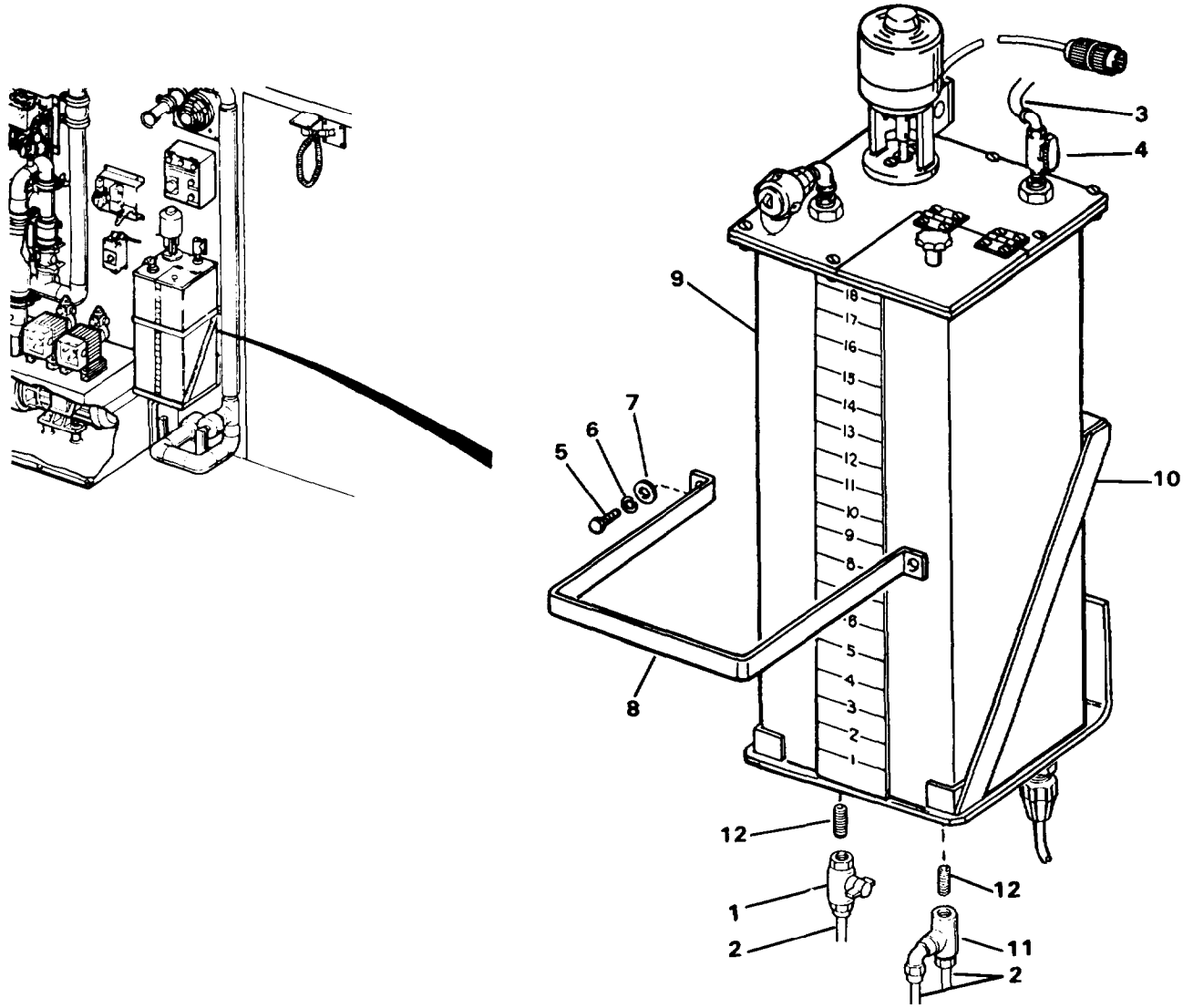


Figure 4-42. Hypochlorite Tank Assembly

WARNING

Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

DISASSEMBLY.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

NOTE

Refer to para. 4.26 for chemical tubing repair procedure.

a. Open drain valve (1, Figure 4-42) at bottom of tank and drain tank.

b. Tag and disconnect chemical tubing (2) from drain valve (1) and tee (11).

c. Disconnect chemical tubing (3) from backwash hypochlorite pump vent valve (4).

d. Cut plastic ties securing wiring harness to wall.

e. Loosen screw (5), lockwasher (6), and washer (7) and lift and remove bracket (8).

CAUTIONS

- When lifting out of frame be careful mixer motor does not hit panel.
- Be careful not to break valve or tee on tank bottom.

f. Lift entire hypochlorite tank assembly (9) from frame (10).

REPAIR.

Replace valve (1), tee (11) and two nipples (12).

REASSEMBLY.

a. Install two nipples(12) using antiseize tape and install valve (1) and tee (11). Place hypochlorite tank assembly (9) on frame (10).

b. Position bracket (8) on tank and secure with capscrews (5), lockwashers (6) and washers (7).

c. Install electrical cables to switch panel No. 2 (para. 4-31).

d. Secure level switch harness to wall with tie wraps (para. 4-10).

e. Install chemical tubing (3) on backwash hypochlorite pump vent valve (4).

f. Connect chemical tubing (2) to valve (1) and tee (11).

4-39. MIXER ASSEMBLY, This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Electrical Appx E, Sec II, Item 68)
Tape, Friction (Appx E, Sec II, Item 69)
Twine (Appx E, Sec II, Item 72)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Tank drained.

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

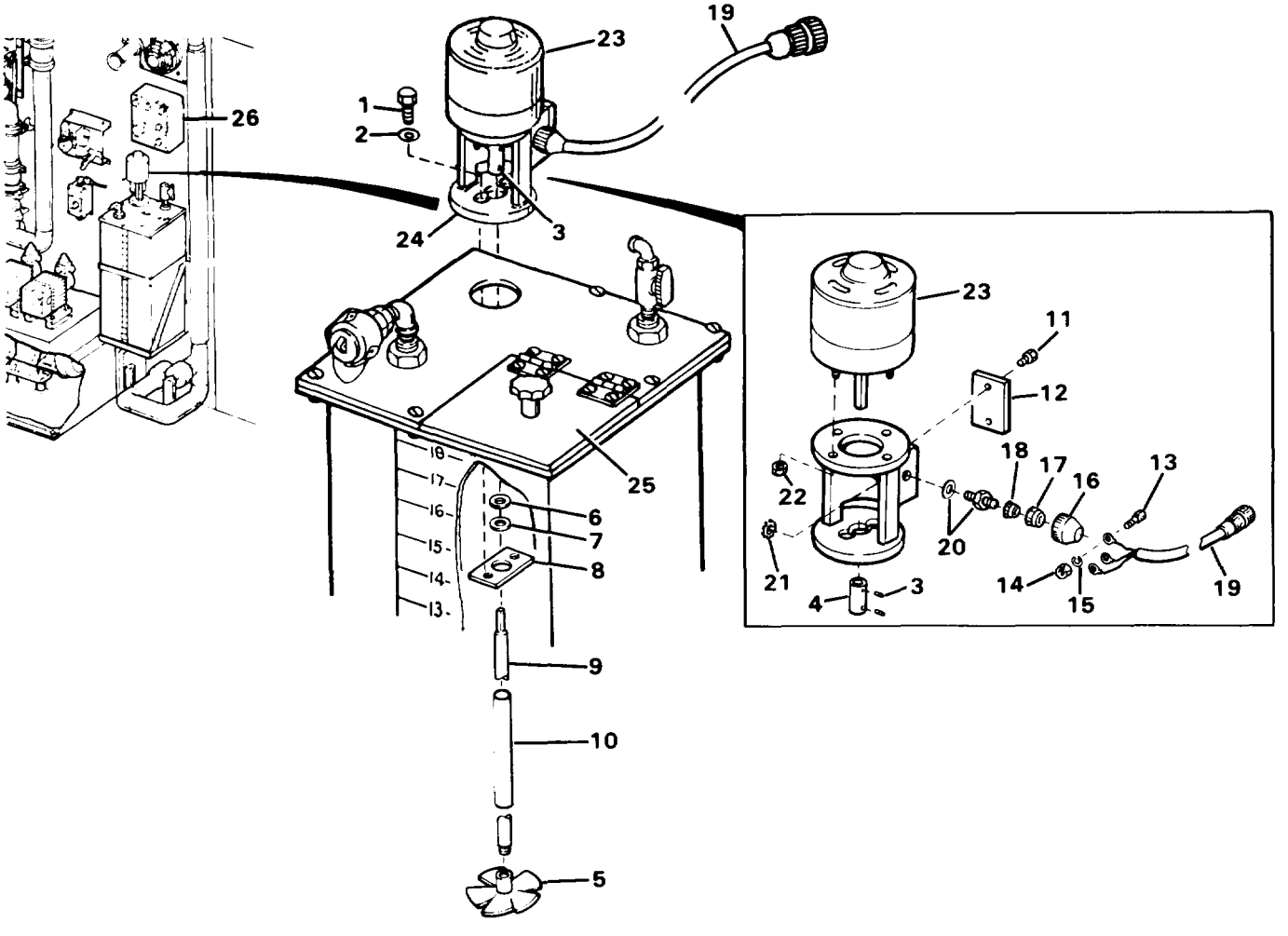


Figure 4-43. Mixer Assembly

DISASSEMBLY.

a. Disconnect mixer cable (19, Figure 4-43) by unscrewing it from switch panel No, 2 (26) (para. 4-31).

b. Remove two capscrews (1) and washers (2).

c. Loosen bottom two setscrews (3).

d. Open the tank access door (25).

e. Remove the shaft assemblv (5, 6, 7, 8, 9 and 10) throuqh the tank access door. Remove washer (6), seal (7) and plate (8). Unscrew propeller (5) and slide plastic tubing (10) off shaft (9).

f. Motor assembly (23) with attaching hardware can now be removed from the tank.

g. Remove top two setscrews (3) and sleeve (4) from motor (23) shaft.

h. Remove two screws (11) and plate (12).

i. Remove twine, tape and tag and disconnect two wires of cable (19) by removing screws (13), nuts (14) and lockwashers (15).

j. Remove ground screw inside conduit box and remove ground wire.

k. Unscrew nut (16). Retainer (17) and bushing (18) are now free on cable (19). Remove cable (19).

1. Remove connector with sealing washer (20) by removing conduit nut (21).

m. Remove nuts (22) and remove motor (23) from motor mount (24).

REPAIR.

a. Replace mixer cable if cable is cut or damaged or if connector is damaged.

b. Replace damaged hardware.

c. Replace the shaft or propeller, if bent or corroded.

d. Replace tubing if worn.

e. Replace wire markers (para. 4-10).

f. Replace loose or damaged ring tongue terminals (para, 4-10).

REASSEMBLY.

a. Install motor (23) on motor mount (24) and secure with nuts (22).

b. Install connector with sealing washer (20) and secure with conduit nut (21).

c. Install cable (19) with bushing (18) and retainer (17). Tighten nut (16).

d. Install ground wire of cable (19) in conduit box and secure with ground screw.

e. Connect two wires of cable (19) to conduit box using screws (13), nuts (14) and lockwashers (15). Tape connections with friction tape and electrical tape and tie with twine.

f. Install plate (12) with two screws (11).

g. Install sleeve (4) on motor (23) shaft and secure with top two setscrews (3).

h. Install assembled sleeve (4), cable (19), motor (23) and motor mount on tank.

i. Slide plastic tubing (10) on shaft (9) and screw propeller (5) onto shaft (9).

j. Install plate(8), seal (7) and washer (6) on propeller shaft(9). Insert propeller shaft assembly (items 5thru 10) into sleeve (4) and secure with top two setscrews (3).

k. Screw two capscrews (1) with washers (2) into plate (8).

l. Close access door (25).

m. Connect cable (19) to switch panel No. 2 (26) (para. 4-31).

4-40. HYPOCHLORITE TANK COMPONENTS AND COVERS. This task covers:

a. Disassembly. b. Repair. c. Test. d. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Multimeter (2)
Heat Gun (16)
Terminal Strip Tool (16)

Materials/Parts:
Sealant, Pipe (Appx E, Sec II, Item 62)
Sealant, Silicone (Appx E, Sec II, Item 63)
Tape, Antiseize (Appx E, Sec II, Item 67)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2

Equipment Condition:
ROWPU shutdown.
Hypochlorite Tank Assembly removed (para. 4-35)
Mixer Assembly removed (para. 4-36)

General Safety Instructions:

WARNING

- Observe specific Warnings in text.
- Do not wear loose clothing or jewelry while working on equipment.

WARNING

Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

WARNING

Protect eyes and skin from direct contact with chemicals. Wash hands thoroughly with soap and water after handling parts in the tank.

DISASSEMBLY

a. Disconnect tubing by unscrewing nut (1, Figure 4-44). Remove cover (37) with assembled components by removing four capscrews (2), washers (3), nuts (4) and washers (5).

b. Remove dust cap (6), elbow (7) and nipple (8), Remove gasket (9) from dust cap (6).

c. Remove nut (10), gasket (11), fitting (12), bushing (13) and tube fitting (14).

d. Remove elbow (15), valve (16), nipple (17), nut (18), fitting (19) and gasket (20).

e. Remove two screws (21), nuts (22), washers (23) and nameplate (24).

f. Remove two screws (25), nuts (26), washers (27) and nameplate (28)

g. Remove four screws (29), nuts (30), washers (31) and hinges (32).

h. Remove knob (33) by removing screw (34) and washer (35). Plate (36) and cover (37) are now free.

i. Disconnect nut (44) and pull assembled items (38 thru 49) out as an assembly. Remove strainer (38), valve seat (38A), preformed packing (38 B), and ball check (38C) from primer fitting (39).

i.1. Unscrew nuts (40) from primer fitting (39) and elbow (45). Compression rings (41) and tubing (42 and 43) can now be removed. Remove elbow (45), nipple (46), bushing (47), bulkhead fitting (48) and gasket (49).

j. Unscrew nut (50). Retainer (51) and bushing (52) are now loose on wires (53) and can be slid off at the free end.

CAUTION

Wires are covered with shrink tubing. Do not damage switch wires.

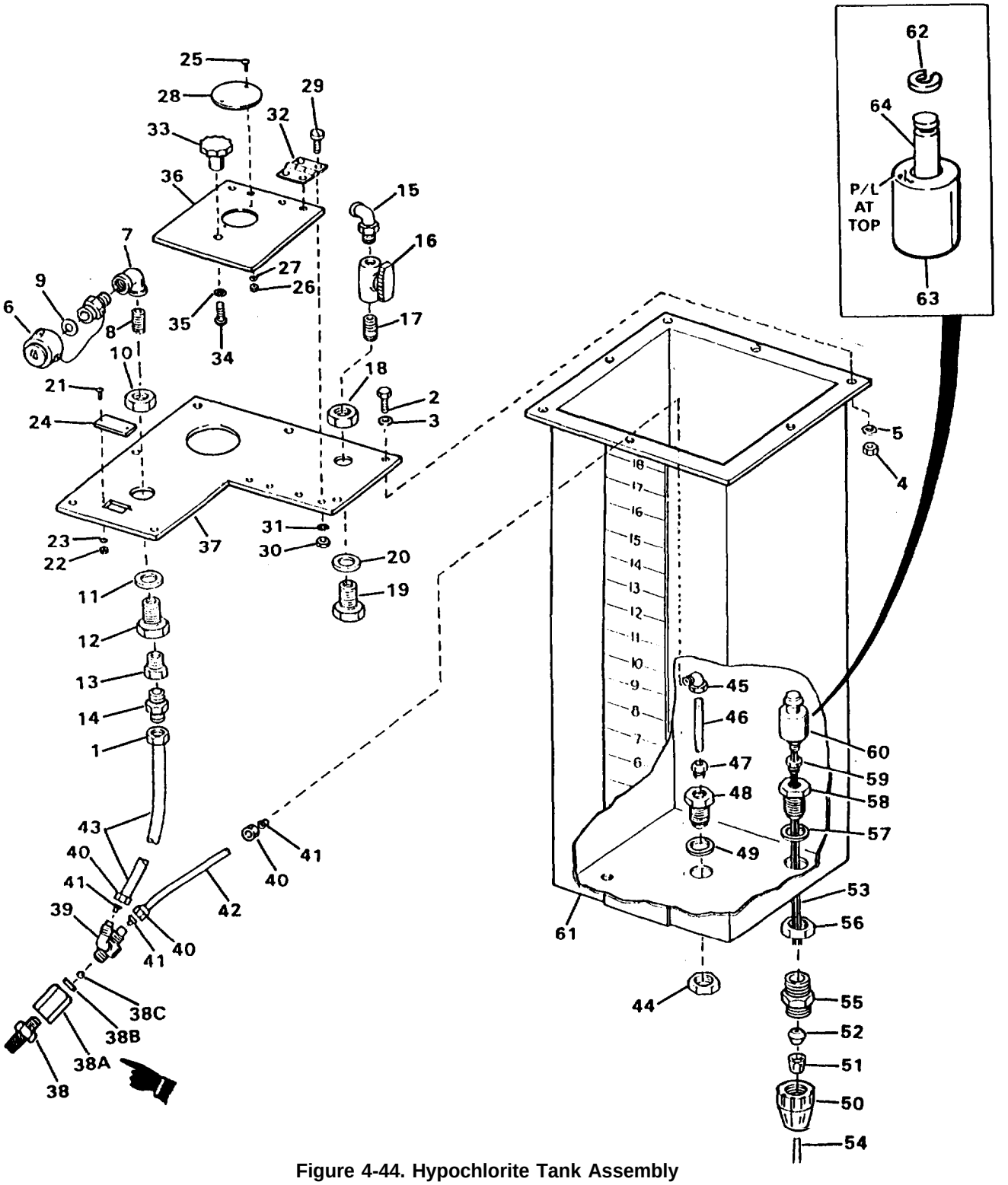


Figure 4-44. Hypochlorite Tank Assembly

k. If necessary, remove shrink tubing (54) by carefully slitting it with a knife.

l. Unscrew body (55) from bulkhead fitting (58) and remove body (55) and nut (56).

m. Remove items (57 thru 60) as an assembly. Remove gasket (57), fitting (58), bushing (59) and level switch (60). Tank (61) is now free.

REPAIR.

a. Repair all unserviceable components by replacement.

b. Repair leaks at pipe threads using two wraps of antiseize tape on male fittings.

c. Repair leaks around nuts (44 and 56) by tightening nuts. If that does not work, replace gaskets (49 and 57).

d. Repair leaks into wire shrink tubing (54) by applying antiseize tape on all threaded fittings. Also, fill bottom hole in fitting (58) with silicone sealant.

e. Replace inlet strainer (38) if plugged.

f. Replace damaged or inoperative level switch (60).

TEST.

NOTE

If level switch assembly must be replaced, proceed with test procedure. If the original switch is being used, proceed to reassembly.

a. Hold switch (60) with clip pointing upward and wires (53) pointing downward as shown in Figure 4-44.

b. Refer to the inset on Figure 4-44 and find letters P/L on float (63), P/L must be at clip end of shaft (64). If not, remove clip (62), and reposition float (63) on shaft (64) with P/L clip end. Reinstall clip (62).

c. Attach a multimeter set to ohms x 1 to the black wire (53) and either one of the other two wires (53).

d. Check for continuity between the two wires while holding the switch (60) with the wires pointing down and the float bottomed out on the switch shaft, If the circuit is open, attach the multimeter to the other colored wire.

e. The black wire is No. 324. Attach a wire label (para. 4-10).

f. When the meter shows continuity, the other tested wire is No. 342 and the third wire is No. 341. Attach wire labels (para. 4-10).

g. Check the operation of the switch as follows:

(1) Wires down/float down . . . . . 324 to 342 = continuity; 324 to 341 = open circuit

(2) Wires down/float up . . . . . 324 to 342 = open circuit; 324 to 341 = continuity

NOTE

Tighten all connections without using excessive force on plastic fittings.

REASSEMBLY.

a. Put antiseize tape on level switch (60) and bushing (59) threads. Install switch (60) into bushing (59) and install this assembly into bulkhead fitting (58).

b. Fill the bore of fitting (58) with silicone sealant.

c. Install gasket (57) unfitting (58) and install items (57 thru 60) in the tank as an assembly, with wires (53) protruding through the bottom of the tank.

d. Install nut (56) over wires (53) and install body (55) in fitting (58). Tighten nut (56) securely to prevent leaks

NOTE

Proceed with step e only if new switch or new shrink wrap tubing are being installed. Otherwise, proceed with step f.

e. Install new shrink tubing (54) on wires (53) as follows:

(1) Slide wires (53) through a new piece of shrink tubing (54). Make sure the new tubing is long enough to reach the junction box and that the wires stick out at least ten inches from the end of the tubing.

(2) Push the shrink tubing on the wires until one end of it goes into body (55).

(3) Apply heat with the heat gun and shrink the tube onto the wires.

f. Slide bushing (52), retainer (51) and nut (50) over the wires and screw nut (50) onto body (55).

NOTE

Ensure that ball check (38C) is in the strainer.

f.1. Install ball check (38C), preformed packing (38B) and valve seat (38A) onto strainer (38).

g. Reassemble inlet strainer (38), primer fitting (39), tubes (42 and 43) with tube nuts (40) and compression rings (41), elbow (45), nipple (46), bushing (47), bulkhead fitting (48) and gasket (49) and install in tank (61) as a unit.

h. Install nut (44) to secure the assembly in place. Tighten nut (44) securely to prevent leaks.

i. Install knob (33) on plate (36) and secure with screw (34) and washer (35).

j. Install hinges (32) on plate (36) and secure hinges to plate (36) and cover (37) using screws (29), washers (31) and nuts (30).

k. Install nameplate (28) and secure with screws (25), washers (27) and nuts (26).

l. Install nameplate (24) and secure with screws (21), nuts (22) and washers (23).

m. Install gasket (20) on fitting (19) and secure fitting (19) on cover (37) with nut (18). Install bushing (17), valve (16), and elbow (15).

n. Reassemble fitting (14), bushing (13), fitting (12), and gasket (11) and secure the subassembly to cover (37) with nut (10).

o. Install bushing (8), elbow (7), gasket (9) in dust cover (6) and install adapter with dust cover on elbow (7).

p. Install assembled cover (37) on tank (61) and secure with capscrews (2), washers (3), washers (5) and nuts (4).

q. Reach inside tank and secure tubing (43) to fitting (14) using nut (1).

4-41. HYPOCHLORITE TANK FRAME. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
Hypochlorite tank assembly removed (para. 4-38).

REMOVAL.

a. Remove six screws (1, Figure 4-45), Iockwashers (2) and flat washers (3).

b. Remove tank bracket (4).

INSTALLATION.

a. Install new bracket (4).

b. Install six screws (1), Iockwashers (2) and flat washers (3).

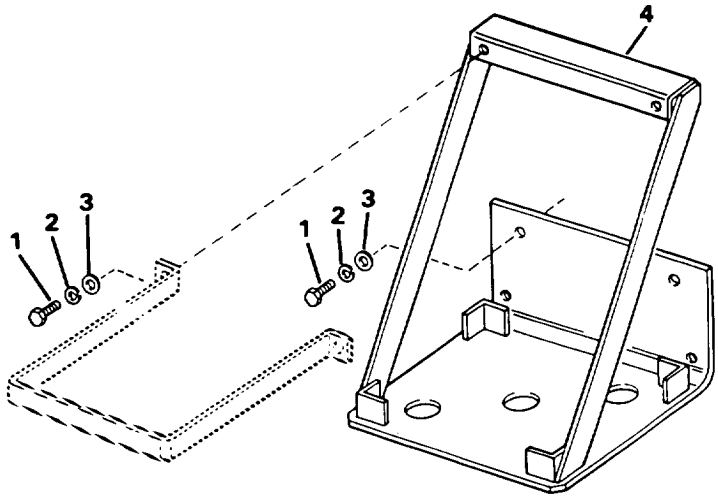


Figure 4-45. Hypochlorite Tank Frame

4-42. BOOSTER PUMP COVER ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Riveter, Blind, Hand (2)
Rivnut Repair Kit(15)

Materials/Parts:
Adhesive, Neoprene Contact (Appx E, Sec II, Item 1)
Sealant, Silicone (Appx E, Sec II, Item 63)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)
Rivets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
Chemical injection pumps removed (para. 4-36).

DISASSEMBLY.

a. Remove four capscrews (1, Figure 4-46), Iockwashers (2) and washers (3) and remove cover (4).

b. Remove four capscrews (5), Iockwashers (6) and washers (7).

c. Remove three capscrews (8), Iockwashers (9), and washers (10).

d. Remove four screws (12), washers(13) and two brackets(14) and remove sound enclosure (11).

e. Remove two capscrews (18), Iockwashers (19), washers (20), nuts (21) and panel (22).

f. Remove two capscrews (23), Iockwashers (24), washers (25), nuts (26) and panel (27).

g. Remove two capscrews (28), Iockwashers (29), washers (30) and bracket (31).

h. Remove two capscrews (37), Iockwashers (38), washers (39) and bracket (40).

i. Remove two capscrews (32), washers (33), nuts (34), washers (35) and Iockwashers (19).

REPAIR.

a. Repair cuts in panels by riveting on a waterproof patch.

b. Replace damaged components and missing hardware.

c. If insulation is damaged, pull off the sheets of insulation, scrape off old glue, and cut new panels of insulation to fit. Spray interior surfaces of sound enclosure (11) and new insulation with neoprene contact adhesive, install insulation and seal edges of new insulation with sealant.

d. If rivets are broken, drill them out and replace them from inside enclosure(11). If necessary, remove and replace insulation to replace rivets.

e. Replace nameplates if damaged (para. 4-10).

f. Replace damaged rivnuts (para. 4-10).

REASSEMBLY.

a. Install bracket (40) and secure with capscrews (37), Iockwashers (38) and washers (39).

b. Secure top of bracket (40) using capscrews (32), washers (33), nuts (36), washers (35) and Iockwashers (34).

c. Install bracket (31) and secure with capscrews (28), Iockwashers (29) and washers (30).

d. Install panel (27) and secure it with capscrews (23), Iockwashers (24), washers (25) and nuts (26).

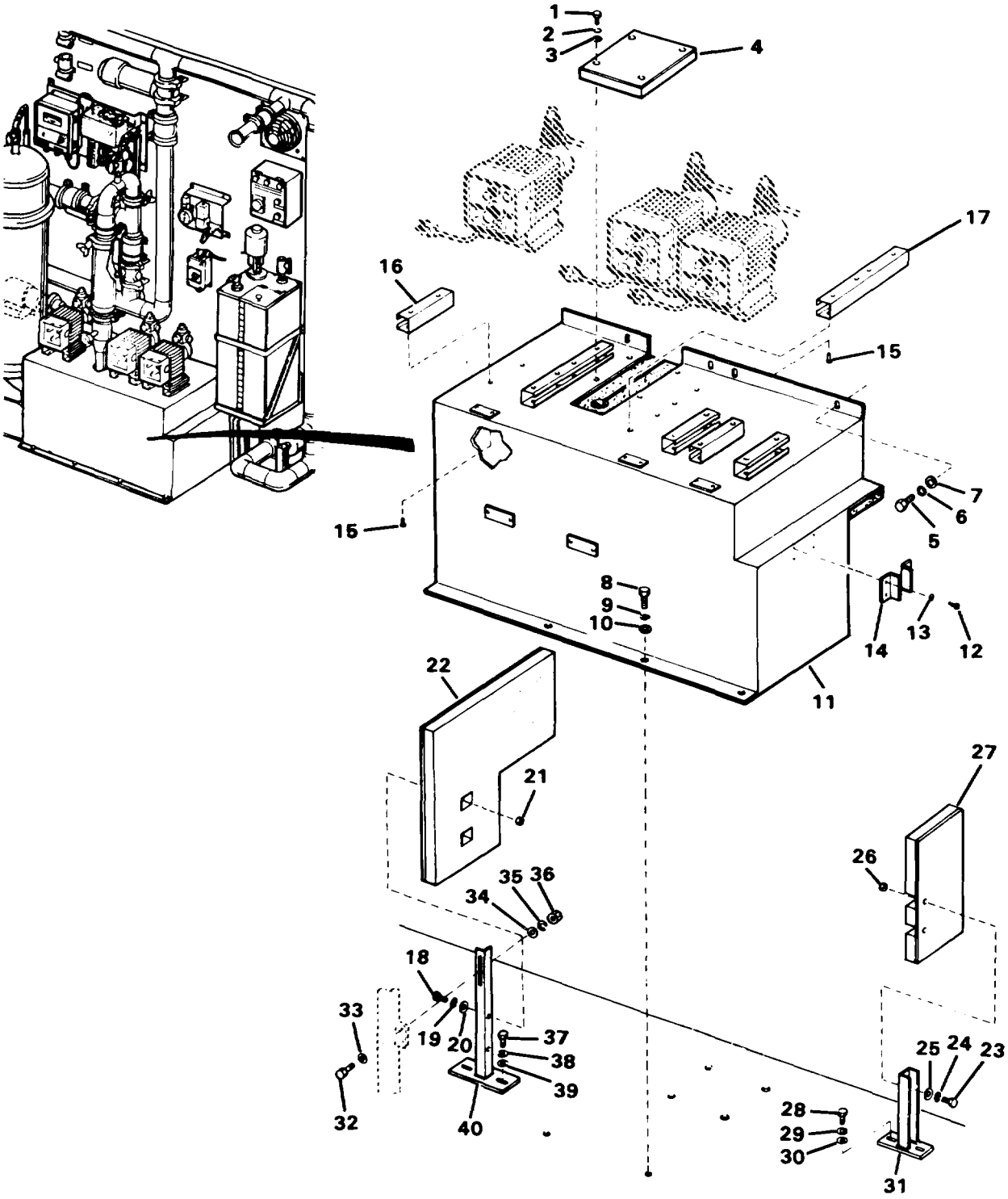


Figure 4-46. Booster Pump (Sound Enclosure) Cover Assembly

e. Install panel (22) and secure with capscrews (18), lockwashers (19), washers (20) and nuts (21).

f. If channels (16 and 17) were removed, install and secure with rivets (15).

g. Install brackets (14) and secure with washers (13) and capscrews (12).

h. Install assembled enclosure (11) and secure with capscrews (8), lockwashers (9), washers (10), capscrews (5), lockwashers (6) and washers (7).

i. Install cover (4) and secure with capscrews (1), lockwashers (2) and washers (3).

4-43. BOOSTER PUMP AND MOTOR ASSEMBLY. This task covers**: (MODEL WTA-060 ONLY)**
a. Removal b. Disassembly c. Repair d. Reassembly e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Multimeter 12)
Lifting Equipment (8)
Electrical Repair Kit (16)

Materials/Parts:
Tape, Electrical (Appx E, Sec II, Item 68)
Tape, Friction (Appx E, Sec II, Item 69)
Twine (Appx E, Sec II, Item 72)
Varnish, Electrical (Appx E, Sec II, Item 73)
Suitable Tags
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown, basket strainer and piping drained down below level of booster pump, chemical Injection pumps removed (para. 4-36), booster pump cover removed (para. 4-42). Access panel removed (para. 4-74).

Personnel Required: 2

General Safety Instructions:
WARNING

Observe specific Warning in text.

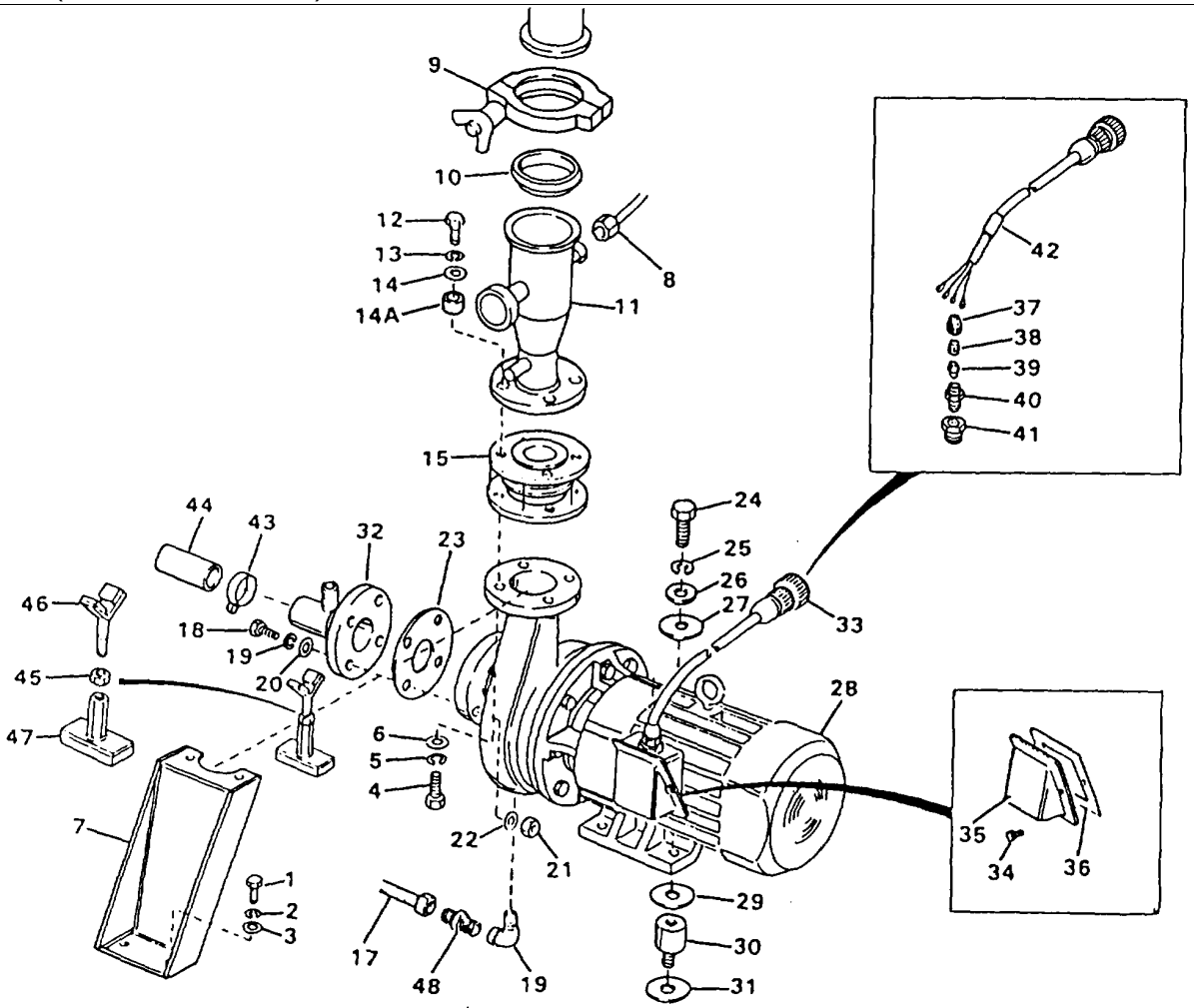


Figure 4-47. Booster Pump Motor Assembly (sheet 1 of 2)
(MOOEL WTA-060 ONLY)

WARNINGS

- The booster pump is too heavy to be carried manually. Use proper lifting equipment.
- Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

REMOVAL.

a. Disconnect booster pump motor power cable (33, Figure 4-47, sheet 1).

b. Remove four lockwashers (2), flat washers (3), and capscrews (1) holding bracket (7) to floor. Remove four capscrews (4), lockwashers (5), flat washers (6) and remove bracket (7).

c. Loosen tubing nut and remove tubing (8).

d. Remove clamp (9) and gasket (10).

NOTE

Some ROWPU's may not have spacer (14A).

e. Remove four capscrews (12), lockwashers (13), flat washers (14), spacer (14A), piping assembly (11) and expansion joint (15).

f. Loosen nuts(16) and remove drain line (17).

g. Remove fourcapscrews(18), lockwashers (19), flat washers (20), nuts (21) and flat washers (22).

h. Remove four capscrews (24), lockwashers (25), flat washers (26) and rubber washers (27). Remove pump assembly (28) and gasket (23).

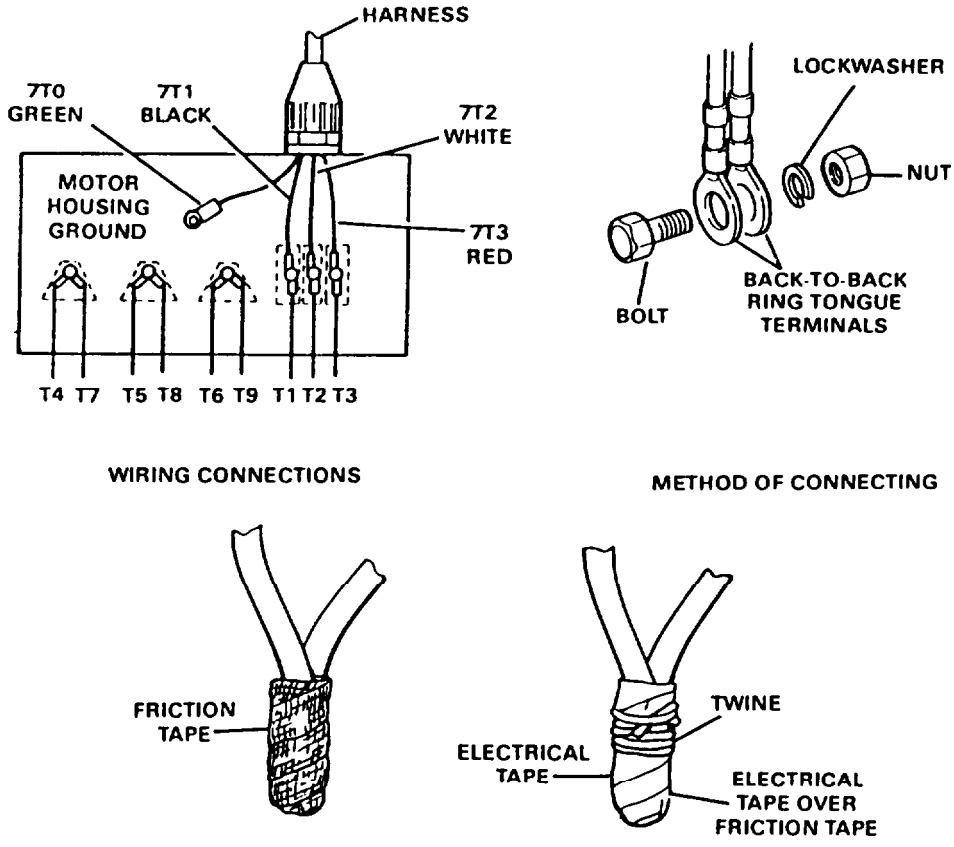


Figure 4-47. Booster Pump Motor Assembly (sheet 2 of 2)

i. Remove four rubber washers (29), mounts (30) and rubber gaskets (31).

WARNING

To avoid injury, two personnel are required to lift pump. Pump weighs over 50 lbs.

j. Use lifting chain hoist to remove booster pump from van.

DISASSEMBLY.

a. Remove two screws (34), cover (35) and gasket (36) from the electrical box on the motor.

b. Unscrew nut (37), and slide retainer (38) and bushing (39) up on cable (42).

c. Refer to Figure 4-47, sheet 2 and disconnect and tag the four wires from cable (42, sheet 1) as illustrated. Cable (42, sheet 1) is now free.

d. Remove connector body (40) and reducing bushing (41).

e. Loosen the clamp (43) on the boot (44), Remove four capscrews (18), washers (20), nuts (21), lockwashers (19) and washers (22) and slide flange (32) away from pump to facilitate removal. Remove gasket (23).

f. Loosen the nut (45) between the support (46) and bracket (47) and turn the bracket to obtain adequate room for pump removal.

NOTE

Use lifting hoist and eyebolts in ROWPU ceiling to remove pump from ROWPU.

g. Remove four capscrews (24), lockwashers (25), washers (26), rubber washers (27) and pump assembly (28).

h. Remove rubber washers (29), mounts (30) and rubber washers (31).

i. Remove fining (48) and elbow (49).

REPAIR.

a. Repair by replacing cable if it is shorted, does not show continuity from end to end on any wire, if connector is damaged, or installation is cut or damaged.

b. Repair any damaged part by replacement.

c. Repair leaking pump drain connection by using pipe thread sealant on pipe threads.

d. Replace wire markers (para. 4-10).

e. Replace any damaged or loose ring tongue terminals (para. 4-10).

REASSEMBLY.

a. Install reducing bushing (41) and screw body (40) into the bushing (41).

b. Slide nut (37), retainer (38) and bushing (39) onto cable (42).

c. Refer to Figure 4-47, sheet 2, slide the four cable wires through reducing bushing into the motor housing box and connect the red, white, black and green motor wires as shown. Use a bolt, washer and nut to secure each pair of ring tongue connectors.

d. Connect the ground lead (green) to the motor housing, using a capscrew as shown. Also, check to see that the internal motor connections (which are marked with small metal tags) are connected as shown (T4 to T7, T5 to T8 and T6 to T9) if these wires have been disconnected or if a new motor is being installed.

NOTE

Spray or brush electrical connections with varnish conforming to MIL-V-173 before taping electrical connections.

e Tape all motor connections with friction tape, then with electrical tape and tie them with twine as shown.

f Refer to Figure 4-47, sheet 1 and install gasket (36) cover (35) and capscrews (34).

g. If bracket (47) and/or support (46) have been removed, install under flange (32) and tighten nut (45) until support (46) is snug against flange (32).

h. If clamp (43) and boot (44) have been removed, position boot (44) and clamp (43) on flange (32) and tighten screw on clamp (43).

INSTALLATION.

a. Install rubber gaskets (31), mounts (30) and rubber washers (29).

WARNING

To avoid injury, two personnel are required to lift pump. Pump weighs over 50 lbs.

b. Using suitable lifting equipment, place the pump assembly(28) on mounts(30), taking care that washers (29) are properly positioned on the mounts. Secure with capscrews (24), lockwashers (25), washers (26) and rubber washer (27)

c. Install gasket (23) with hardware (18 thru 22).

d. Install drain line (17) with nuts (16).

NOTE

Some ROWPU's may not have spacer (14A).

e. Position expansion joint (15) on pump flange. Install piping (1) and secure with capscrews (12), lockwashers (13), flat washers (14) and spacer (14A).

f. Install gasket (10) and clamp (9).

g. Attach tubing (8) with tubing nut.

h. Position bracket (7) and secure with hardware (1 thru 3).

I. Secure expansion joint (15). to pump flange with capscrews (4), lockwashers (5) and washers (6).

j. Connect motor power cable (42)

4-43.1. BOOSTER PUMP AND MOTOR ASSEMBLY. This task covers: **(MODEL ROWPU-1 ONLY)**
a. Removal b. Disassembly c. Repair d. Reassembly e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Multimeter (2)
Lt.hing Equipment (8)
Electrical Repair Kit (16)
Access panel removed (para. 4-74).

Equipment Condition:
ROWPU shutdown, basket strainer and piping drained down below level of booster pump, chemical injection pumps removed (para. 4-36), booster pump cover removed (para. 4-42).

Materials/Parts.
Tape, Electrical (Appx E. Sec II, Item 68)
Tape, Friction (Appx E, Sec II, Item 69)
Twine (Appx E. Sec II, Item 72)
Varnish, Electrical (Appx E, Sec II, Item 73)
Suitable Tags
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2
General Safety Instructions:

WARNING
Observe specific Warning in text.

WARNING

- The booster pump is too heavy to be carried manually. Use proper lifting equipment.
- Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury from electrical shock or moving pans.

REMOVAL.

.

a. (Refer to Figure 4-47.1, sheet 1). Close feed valve V14 (53) and cleaning bypass valve V13 (54).
b. Remove clamp (55), clamp (56), and clamp (57).
c. Remove dual strainer system (58) as an assembly.
d. Disconnect booster pump motor power cable (33).
e. Remove four lockwashers (2), flat washers (3), and capscrews (1) holding bracket (7) to floor. Remove four capscrews (4), lockwashers (5), flat washers (6) and remove bracket (7).
f. Loosen tubing nut and remove tubing (8).
g. Remove two clamps (50) and two gaskets (51).

NOTE
Some ROWPU's may not have spacer (1 4A),

h. Remove four capscrews (12), four lockwashers (13), four flat washers (14), spacer (14A), pipe section (52), and expansion joint (15).
i. Loosen nuts (16) and remove drain line (17).
j. Remove four capscrews (18), lockwashers (19), flat washers (20), nuts (21) and flat washers (22).
k. Remove four capscrews (24), lockwashers (25), flat washers (26) and rubber washers (27). Remove pump assembly (28) and gasket (23).
I. Remove four rubber washers (29), mounts (30) and rubber gaskets (31).

WARNING
To avoid injury, two personnel are required to lift pump. Pump weighs over 50 lbs.

m. Use lifting chain hoist to remove booster pump from van.

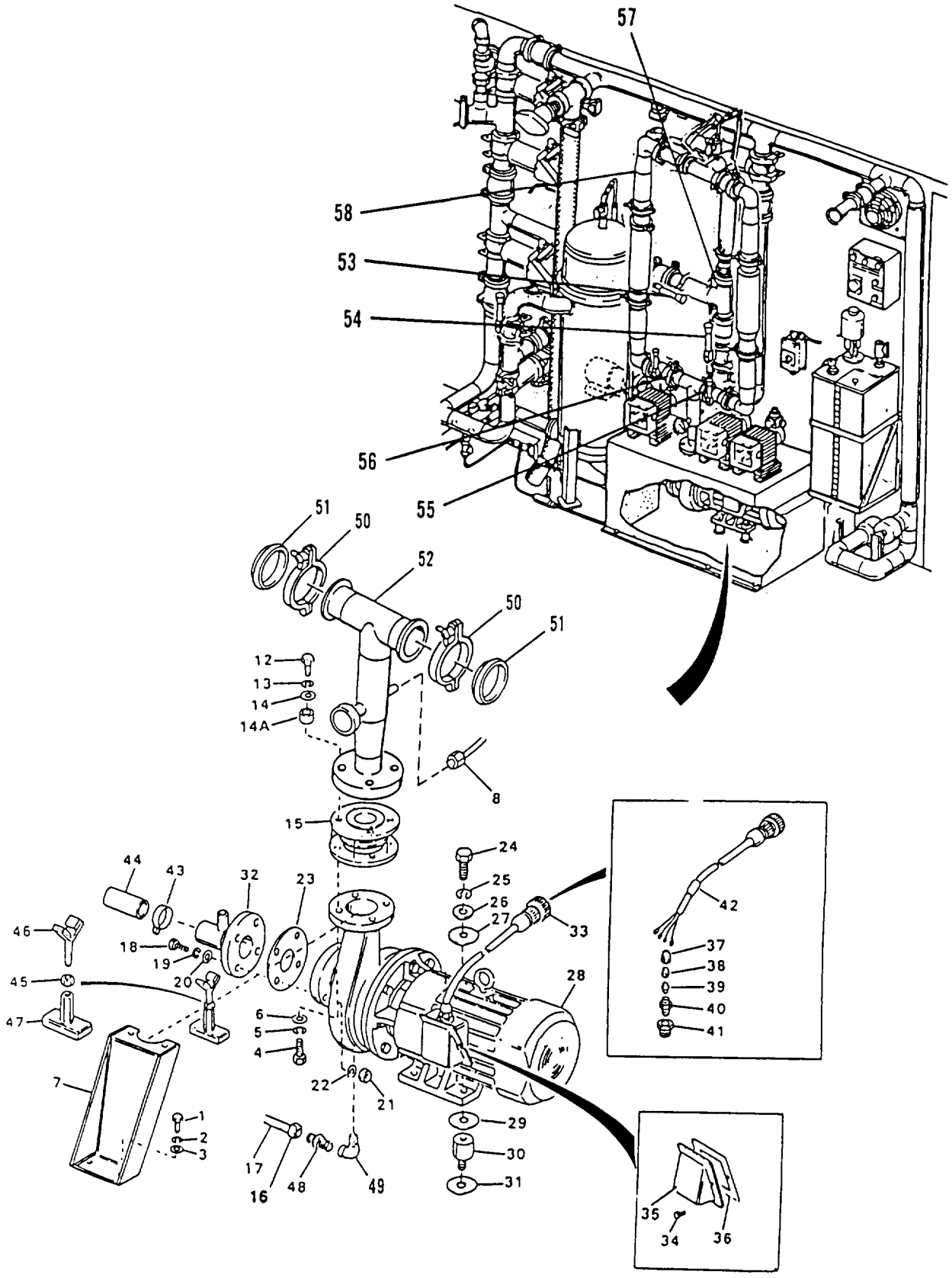


Figure 4-47.1 Booster Pump Motor Assembly (Sheet 1 of 2)
(MODEL ROWPU-1 ONLY)

DISASSEMBLY.

a. Remove two screws (34), cover (35) and gasket (36) from the electrical box on the motor.
b. Unscrew nut 137), and slide retainer (38) and bushing (39) up on cable (42).
c. Refer to Figure 4-47.1, sheet 2 and disconnect and tag four wires from cable (42, sheet 1) as illustrated. Cable (42, sheet 1 is now free.
d. Remove connector body (40) and reducing bushing (41). V
e. Loosen the clamp (43) on the boot (44). Remove four capscrews(18). washers (20), nuts (21), lockwashers (9) and ,washer (22) and slide flange (32) away from pump to facilitate removal. Remove gasket (23).
f. Loosen the nut (45) between the support (46) and bracket (47) and turn the bracket to obtain adequate room for pump removal.

NOTE

Use lifting hoist and eyebolts in ROWPU ceiling to remove pump from ROWPU.

g. Remove four capscrews (24), lockwashers (25), washers (26), rubber washers (27) and pump assembly (28)
h. Remove rubber washers (29), mounts (30) and rubber washers (31).
i. Remove fitting (48) and elbow (49).

REPAIR

a. Repair by replacing cable if it is shorted, does not show continuity from end to end on any wire, if connector is damaged, or installation is cut or damaged.
b. Repair any damaged part by replacement.
c. Repair leaking pump drain connection by using pipe thread sealant on pipe threads.
d. Replace wire markers (para. 4-10).
e. Replace any damaged or loose ring tongue terminals (para. 4-10).

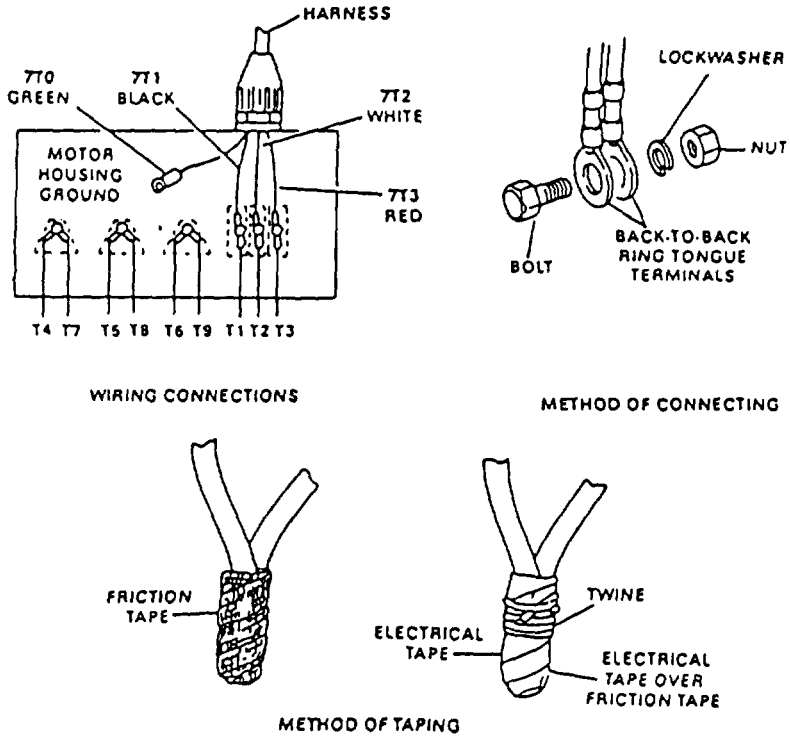


Figure 4-47.1 Booster Pump Motor Assembly (Sheet 2 of 2) -
(MODEL ROWPU-1 ONLY)

REASSEMBLY.

a. Install reducing bushing (41) and screw body (40) into the bushing (41).

b. Slide nut (37), retainer (38) and bushing (39) onto cable (42).

c. Refer to Figure 4-47.1, sheet 2, slide the four cable wires through reducing bushing into the motor housing box and connect the red, white, black, and green motor wires as shown. Use a bolt, washer, and nut to secure each pair of ring tongue connectors.

d. Connect the ground lead (green) to the motor housing, using a capscrew as shown. Also, check to see that the internal motor connections (which are marked with small metal tags) are connected as shown (T4 to T7, T5 to T8 and T6 to T9) if these wires have been disconnected or if a new motor is being installed.

NOTE
Spray or brush electrical connections with varnish conforming to MIL-V-173 before taping electrical connections.

e. Tape all motor connections with friction tape, then with electrical tape and tie them with twine as shown.

f. Refer to Figure 4-47.1, sheet 1 and install gasket (36), cover (35) and capscrews (34).

g. If bracket (47) and/or support (46) have been removed, install under flange (32) and tighten nut (45) until support (46) is snug against flange (32).

h. If clamp (43) and boot (44) have been removed, position boot (44) and clamp (43) on flange (32) and tighten screw on clamp (43).

INSTALLATION.

a. Install rubber gaskets (31), mounts (30) and rubber washers (29).

WARNING
To avoid injury, two personnel are required to lift pump. Pump weighs over 50 lbs.

b. Using suitable lifting equipment, place the pump assembly (28) on mounts (30), taking care that washers (29) are properly positioned on the mounts. Secure with capscrews (24), lockwashers (25), washers (26) and rubber washer (27).

c. Install gasket (23) with hardware (18 thru 22).

d. Install drain line (17) with nuts (16).

NOTE
Some ROWPU's may not have a spacer.

e. Position expansion joint (15) on pump flange. Install piping (52) and secure with four capscrews (12), four lock washers (13), four flat washers (14), and spacer (14A).

f. Install two gaskets (51) and two clamps (50).

g. Attach tubing (8) with tubing nut.

h. Position bracket (7) and secure with hardware (1 thru 3).

I. Secure expansion joint (15) to pump flange with capscrews (4), lockwashers (5) and washers (6).

j. Connect motor power cable (42).

k. Place dual strainer system (58) into position.

l. Install clamp (57), clamp (56), and clamp (55).

m. Open cleaning bypass valve V13 (54) and feed valve V14 (53).

4-44. CARTRIDGE FILTER ASSEMBLY. This task coves:

a. Removal. b. Disassembly. c. Repair. d. Reassembly e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown.

Materials/Parts:
Elements, Cartridge Filter (Appx E, Sec II Item 35)
Tape, Antiseize (Appx E, Sec II, Item 67)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

NOTE
Valves are open when handles are parallel to drain lines.

NOTE
Internal components of cartridge filter can be repaired without removing cartridge filter assembly.

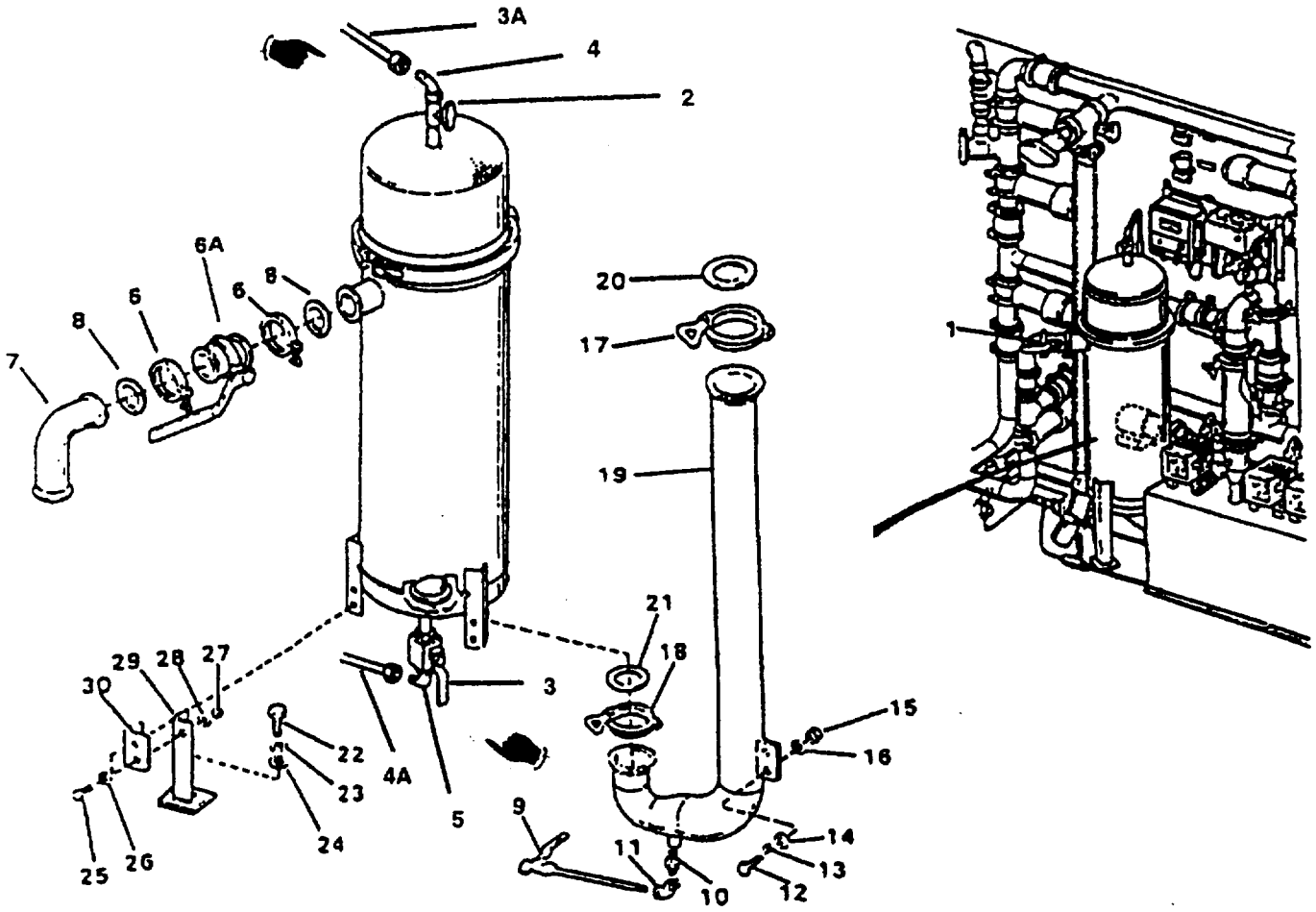


Figure 4-48. Cartridge Filter (Sheet 1 of 3)
(MODEL WTA-060 ONLY)

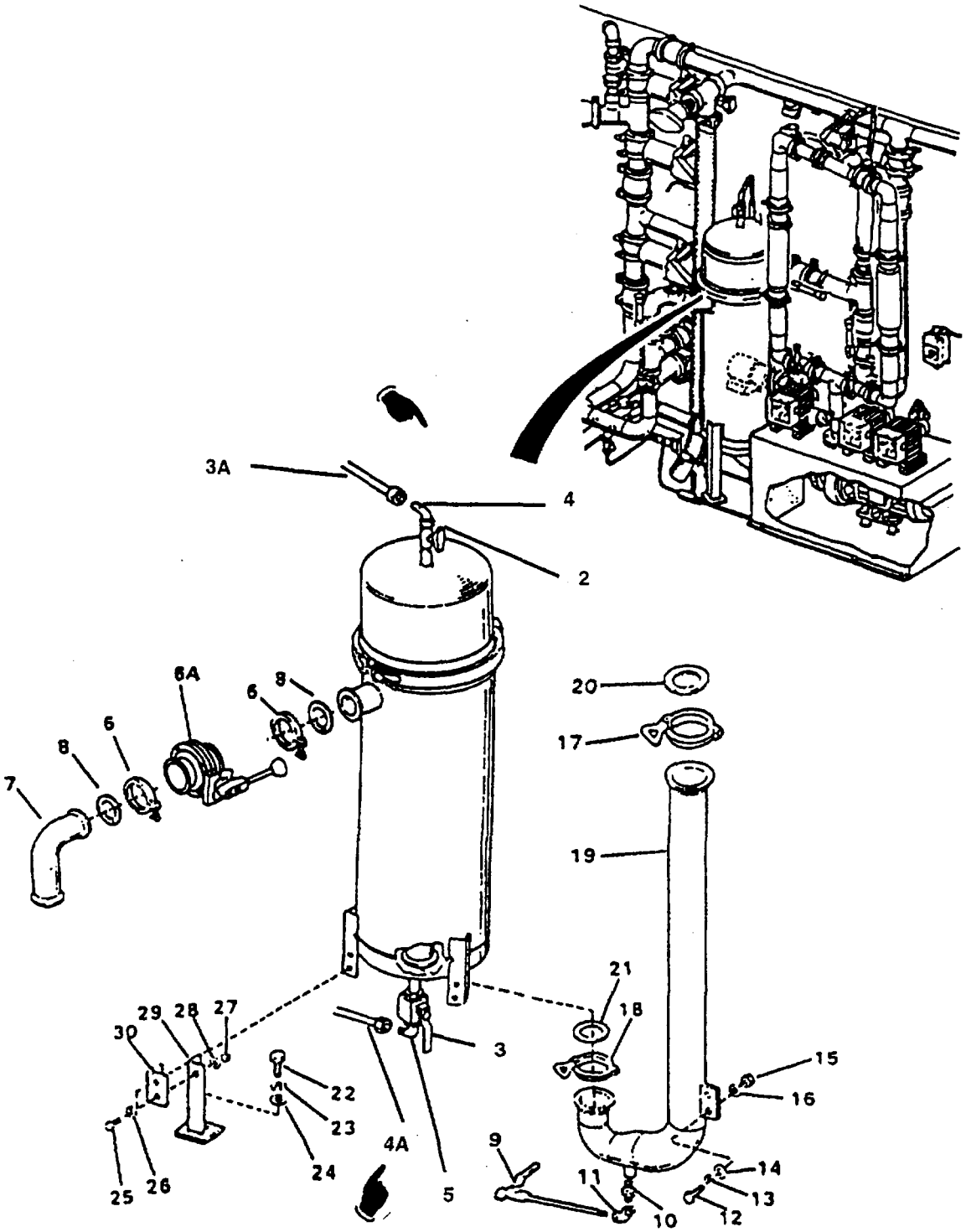


Figure 4-48. Cartridge Filter (Sheet 2 of 3)
(MODEL ROWPU-1 ONLY)

REMOVAL.

a. Close cartridge filter block valve (1, Figure 4-48, sheet 1).
b. Open vent valve (2).
c. Open valve (3) and drain the cartridge filter.
d. Unscrew coupling nut (3A) from elbow (4) and remove tubing.
e. Unscrew coupling nut (4A) from elbow (5) and remove tubing.
f. Disconnect clamps (6) and remove butterfly valve (6A), pipe section (7) and gaskets (8).
g. Open drain valve (9) to drain pipe section (19).
h. Unscrew coupling nut (10) from elbow (11).
i. Remove two capscrews (12), lockwashers (13), washers (14), nuts (15) and washers (16).
j. Disconnect clamp (17) and clamp (18). Remove pipe section (19) with gasket (20) and gasket (21). Pipe section is now free.
k. Remove capscrews (22), lockwashers (23) and washers (24). Tank is now free to be removed.

DISASSEMBLY.

CAUTION
Support tank so it can not fall.

a. Remove twelve capscrews (25), washers (26), nuts (27) and lockwashers (28) and remove brackets (29 and 30).
b. Refer to Figure 4-48, sheet 2 and remove cover (31) by opening T-bolts (32) on clamp (33).
c. Remove gasket (34).
d. Remove nut (35) and washer (36), plate (37), retainer (38), ten springs and seals (39), ten filters (40) and ten filter guide posts (41), if necessary.
e. Remove valves (2 and 3) and elbows (4 and 5).

REPAIR.

a. Replace T-bolts (32) if damaged or stripped.
b. Replace gasket (34) if damaged.
c. Replace any missing or damaged components.
d. Replace valves (2 and 3) if they don't shut off or are plugged.
e. Repair leaking pipe threads with antiseize tape.
f. Use a wire brush on threads to remove built up dirt or other foreign matter.
g. Repair a plugged drain nipple on the bosom of the filter housing (42) by inserting a screwdriver or similar tool from beneath the filter housing. To open the clogged nipple, an alternate method is to use a drill to remove the blockage.

REASSEMBLY.

a. Install valves (2 and 3) and elbows (4 and 5).
b. Install ten filter guide posts (41), ten new filters (40), ten springs and seals (39), retainer (38), plate (37), washer (36) and nut (35).
c. Install gasket (34).

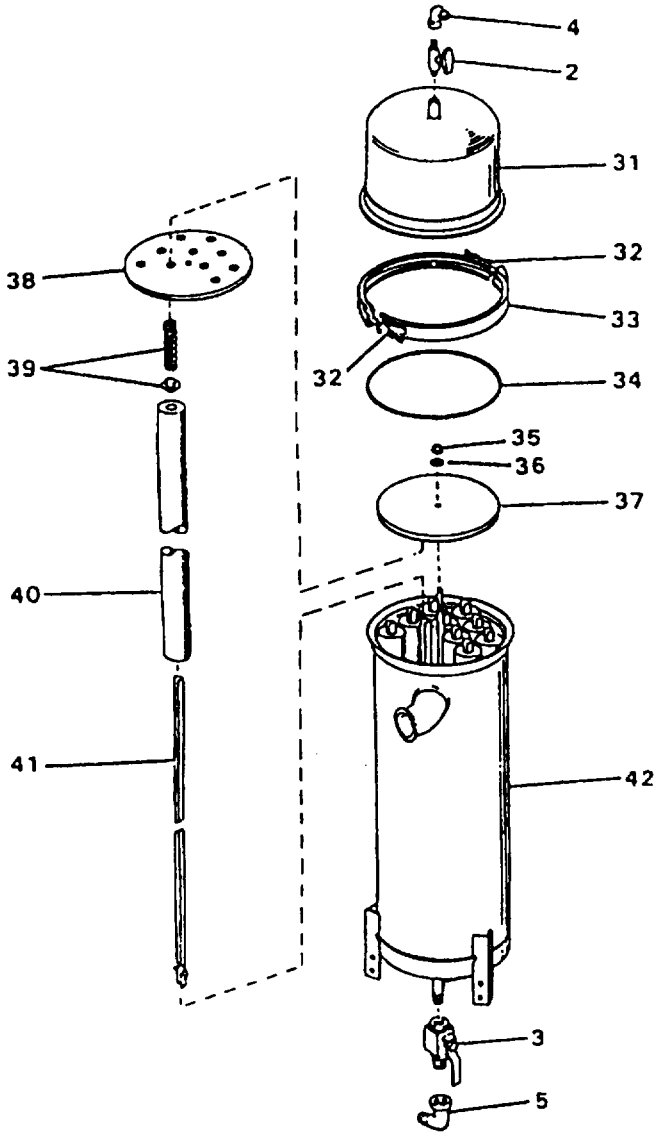


Figure 4-48. Cartridge Filter (Sheet 3 of 3)

d. Install cover (31) and clamp (33). Close and tighten T-bolts (32) on clamps.

e. Install brackets (30 and 29, Figure 4-48, sheet 1) and secure with 12 lockwashers (28), nuts (27), washers (26) and capscrews (25).

INSTALLATION.

a. Place cartridge filter assembly in position and secure with capscrews (22), lockwashers (23), and washers (24).

b. Install gaskets (20 and 21) on pipe section (19) and connect pipe section (19) to filter assembly and eternal piping with clamp (17) and clamp (18).

c. Secure pipe section (19) to floor bracket with capscrews (12), lockwashers (13), washers (14), nuts (15) and washers (16).

d. Install gaskets (8) on pipe section (7) and butterfly valve (6A) and secure with clamps (6) to external piping and filter assembly.

e. Connect tubing to elbows (4 and 5) by tightening coupling nuts (3A and 4A).

f. Close valves (1 and 2).

4-45. LOW PRESSURE PIPING AND FILL AND DRAIN HOSES. This task covers:

a. Removal b. Repair. c. Installation.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Soap (Appx E, Sec II, Item 65)
Suitable Tags
Lockweshers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown and drained (para. 2-18).
Low pressure water tubing and hoses removed (para. 4-25).
Low pressure water tubing and hoses removed (para. 4-24).

NOTE

Detailed procedures for removing low pressure tubing, hoses, valves, etc. from major components of the low pressure water system are covered in detailed procedures for those components. Refer to para. 4-9 for a listing of detailed maintenance tasks. The procedures below are for components of the low pressure water piping system not directly connected to major components.

NOTE

Repair consists of replacing unserviceable components or tightening loose fittings. Clean off old antiseize tape and apply new antiseize tape to male pipe threads to stop leaks. If antiseize tape does not stop leaks, replace fittings.

NOTE

When removing more then one low pressure piping component at a time, tag components to simplify installation. Tag all hoses and/or piping and their attaching brackets and/or clamps.

REMOVAL — BRACKETS.

a. Restraint brackets (Views A thru F, Figure 4-49, sheet 1).

(1) Remove the screws (1), washers (2) and locknuts (3) that hold the two sections of clamps (4) together.

(2) Remove hoses and/or piping from clamp halves (4) and slide the clamps (4) off the brackets (9).

(3) Remove cushions (5).

(4) Remove capscrews (6), Iockwashers (7) and washers (8) and remove brackets (9).

b. Hanger Brackets (View G).

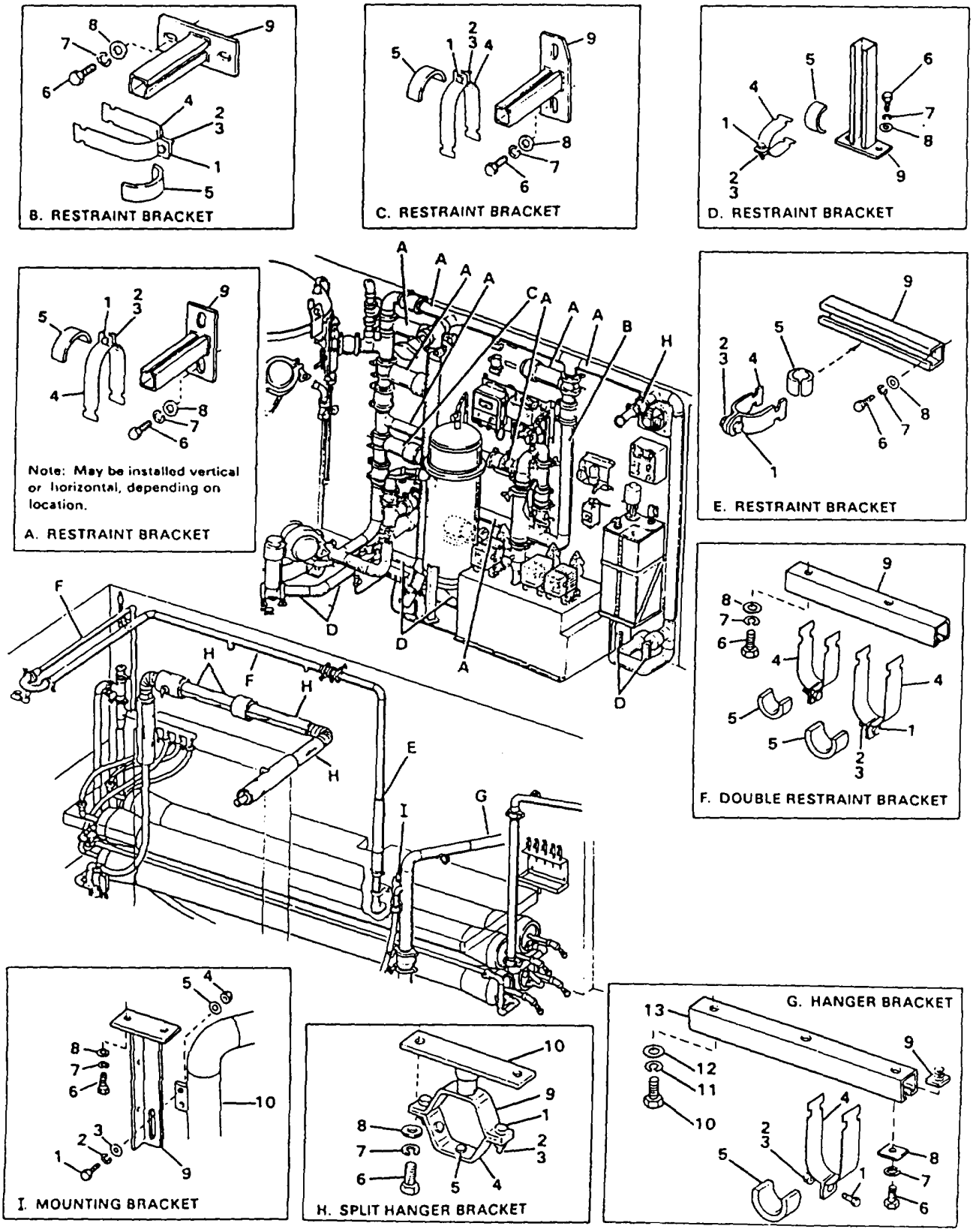
(1) Remove the screws (1), washers (2) and locknuts (3) that hold the two sections of clamps (4) together.

(2) Remove hoses and/or piping from clamp halves (4) and slide the clamps (4) off the brackets (13).

(3) Remove cushions (5).

(4) Remove two capscrews (6), lockwashers (7) and square washers (8). Slide spring nuts (9) out of channel,

(5) Remove capscrew (10), Iockwasher(11), washer (12) and bracket (13).



☛Figure 4-49. Low Pressure Piping **(Sheet 1 of 8)** Brackets

c. Split Hanger Brackets (View H).

(1) To free sound insulating blankets, hoses and/or piping, remove two capscrews (1), washers (2) and locknuts (3) and remove lower half of bracket (4) and cushions (5).

(2) If necessary, remove two capscrews (6), lockwashers (7) and flat washers (8) and remove upper half of bracket (9 and 10).

(3) If necessary, unscrew bracket (9) from mount (10).

d. Mounting Brackets (View I).

(1) To free piping (10). remove two capscrews (1), Iockwashers (2) and washers (3), nuts (4) and washers (5),

(2) If necessary, remove two capscrews (6), Iockwashers (7), and washers (8) and remove bracket (9).

REPAIR – BRACKETS.

a. Replace all worn or damaged cushions.

b. Straighten bent damps.

c. Replace unserviceable components.

INSTALLATION – BRACKTS.

a. Mounting Brackets (View I).

(1) Install brackets (9) with two capscrews (6), Iockwashers (7) and washers (8).

(2) Secure piping (10) with two capscrews (1), Iockwashers (2), washers (3), nuts (4) and washers (5).

b. Split Hanger Brackets (View H).

(1) Position upper half of bracket (9 and 10) on van ceiling. Secure bracket (10) with two capscrews (6), Iockwashers (7), and flat washers (8).

(2) Install cushions (5) and align lower half of bracket (4) with upper half (9) and push lower bracket (4) and hoses and/or piping against upper half of bracket (9).

(3) Apply pressure to hoses and/or piping to keep lower half of bracket (4) and hoses and/or piping in place and secure lower bracket (4) to upper half with two capscrews (1), nuts (2), and locknuts (3).

c. Hanger Brackets (View G).

(1) Position bracket (13) on ceiling of van and secure with capscrew (10), Iockwasher (11) and washer (12).

(2) Slide spring nut (9) into channel of bracket (13).

(3) Position cushion (5) around hoses and/or piping and push assembled cushion (5) and hoses and/or piping on bracket (13).

(4) Align clamp (4) on bracket(13) with hoses and/or piping held in place.

(5) Secure clamp (4) with hardware (6 thru 9) making certain that hose and/or piping is held in position by square washer (8) without crimping or binding.

(6) Install washer (2), locknut (3) and tighten screw (1) to secure clamp halves.

d. Restraint Bracket (Views A thru F).

(1) Install brackets (9) and secure with capscrews (6), Iockwashers (7) and washers (8).

(2) Position cushions (5) and clamp halves (4) around hoses and/or piping and secure with screws (1), washer (2) and locknuts (3).

REMOVAL – PIPE SECTIONS.

a. Remove capscrews (1, View J), washer (2) and locknuts (3).

b. Open clamps (4).

c. Remove pipe connecting sections (7) and gaskets (5 and 6).

REPAIR — PIPE SECTIONS.

a. Replace worn or damaged gaskets.

b. Replace damaged clamps.

c. Replace damaged pipe sections.

INSTALLATION – PIPE SECTIONS.

Align pipe sections(7) and clamps (4), with gaskets (5 and 6) in place, and secure by tightening capscrews (1), washer (2) and locknuts (3).

REMOVAL – BUTTERFLY BLOCK VALVES.

Loosen tri-clamp studs (1, View K) and pivot studs(1) to open clamps (2) and remove clamps (2) and gaskets (3).

REPAIR – BUTTERFLY BLOCK VALVES.

a. Replace worn or damaged gaskets (3).

b. Clean or repair butterfly block valves (4) if necessary (para. 4-47).

INSTALLATION — BUTTERFLY BLOCK VALVES.

Align butterfly block valves (4) with gaskets (3) in place on pipe sections and secure by closing clamps (2) and tightening wing nuts on studs(1).

REMOVAL – DRAIN VALVES.

NOTE

Typical drain valve installations are shown in Views L thru M.

a. Typical drain valves shown in Views L and M are removed by turning fittings (1) off valves (2) and valves (2) off nipples or elbows (3). Remove remaining fittings only if necessary to replace.

b. If drain valves have strainers (4, View N) proceed as follows:

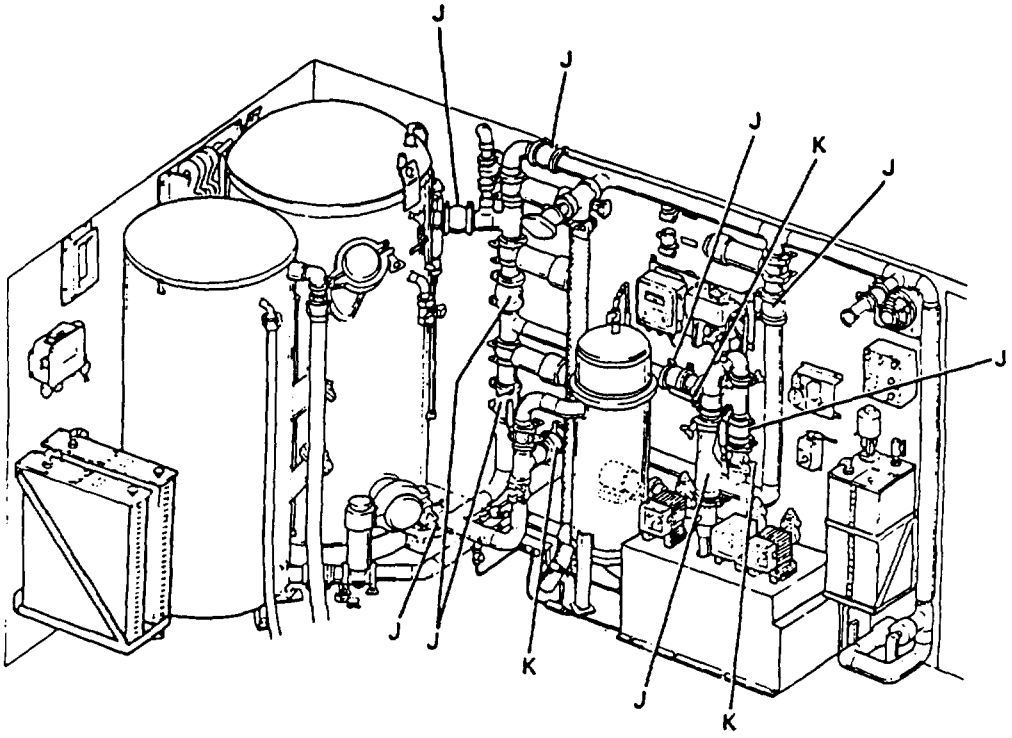
(1) Remove fitting (1), valve (2) and fitting (3) from strainer (4).

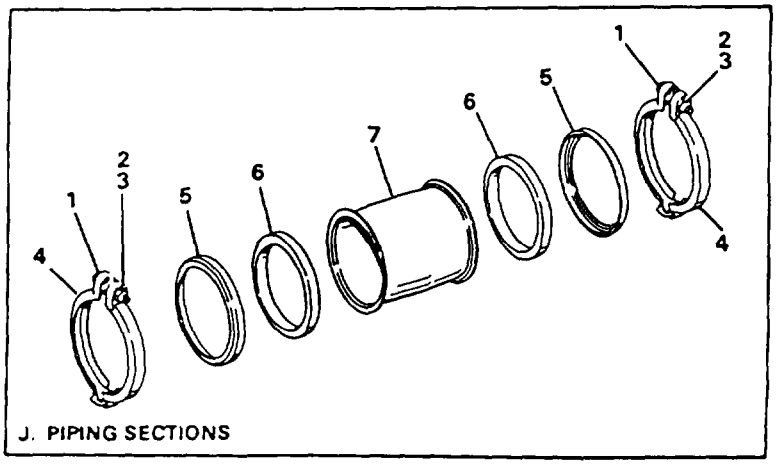
(2) Turn strainer (4) off drain valve (5).

(3) Remove drain valve (5) from adapter (6).

(4) If necessary, remove adapter (6).

c. I drain valves have mounting brackets (9, View 0) proceed as follows:
   (1) Remove the two capscrews (1), lockwashers (2) and washers (3) that hold the valve (5) to the bracket (9).
   (2) Remove valve (5) and if necessary remove fittings (4) from valve (5).
   (3) H necessary, remove two capscrews (6), lockwashers (7) and washers (8) and remove bracket (9).





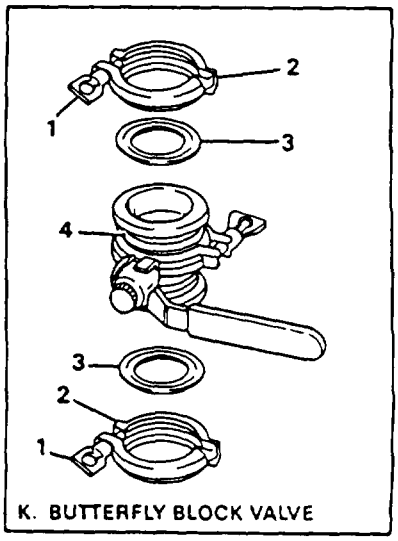
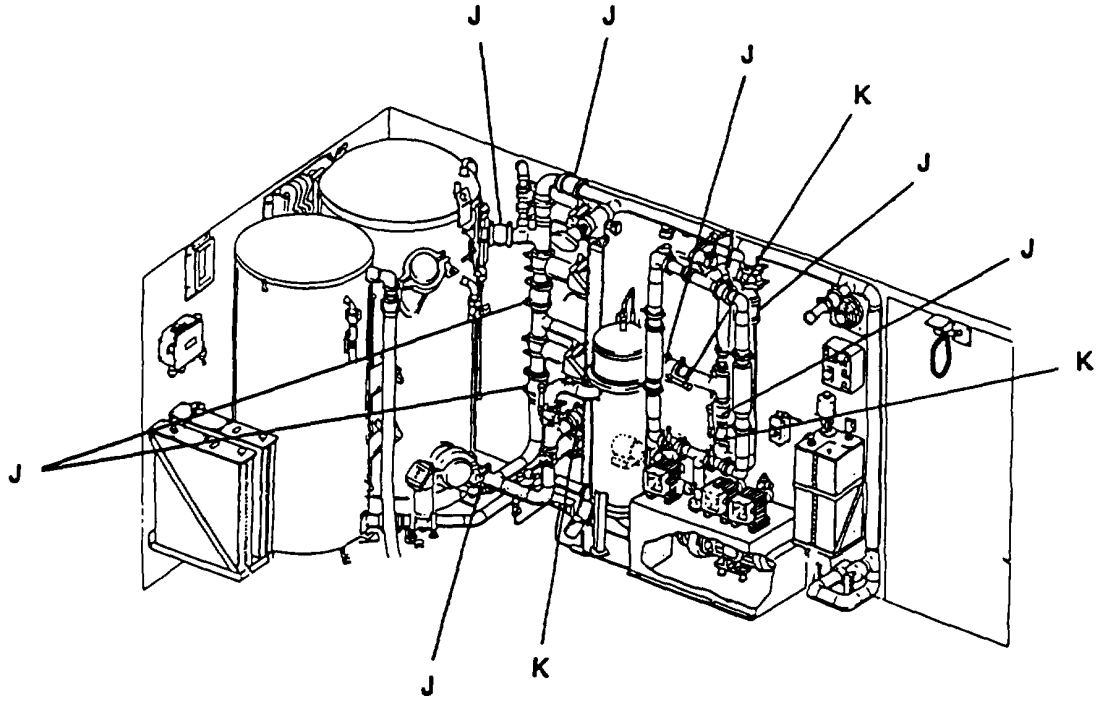
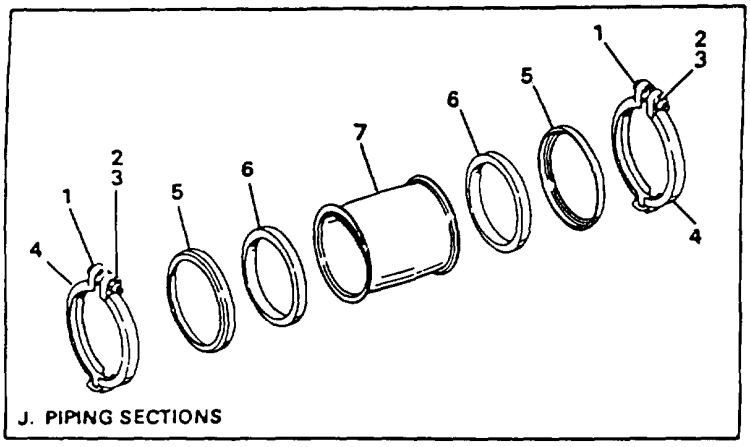


Figure 4-49. Low Pressure Piping **(Sheet 2 of 8)** Pipe Sections and Manually Actuated Butterfly Block Valves ☛(MODEL WrA40 ONLY)





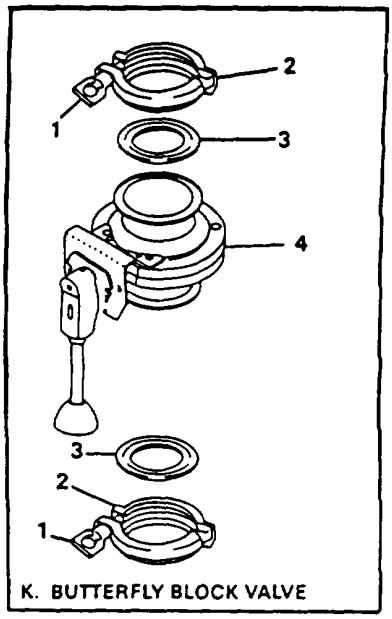


Figure 4-49. Low Pressure Piping **(Sheet 3 of 8)** Pipe Sections and Manually Actuated Butterfly Block Valves (MODEL ROWPU-1 ONLY)

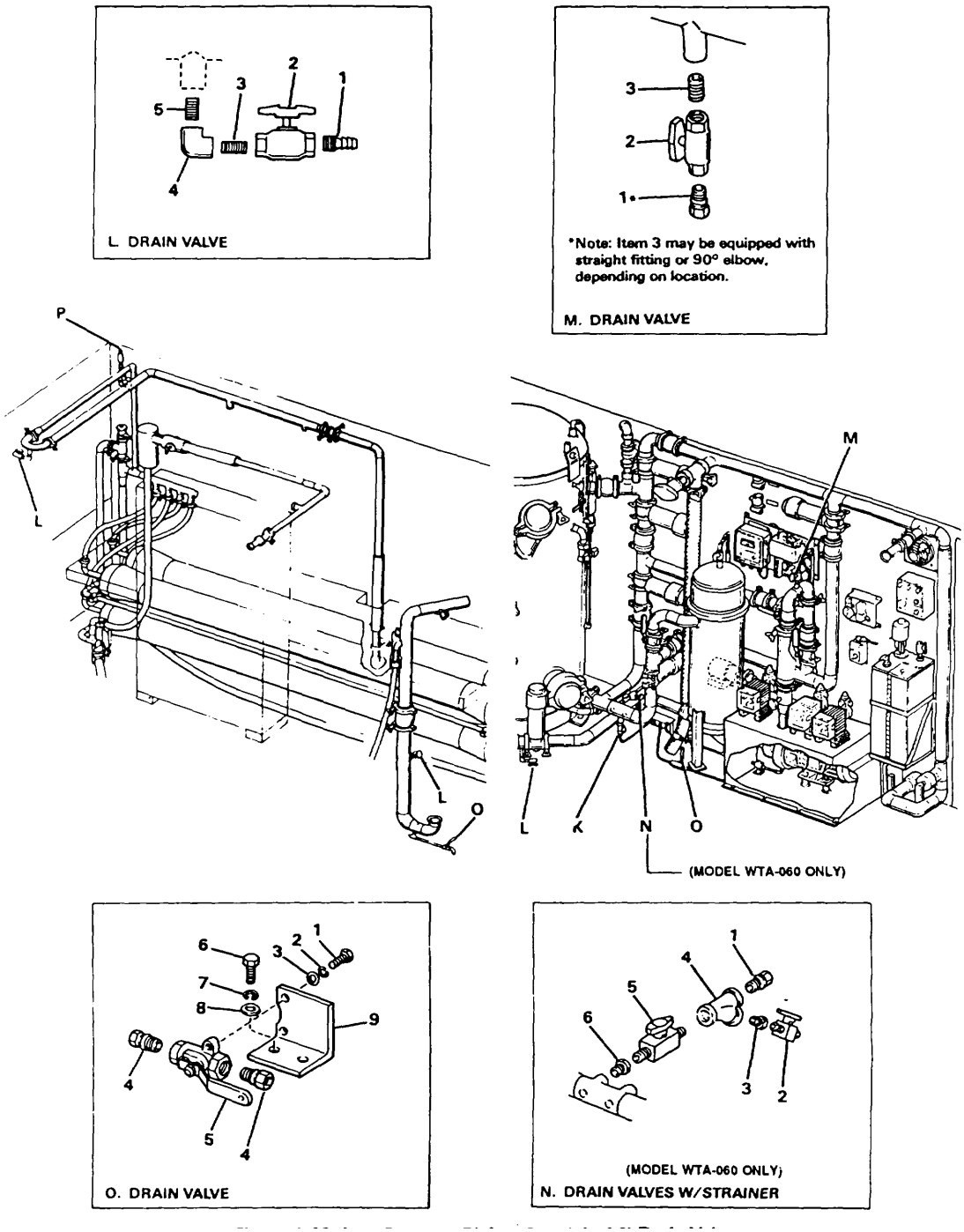


Figure 4-49. Low Pressure Piping **(Sheet 4 of 8)** Drain Valves

REPAIR – DRAIN VALVES.

a. If application of new antiseize tape and/or tightening does not stop leaks, replace valves and fittings

b. Clean out strainers (4, View N) by flushing in soapy water, rinsing in clean water and drying.

c. Replace blocked or damaged strainers.

INSTALLATION – DRAIN VALVES.

a. Valves with mounting brackets (View O).

(1) Install mounting brackets (9) and secure with two capscrews (6), lockwashers (7) and washers (8),

(2) Install valve (5) on bracket with two capscrews (1), lockwashers (2) and washers (3) and install fittings (4).

(3) Connect tubing (para. 4-25).

b. Valves with strainers (View N).

(1) Install adapter (6).

(2) Install valve (5) on adapter (6).

(3) Install strainer (4) onto valve (5).

(4) Install fittings (1) and (3) on strainer (4) and valve (2) on fitting (3).

(5) Connect tubing (para. 4-25).

c. Drain valves shown in Views L and M are installed by screwing valves (2) onto nipples or elbows (3). Turn fittings (1) onto valves (2).

REMOVAL – CHECK VALVES.

a. Loosen compression fitting on valve (1, View P). Remove check valve (1) from nipple (2).

b. Loosen compression fitting on elbow (3) and remove nipple (2).

c. Remove elbow (3).

REPAIR – CHECK VALVES.

a. Clean check valve (para. 4-10).

b. Replace damaged check valve.

INSTALLATION – CHECK VALVES.

NOTE

When installing check valve, be sure seat is positioned downstream (para. 4-10).

a. Install elbow (3) and nipple (2).

b. Install nipple (2) in elbow (3) and tighten compression fitting.

c. Install valve (1) on nipple (2) and tighten compression fitting.

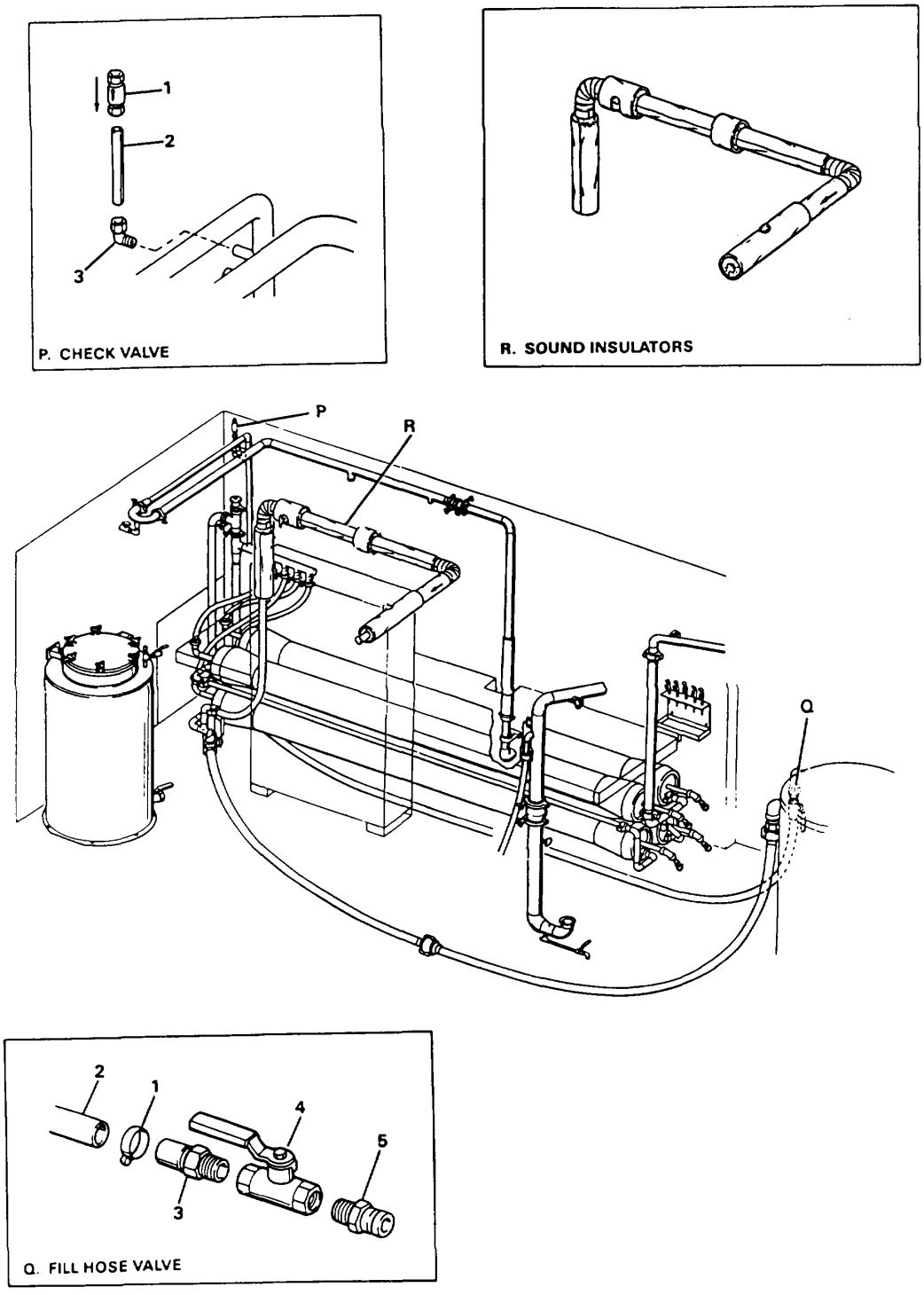


Figure 4-49. Low Pressure Piping **(Sheet 5 of 8)** Fill Hoses. Check Valves and Sound Insulating Blankets

REMOVAL – FILL HOSE VALVE.

a. Remove clamp (1, View Q) and remove valve (4) with fittings (3 and 5).

b. If necessary, remove fittings (3 and 5) from valve.

REPAIR – FILL HOSE VALVE.

If application of new antiseize tape and/or tightening does not stop leaks, replace valve and fittings.

INSTALLATION – FILL HOSE VALVE.

a. Install antiseize tape on male threads and install fittings (3 and 5) on valve (4).

b. Install hose (2) on fitting (3) and secure with clamp (1).

REMOVAL – SOUND INSULATORS.

NOTE

It may be necessary to remove lower half of split hanger brackets to remove some sound insulators.

Sound insulating blankets (View R) are held together by hook and loop fasteners, peel fasteners apart to remove.

REPAIR – SOUND INSULATORS.

Replace any torn or damaged sound insulators.

INSTALLATION – SOUND INSULATORS.

a. Wrap sound insulators around piping and secure with hook and loop fasteners.

b. If removed, install lower half of split hanger brackets (4, View H).

REMOVAL – FLOW SENSORS.

NOTE

Replacement of flowmeters is done at Direct Support Maintenance.

Remove four capscrews (1, View S), lockwashers (2), and washers (3) and remove the flow sensor (4).

REPAIR – FLOW SENSORS.

Clean the paddle wheel on the sensor to make certain it rotates freely.

INSTALLATION – FLOW SENSORS.

a. Position the sensor (4) on the piping boss making certain that the “FLOW” arrow on the side of the sensor is in direction of flow as marked on piping,

b. Secure the flow sensor with four capscrews (1), lockwashers (2) and washers (3).

REMOVAL - THERMOMETER.

a. Turn nut (1, View T) on thermometer to remove it from fitting (2).
b. If necessary, unscrew fitting (2) from pipe section (3).

REPAIR - THERMOMETER.

Replace damaged or inaccurate thermometer.

INSTALLATION - THERMOMETER.

a. Apply antiseize tape and screw fitting (2) into pipe section (3).
b. Apply antiseize tape and tighten nut (1) on thermometer into fitting (2).

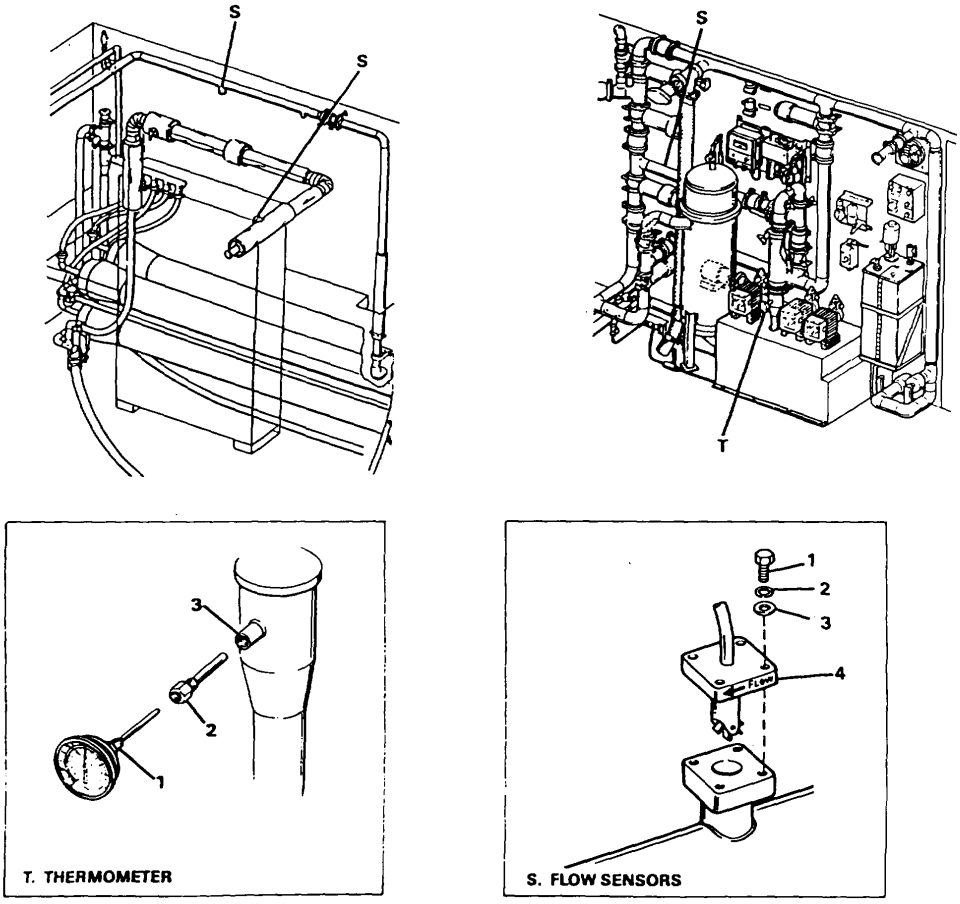


Figure 4-49. Low Pressure Piping **(Sheet 6 of 8)**Thermometer and Flow Sensor
☛ (MODEL WA6CO0 ONLY)

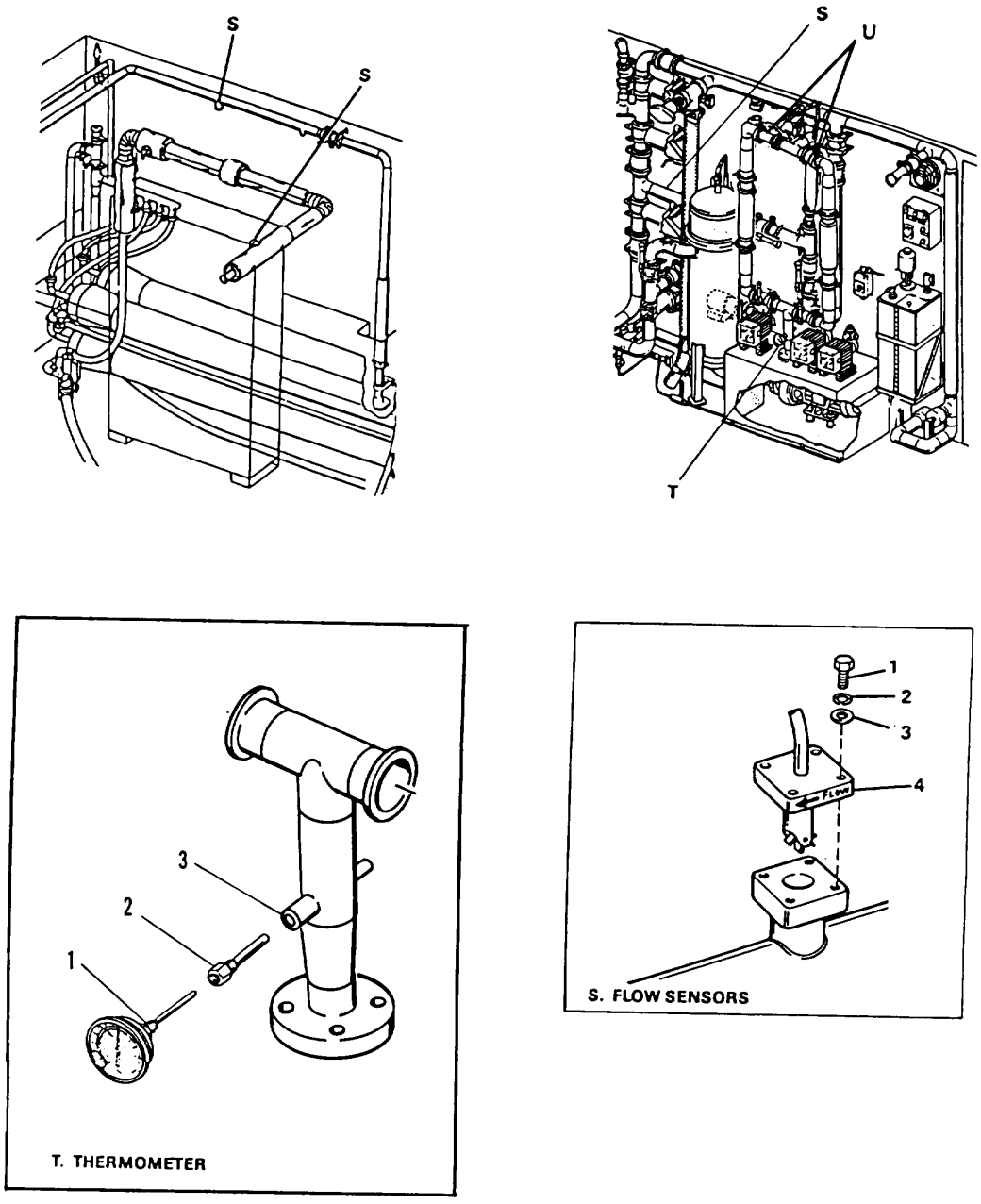


Figure 4-49. Low Pressure Piping **(Sheet 7 of 8)**Thermometer and Flow Sensor (MODEL ROWPU-1 ONLY)

REMOVAL - CHECK VALVE. (MODEL ROWPU-1 ONLY)

a. Remove clamp (1) clamp (2), gasket (3), and gasket (4).
b. Remove check valve (5) from system.
c. Remove spider (6), spring (7), plunger (8), and O-ring (9) from housing (10).

REPAIR - CHECK VALVE. (MODEL ROWPU-1 ONLY)

Repair is limited to replacement of damaged or defective components.

INSTALLATION - CHECK VALVE. (MODEL ROWPU-1 ONLY)

a. Install O-ring (9), plunger (8), spring (7), and spider (6) into housing (10).
b. Place check valve (5) into position in piping system and install gasket (4), gasket (3), clamp (2), and clamp (1).

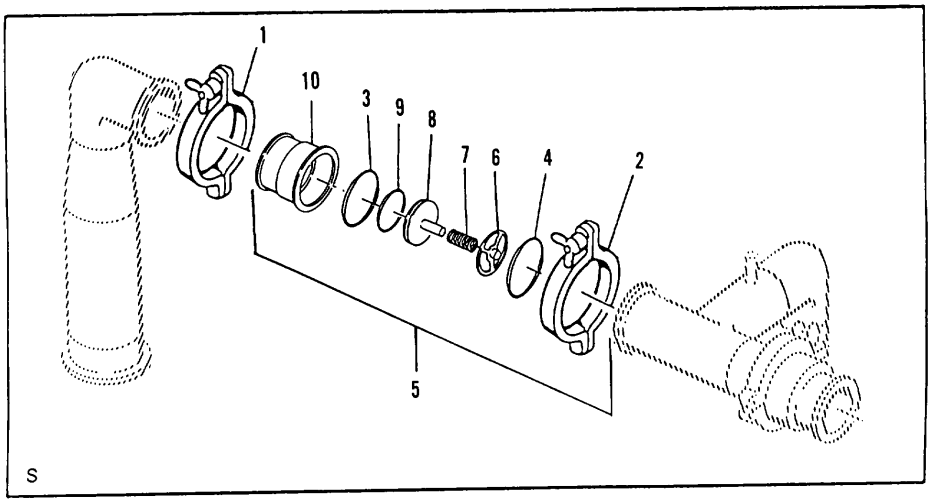


Figure 4-49. Low Pressure Piping **(Sheet 8 of 8)** Check Valve (MODEL ROWPU-1 ONLY)

4-45.1. SOUND BAFFLING SYSTEM. This task covers:

a. Disassembly b. Repair c. Reassembly

INITIAL SETUP:

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)
Orifice Plates (TM 10-4610-232-24P)

Equipment Condition:
ROWPU off.
Pipe section removed (para. 4-45).

DISASSEMBLY.

a. Remove nut (1), lockwasher (2), and washer (3) from shaft (4).
b. Remove larger orifice plate (5).
c. Remove spacer (6).

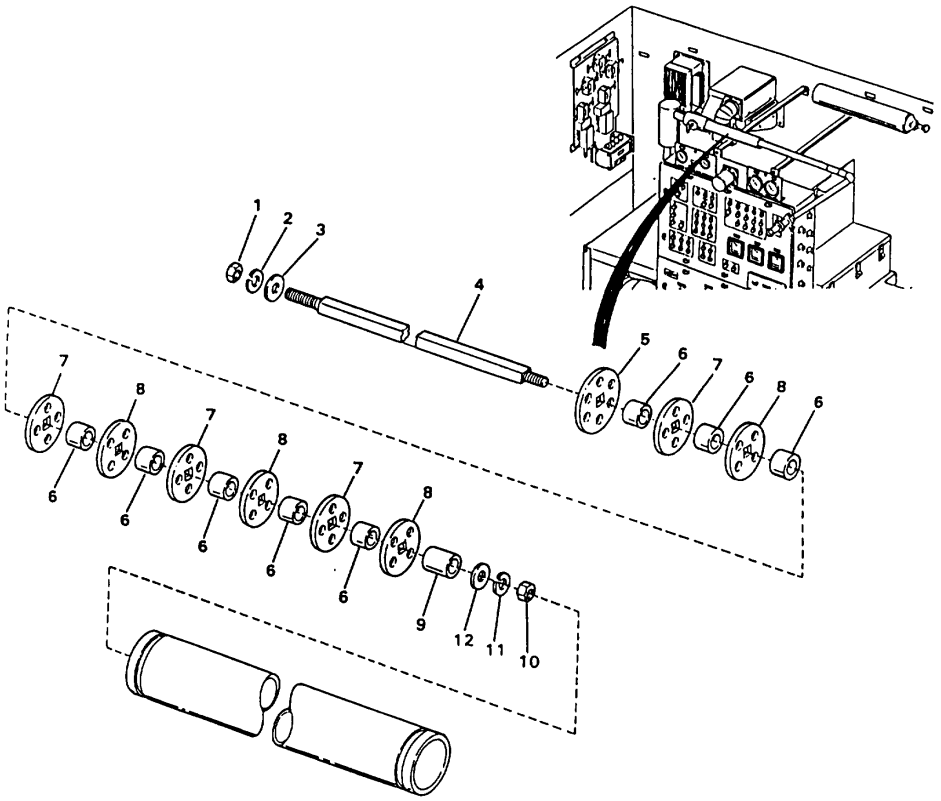


Figure 4-49.1. Sound Baffling System

NOTE

Keep the orifice plates in the same order as which they were removed.

d. Remove the eight orifice plates (four orifice plates (7) and four orifice plates (8)), and remaining seven spacers (6).
e Remove longer spacer (9).
f. Remove nut (10), lockwasher (11), and washer (12) from shaft (4).

REPAIR.

a. Repair consists of replacing damaged or worn parts.
(1) Replace orifice plates (7) and (8) if diameter of opening exceeds 0.349 in,
(2) Replace orifice plate (5) if diameter of opening exceeds 0.286 in.

REASSEMBLY.

a. Install washer (12), lockwasher (11), and nut (10) on shaft (4). Torque nut to 6.5 ft/lb.
b Install longer spacer (9).

NOTE

The two different types of orifice plates must be installed alternately.

c. Install eight orifice plates (four orifice plates (8) and four orifice plates (7)), and eight spacers (6).
d. Install larger orifice plate (5) and secure with washer (3) and nut (1). Torque nut to 6.5 ft/lb.

4-46. BASKET STRAINER. This task covers: (MODEL WTA-060 ONLY)

a. Removal b. Disassembly c. Repair d. Reassembly e. Installation

INITIAL SETUP:

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Preformed Packings (TM 10-4610-232-24P)
Gaskets (M 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
Strainer drained, top pipe removed (para. 3-22).

REMOVAL

a. Remove clamp (1, Figure 4-50, sheet 1).
b. Remove capscrew (2), washers (3) and locknut (3A), and remove clamp (4) and rubber cushion (5) from bracket (11).
c. Lift and remove strainer assembly (6).
d. Remove gasket (7).

DISASSEMBLY.

a. Remove piping around basket strainer, if bracket (11) removal is necessary (para. 4-45).
b. Remove four capscrews (8), lockwashers (9) and washers (10) and remove bracket (1 1), if necessary.
c. Remove clamp (12, Figure 4-50, sheet 2).
d. Lift basket strainer assembly (13) from strainer case (14).
e. Unscrew cap (15) and remove gasket (16). Remove overscreen (17).
f. Remove gasket (18) and preformed packing (19).

REPAIR.

a. Replace any damaged or missing gaskets and preformed packing.
b. Replace inner strainer (20) or overscreen (17) if damaged.

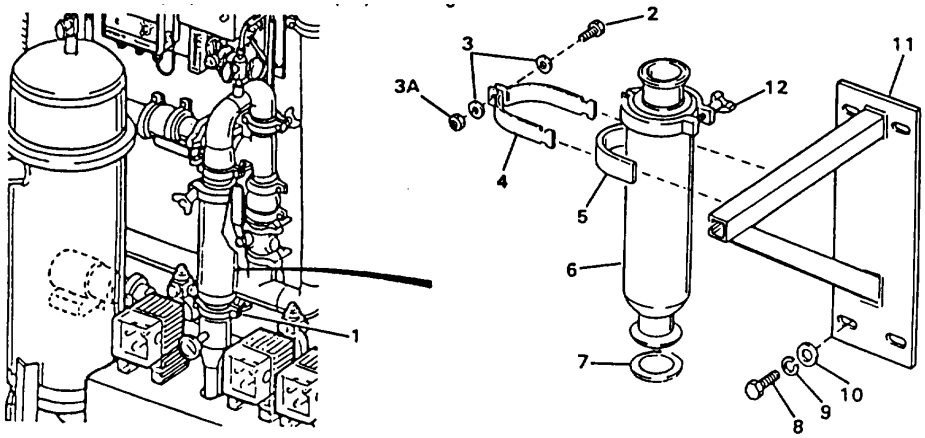


Figure 4-50. Basket Strainer **(sheet 1 of 2)**
(MODEL WTA-060 ONLY)

c. Replace any missing or damaged components or hardware.
d. Replace assembly if outer shell (14) is cracked or damaged.

REASSEMBLY.

a. Install preformed packing (19) and gasket (18) on Inner strainer (20).
b. Install overscreen (17) and gasket (16) and screw cap (15) onto inner strainer (20).
c. Lower entire assembly (13) into outer shell (14).
d. Install clamp (12) and tighten.
e. If removed, install bracket (11, Figure 4-50, sheet 1) and secure with four capscrews (8), lockwashers (9) and washers (1 0).
f. If necessary, install piping (para. 4-45).

INSTALLATION.

a. Install gasket (7) and position strainer assembly (6) on lower piping. Install and tighten clamp (1).
b. Install rubber cushion (5) and clamp (4). Secure filter assembly (6), cushions (5) and clamp (4) with capscrew (2), washers (3) and locknut (3A).

Figure 4-50. Basket Strainer (sheet 2 of 2)
☛(MODEL WTA-060 ONLY)

4-46.1. BASKET STRAINER. This task covers: **(MODEL ROWPU-1 ONLY)**

a. Disassembly b. Repair c. Assembly

INITIAL SETUP

Tools, see Appx B. Sec III, Ref Code (No.):
Tool Kit. General Mechanics Automotive (1)
Materials/Parts:
Preformed Packings (TM 10-4610-232-24P)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
Basket strainer removed and drained (para. 3-22.1)

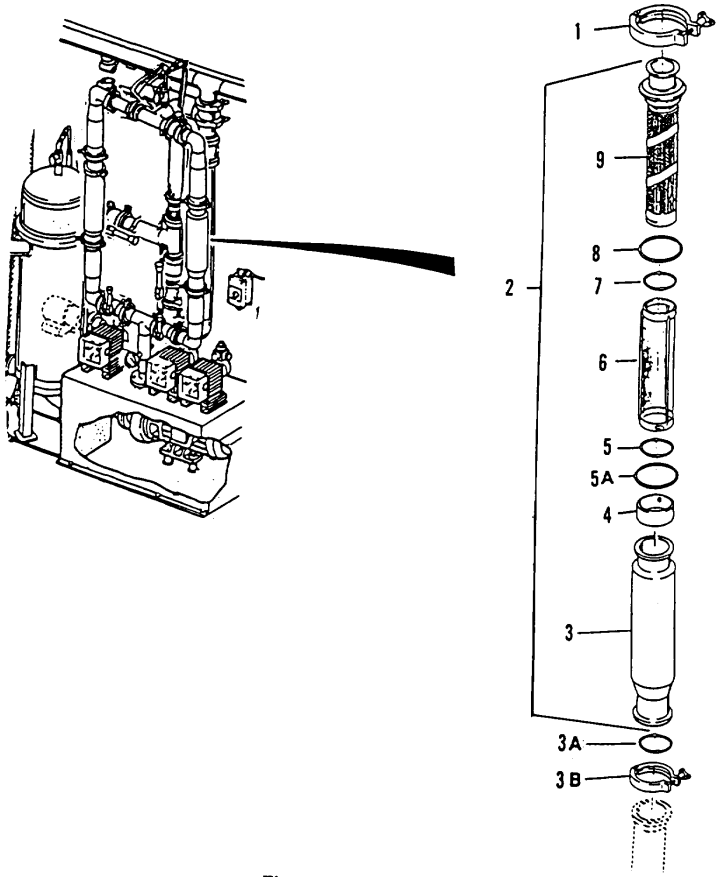


Figure 4-50.1. Basket Strainer
(MODEL ROWPU-1 ONLY)

REMOVAL.

a. Remove clamp (1), clamp (3A), and gasket (3B).
b. Remove basket strainer assembly from piping.

DISASSEMBLY.

a. Lift basket strainer assembly (2) from strainer case (3).
b. Unscrew cap (4) and remove gasket (5) and seal (5A).
c. Remove overscreen (6).
d. Remove gasket (7) and preformed packing (8).

REPAIR.

a. Replace any damaged or missing gaskets and preformed packing.
b. Replace inner strainer (9) or overscreen (6) if damaged.
c. Replace any missing or damaged components or between hardware.
d. Replace assembly if outer shell (3) is cracked or damaged.

REASSEMBLY.

a. Install preformed packing (8) and gasket (7) on inner strainer (9).
b. Install overscreen (6), gasket (5), and seal (5A) and screw cap (4) onto inner strainer (9).
c. Lower entire assembly (2) into outer shell (3).
d. Install basket strainer into piping system (para 3-22.1).

INSTALLATION.

a. Place basket strainer assembly into piping.
b. Install gasket (3B), clamp (3A), and clamp (1).

4-47. BUTTERFLY VALVES WITH VALVE ACTUATORS. This task covers: **(MODEL WTA-060 ONLY)**
a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Lockwashers (TM 10-4610-232-24P)
Washers TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown when replacing unit.
General Safety Instructions:
WARNING

Observe specific Warning in the text.

REMOVAL.

NOTE
Mark actuator valve position in relation to butterfly valve before removal.

Remove butterfly valve with actuator from system (para. 4-45a).

DISASSEMBLY.

a. Refer to Figure 4-51, loosen clamp (1) and remove valve actuator (2) from butterfly valve (3).
b. Disassemble the upper section of actuator valve as follows:
(1) Remove air hose (1, Figure 4-52) by pushing in on connector (2) with a wrench while pulling on hose (1). Remove fitting (2) if necessary.
(2) Turn cap (3) counterclockwise and remove cap (3).
(3) Unscrew and remove switch positioner (4).
(4) Remove three screws (5).
(5) Remove top section (6) from actuator.

Figure 4-51. Remove Valve Actuators from Butterfly Valves
☛(MODEL WTA-060 ONLY)

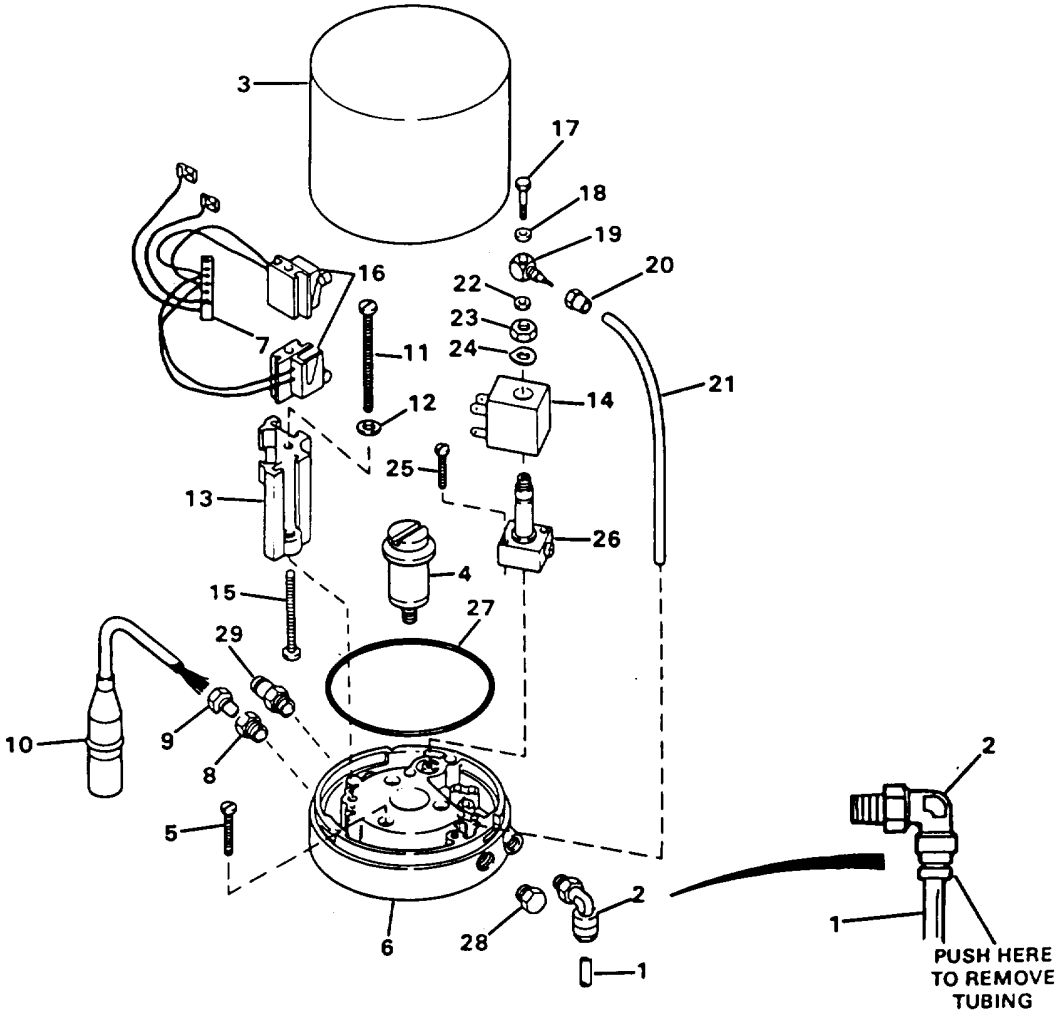


Figure 4-52. Valve Actuator Upper Section
(MODEL WTA-060 ONLY)

NOTE
Mark wiring harness wires for identification before removing wires from terminal strip.

(6) Mark and disconnect wiring harness (10) wires from terminal strip (7).
(7) Remove connector (8) and nut (9) and remove wiring harness (10).
(8) Remove screw (11) and washer (12) from mounting bracket (13).

NOTE
Mark positions of switch assembly before removing mounting bracket.

(9) Remove mounting bracket (13).
(10) Tag and disconnect two wires from solenoid coil (14).
(11) Remove two screws (15) and remove two switch assemblies (16) from bracket (13).
(12) Remove capscrew (17), washer (18), swivel connector (19), fitting (20), air line (21), washer (22), nut (23)and wave washer (24) from top of solenoid coil (14).
(13) Remove solenoid coil (14).

(14) Remove two screws (25) and remove solenoid valve (26).

(15) Remove preformed packing (27).

(16) If necessary, remove plug (28) and fitting (29).

c. Refer to Figure 4-53 and disassemble the butterfly valve as follows:

(1) Remove two clamp halves (1) from body valve halves (2) and separate the two body halves.

(2) Remove bushings (3) and bushings (4) from disc and shaft (5).

(3) Remove valve liner (6).

REPAIR.

a. Repair of the upper section (Figure 4-52) consists of replacement of damaged, missing or unserviceable parts and tubing.

b. Replace all damaged, missing or unserviceable parts of butterfly valves (Figure 4-53).

c. Repair leaks at fittings with antiseize tape.

REASSEMBLY.

CAUTION

DO NOT overtighten. The threads in the actuator housing will be stripped.

a. Refer to Figure 4-53 and reassemble butterfly valve as follows:

(1) Position valve liner (6), bushing (4) and bushing (3) on disc and shaft (5).

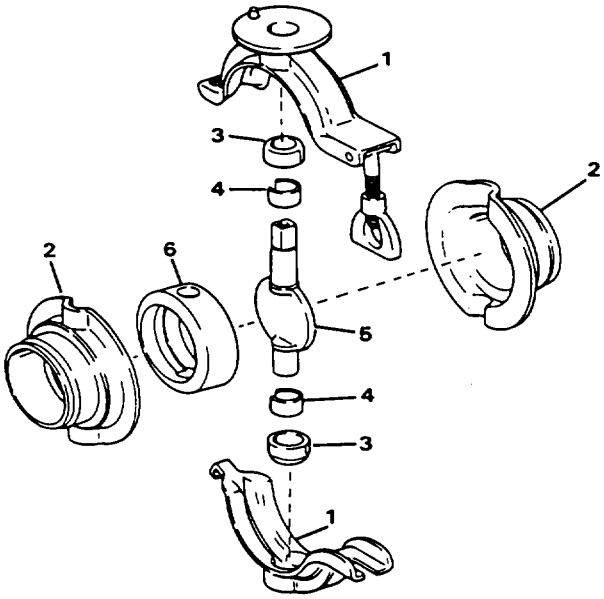


Figure 4-53. Butterfly Valves
(MODEL WTA-060 ONLY)

(2) Position the two body halves (2) around assembled parts (3, 4,5 and 6).

(3) Secure valve body halves (2) with clamp halves (1).

b. Refer to Figure 4-52 and reassemble the upper section of the valve actuator as follows:

(1) Install preformed packing (27) on top section (6). Install fitting (29), plug (28) and fitting (2) if removed.

(2) Position solenoid valve (26) on top section (6) and secure with two screws (25).

(3) Position solenoid coil (14) over solenoid valve (26) and install wave washer (24), nut (23), washer (22), air line (21), fitting (20), swivel connector (19), washer(18) andcapscrew (17).

(4) Slide two switch assemblies (16) in mounting bracket (13) and secure with two screws (15).

(5) Position mounting bracket (13) on top section (6) and secure with screw (11) and washer (12).

(6) Connect two wires, as tagged, to solenoid coil (14).

(7) Install wiring harness (10), using connector (8) and nut (9).

(8) Connect wiring harness wires to terminal strip (7).

(9) Position top section (6) on actuator and secure with three screws (5).

(10) Install switch positioner (4).

(11) Install cover (3).

(12) Install fitting (2) and air hose (1) by pushing hose into fitting (2).

(13) Refer to Figure 4-51 and use an adjustable wrench on the valve (3) stem to position the disk so that the valve is open. Make sure disk is in full open position, not partially open.

(14) Install actuator (2) on valve (3), as marked and align the hole in the actuator base and the peg on the valve body.

NOTE

The actuator and valve should slide together easily and the peg and hole should lineup without twisting either the valve or actuator to allow assembly. If the valve and actuator do not fit together, loosen the setscrew on the bottom side of the actuator and turn the actuator base slightly until a fit is made. Tighten the setscrew securely.

(15) Install clamp (1) and tighten.

INSTALLATION.

Install butterfly valve, with actuator, in system (para. 4-45a).

4-47.1 BUTTERFLY VALVES WITH VALVE ACTUATORS. This task covers: **(MODEL ROWPU-1 ONLY)**

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B. Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown when replacing unit.

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Lockwashers (CM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

General Safety Instructions:
WARNING

Observe specific Warning in the text.

DISASSEMBLY - BUTTERFLY VALVE.

a. (Refer to Figure 4-53.1). Remove two screws (1) from actuator (2).

b. Remove set screw (3) and position indicator (4) from actuator (2).

c. Remove actuator (2) from mounting bracket (7) and butterfly valve.

d. Remove four screws (5), four nuts (6), and mounting bracket (7) from butterfly valve.

e. Separate two valve halves (8) of the butterfly valve and remove two bushings (9) and the disc and seat assembly.

f. Remove seat (10) from disc (11).

REPAIR - BUTTERFLY VALVE.

Repair is limited to replacement of defective or damaged components.

ASSEMBLY - BUTTERFLY VALVE.

a. Install disc (11) into seat (10).

b. Place disc and seat assembly into valve halves (8) with two bushings (9) and place disc into open position.

c. Install mounting bracket (7), four nuts (6), and four screws (5).

d. Place position indicator (4) onto bottom of actuator (2) and place actuator into position on mounting bracket (7).

e. Install two screws (1) into actuator (2).

f. Place position indicator (4) into open position and install set screw (3). Open position for position indicator is with the point of indicator sticking out of slot in mounting bracket (7) and in line with disc (11) in butterfly valve.

DISASSEMBLY - CONTROL TOP.

a. Tag and mark all wiring.

b. Remove water injector (2A).

c. (Refer to Figure 4-53.2). Remove four screws (1), cover (2), and gasket (3).

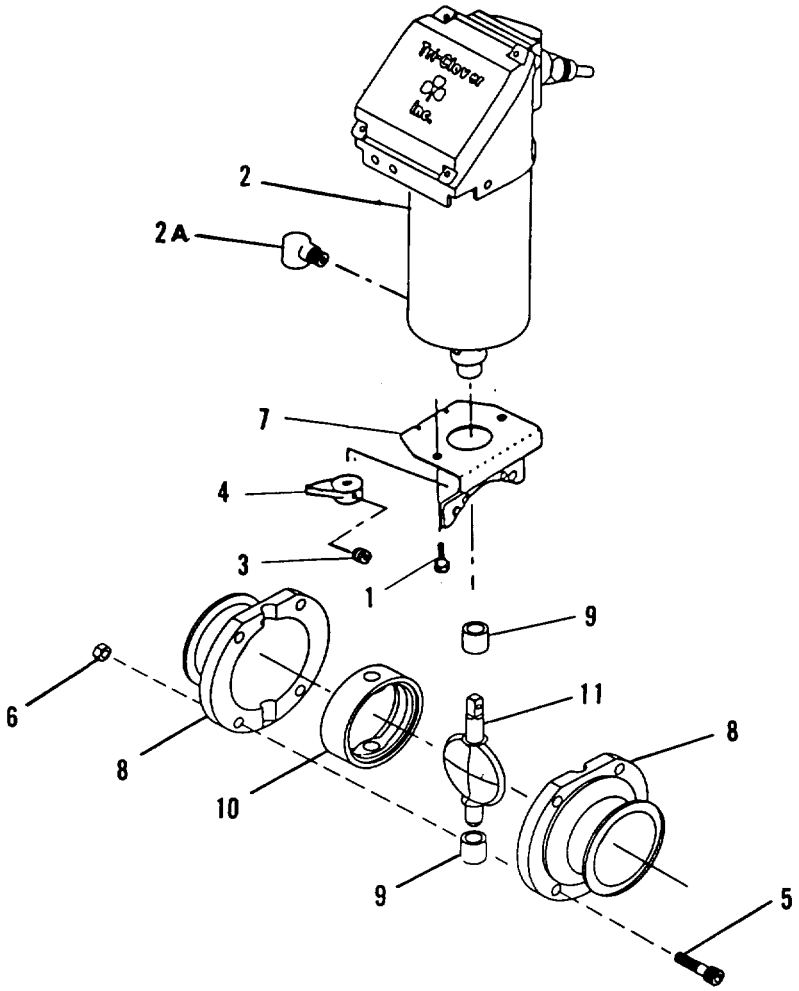


Figure 4-53.1. Butterfly Valve.
(MODEL ROWPU-1 ONLY)

CAUTION

Measure from bottom and mark position micro switches (4) and (5) and nut (12) before disassembly. Improper positioning of these components will cause the automatic valve to malfunction.

d. Slide out two micro switch assemblies (4) and (5).

e. Remove two screws (6), solenoid (7) and gasket assembly (8).

f. Remove three socket head screws (9), screw (10), and lock washer (11).

g. Remove nut (12) and control top (13) from actuator.

h. Cut yellow and black wires from solenoid (7) and butt splice (14).

i. Remove electrical connector (15) from micro switch (16). Repeat for other micro switch.

j. Remove two screws (17), spacer (18), and slide (19) from micro switch (16). Repeat for other micro switch.

k. Pull terminal (20) from connector (15) and cut wire (21) from terminal (20). Repeat for other wires as needed.

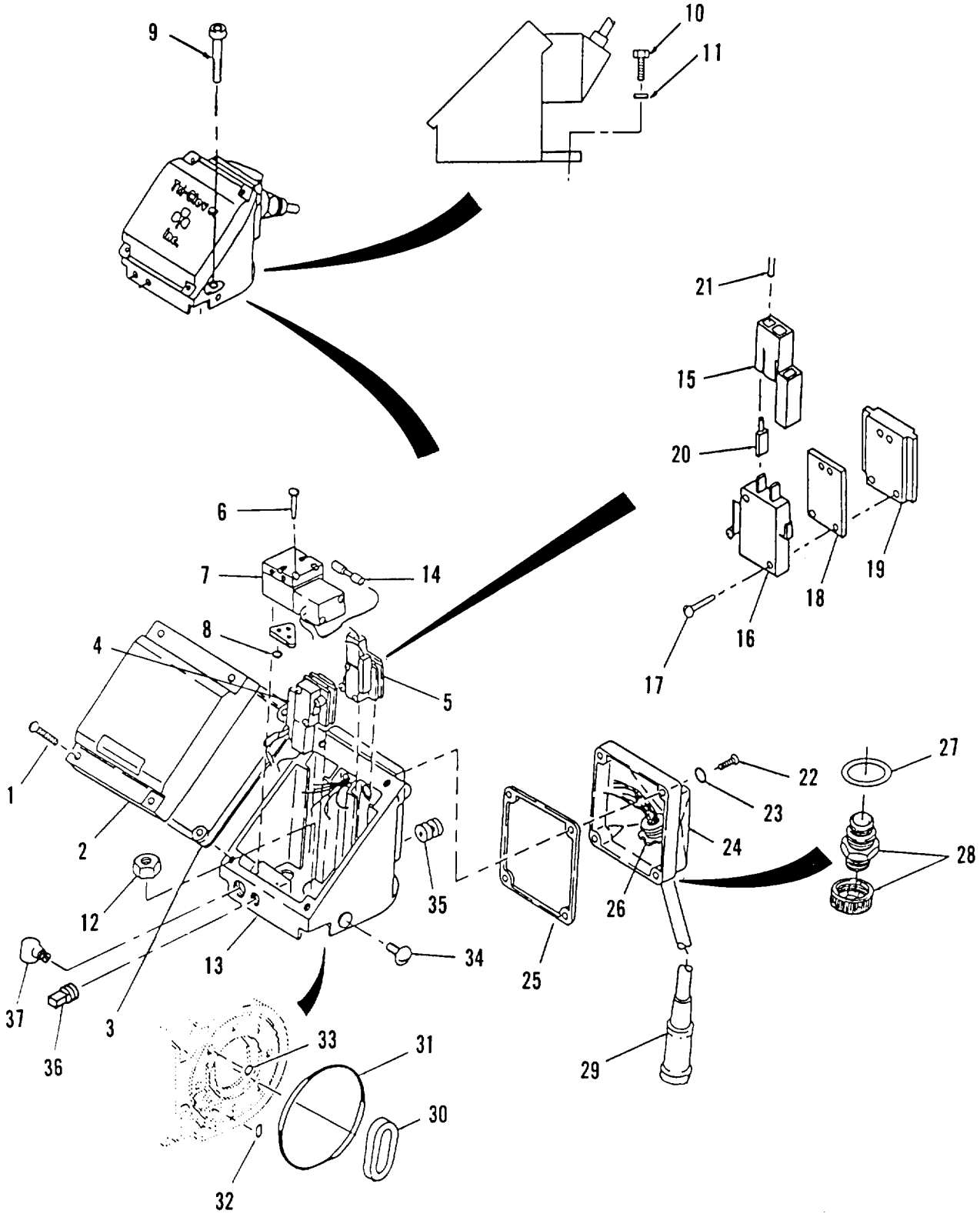


Figure 4-53.2. Control Top.
(MODEL ROWPU-1 ONLY)

l. Remove four screws (22), four O-rings (23), cover (24), and gasket (25) from control top (13).

m. Remove lock nut (26), gasket (27), cord grip (28) and receptacle assembly (29) from cover (24).

n. Remove packing gland (30), O-ring (31), O-ring (32), and O-ring (33) from housing (13).

o. Remove plug (34) and blow-out plug (35) from housing (13).

p. Remove vented plug (36) and air fitting (37) from housing (13).

REPAIR - CONTROL TOP.

Repair of control top is limited to replacement of damaged or defective components.

ASSEMBLY - CONTROL TOP.

CAUTION

Over tightening screws into the plastic control top housing will strip the threads in the housing. Do not over tighten any screws installed into the control top housing.

a. Install air fitting (37) and vented plug (36) into housing (13).

b. Install blow-out plug (35) and plug (34) into housing (13).

c. Install O-ring (33), O-ring (32), O-ring (31), and packing gland (30) into housing (13).

d. Install receptacle assembly (29), cord grip (28), gasket (27), and lock nut (26) onto cover (24).

e. Install gasket (25), cover (24), four O-rings (23), and four screws (22) onto housing (13).

f. Strip .25 inch of insulation from end of wire (21) and slide wire through connector (15) and crimp terminal (20) onto wire. Repeat as required for other wires as shown on wire tags.

g. Install slide (19), spacer (18), and two screws (17) onto micro switch (4). Repeat for other micro switch.

h. Install electrical connectors (15) onto micro switch (4). Repeat for other micro switch.

i. Refer to wire tags and connect yellow and black wires to solenoid (7) using two butt splices (14).

j. Place control top (13) onto actuator and install nut (12) onto actuator. Position nut as measured and marked during disassembly.

k. Refer to match markings made during disassembly, position control top (13) on actuator and install lock washer (11), screw (10), and three socket head screws (9).

l. Install gasket assembly (8), solenoid (7) and two screws (6).

m. Slide two micro switches (4) and (5) onto control top (13). Position each micro switch in accordance with measurements and marks made during micro switch removal.

n. Install gasket (3), cover (2), and four screws (1).

o. Install water ejector (2A).

4-47.2. BUTTERFLY VALVES, MANUAL. This task consists of:: **(MODEL ROWPU-1 ONLY)**

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown when replacing unit.

Materials/Parts:

General Safety Instructions:
WARNING
Observe specific Warning in the text.

REMOVAL.

Remove manual butterfly valve from system (para. 4-45).

DISASSEMBLY. I

a. (Refer to Figure 4-53.3.) Loosen set screw (1) and remove handle (2) and backing plate (3).

b. Remove four screws (4) and nuts (5) from butterfly valve.

c. Separate two valve halves (6) of the butterfly valve and remove two bushings (7) and the disc and seat assembly.

d. Remove seat (8) from disc (9).

REPAIR.

Repair is limited to replacement of defective or damaged components.

ASSEMBLY.

a. Install disc (9) into seat (8).

b. Place disc and seat assembly into valve halves (6) with two bushings (7) and place disc into open position.

c. Install four nuts (5) and four screws (4).

d. Install backing plate (3), handle (2), and set screw (1).

INSTALLATION.

Install butterfly valve into system (para. 4-45).

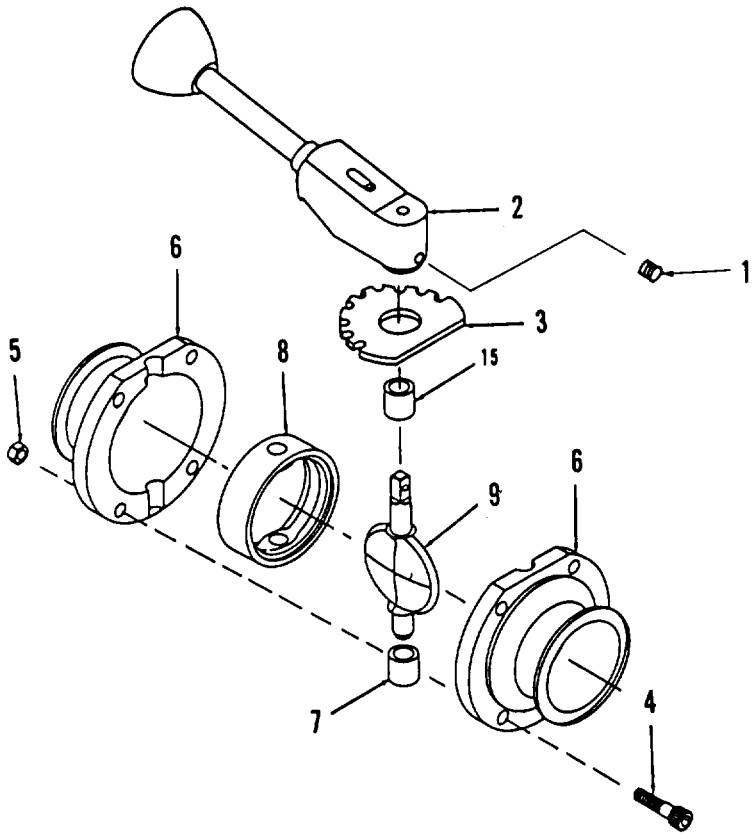


Figure 4-53.3. Butterfly Valve, Manual.
(MODEL ROWPU-1 ONLY)

4-48. SAFETY VALVE. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics (1)
Pipe Wrench (2)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Preformed Packings (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Air pressure zero.

General Safety Instructions:

WARNING

Observe specific Warning in text.

WARNING

Make certain pressure is relieved from tubing. Close the air supply valve and open vent valves on air manifolds. Wait until air pressure gages read zero.

REMOVAL.

a. Disconnect air line (1, Figure 4-54) by loosening compression nut (2).

b. Loosen nut (9) and remove valve assembly from piping.

c. Remove nipple (10), split ring (11) and preformed packing (12) from valve assembly (13).

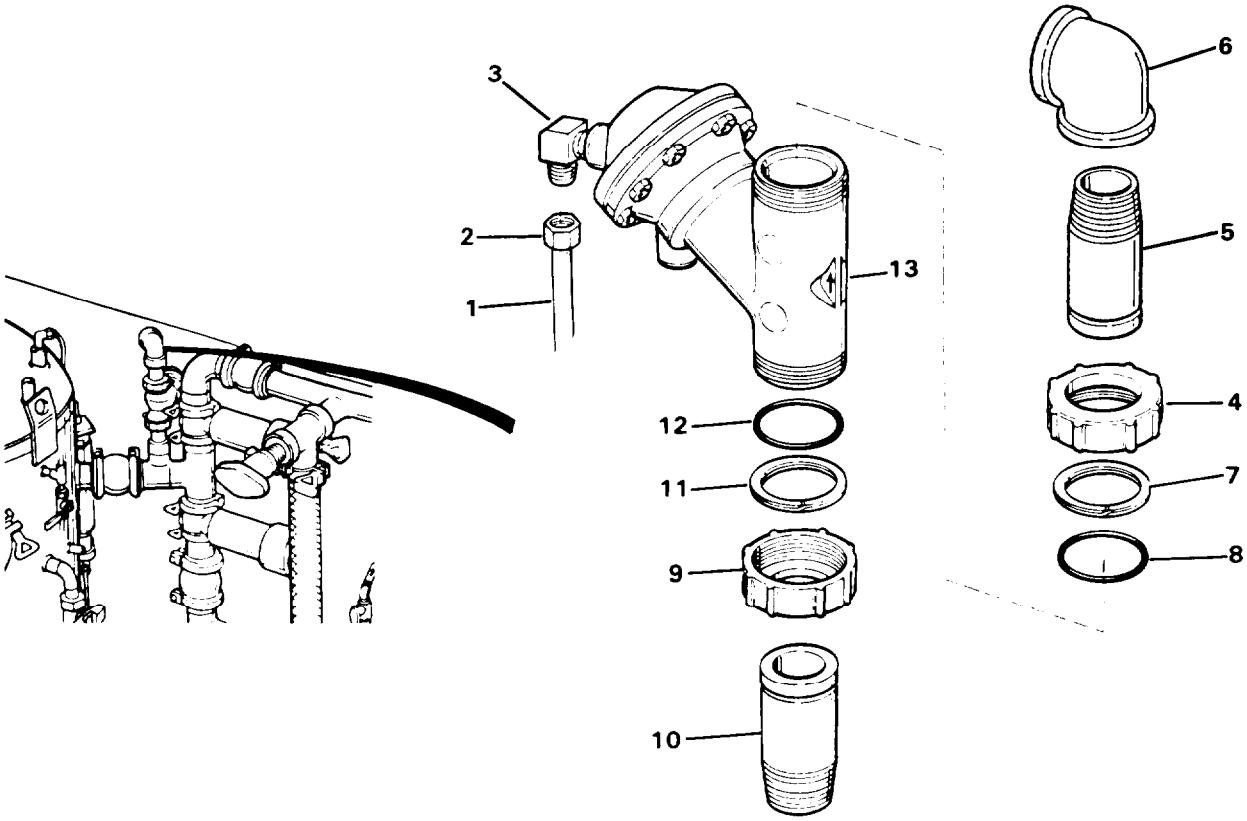


Figure 4-54. Safety Relief Valve

DISASSEMBLY.

a. Turn fitting (3) out of valve assembly (13).

b. Loosen retaining nut (4) and remove pipe nipple (5) and elbow (6).

c. Turn elbow (6) off nipple (5).

d. Spread split ring (7) and remove it from the groove in pipe nipple (5).

e. Remove retaining nut (4), split ring (7) and preformed packing (8).

f. Remove preformed packing (12), split ring (11) and nut (9) from nipple (10).

REPAIR.

a. Apply antiseize tape, replace air tubing and/or tube compression fitting and nut (2).

b. Replace damaged preformed packings (8 and 12).

c. Replace cracked pipe nipples (5 and 10), split rings (7 and 11), and retaining nuts (4 and 9) if damaged.

d. Replace relief valve(13) if the bonnet or body leaks, or if the valve leaks internally and will not seal off

REASSEMBLY.

a. Install nut (9) onto nipple (10). Install split ring (11) and preformed packing (12).

b. Install nut (4), split ring (7) and preformed packing (8) on nipple (5).

c. Install nipple (5) in elbow (6).

d. Install nipple (5) onto valve (13) and secure by tightening nut (4).

e. Install fitting (3) into valve (13).

f. Install nipple (10), nut (9), lock ring (11) and preformed packing (12) into pipe assembly. Tighten nut (9).

INSTALLATION.

a. Turn assembled valve (3 thru 13) onto piping.

b. Connect nut (2) with attached tubing (1) to fitting (3).

4-51. LOW PRESSURE SOLENOID VALVES. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Air pressure zero.

General Safety Instructions:

WARNING

Observe specific Warnings and Caution in text.

WARNING

Make certain pressure is relieved from air tubing. Close the air supply valve and open vent valves on air manifolds. Wait until air pressure gages read zero.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

There are three low pressure solenoid valves located as shown in Figures 4-58, 4-59 and 4-60. The removal and installation procedures for Figures 4-58 and 4-59 are identical. Procedures for Figure 4-60 are covered separately.

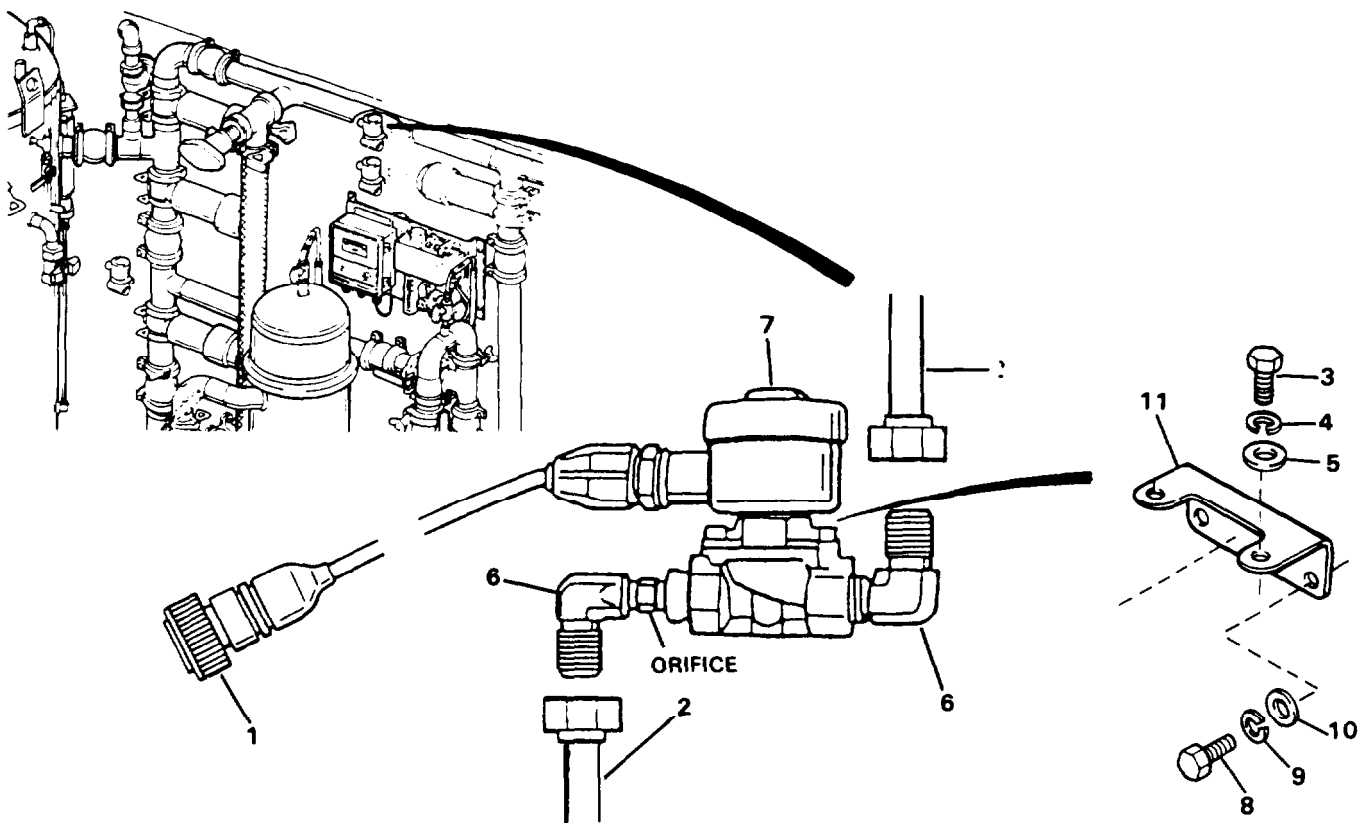


Figure 4-58. Backwash Air Inlet Solenoid Valve

REMOVAL.

a. Refer to Figures 4-58 and 4-59 and remove the air blanket solenoid valve and backwash air inlet solenoid valve as follows:

(1) Disconnect plug (1) from associated jack.

(2) Disconnect air tubing (2) from elbow (6).

(3) Remove two capscrews (3), lockwashers (4) and washers (5). Valve (7) is now free.

(4) Remove two capscrews (8), lockwashers (9) and washers (10) if bracket (11) requires replacement.

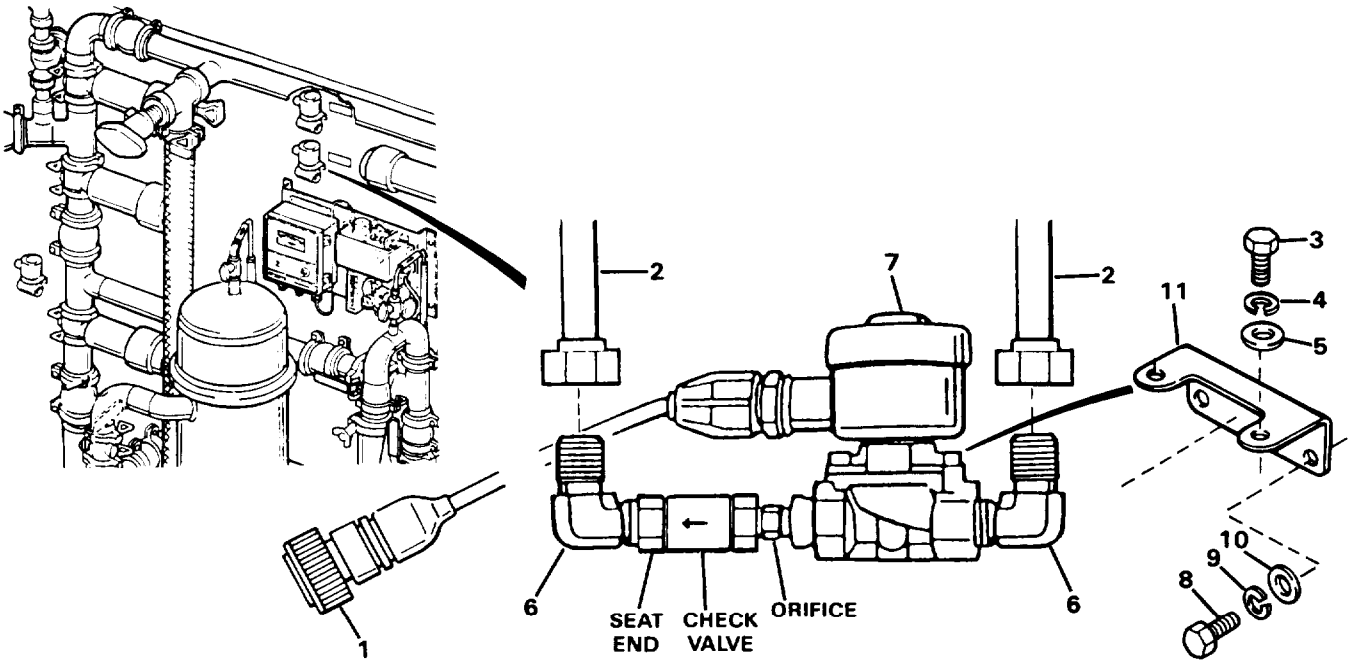


Figure 4-59. Air Blanket Solenoid Valve

b. Refer to Figure 4-60 and remove the solenoid valve as follows:

(1) Disconnect tubing from valve.

(2) Remove two screws (1) and cover (2).

(3) Tag terminals (4) and remove two screws (3).

(4) Loosen nut (5) and slide nut (5), retainer (6), and bushing (7) onto cable (9) away from connector body (8).

(5) Unscrew connector body (8) from solenoid body(12) and remove cable (9) with connector body(8), bushing (7), retainer (6) and nut (5).

CAUTION

When spring plate is removed, valve body is free to fall from bracket. Hold onto valve body during step below.

(6) Remove cap (10) and push down on spring plate (11) to release it.

(7) Remove spring plate (11), solenoid body (12), star washer (13) and valve body (14).

(8) If necessary, remove twocapscrews(15), lockwashers (16) and washers (17) and remove bracket (18).

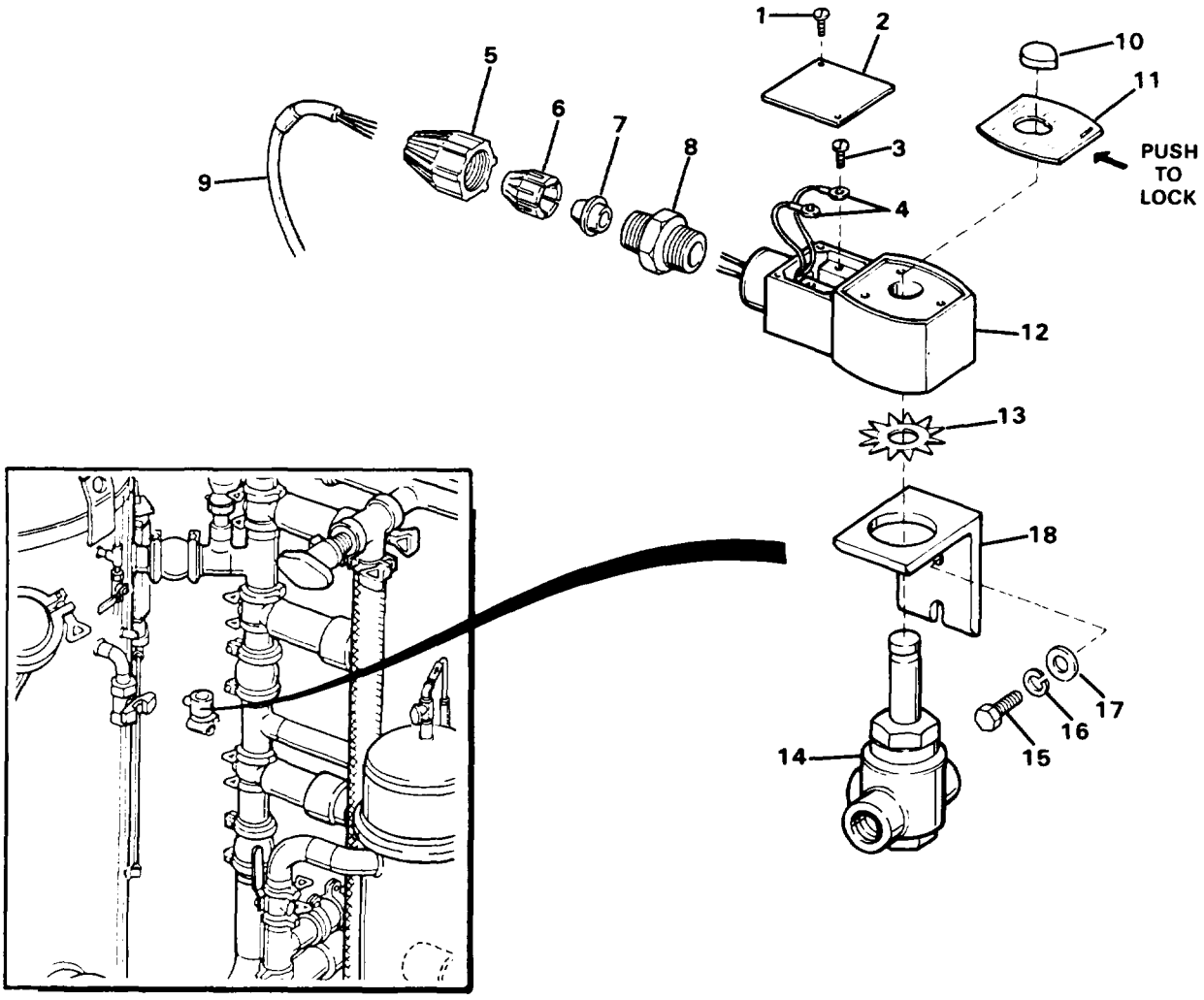


Figure 4-60. Solenoid Valve (for Safety Valve)

DISASSEMBLY.

NOTE

Cable replacement is performed at Direct Support Maintenance.

a. Replace elbow (6, Figures 4-58 and 4-59 and 8, Figure 4-60) if necessary.

b. Remove check valve (Figure 4-59).

c. Remove orifice (Figures 4-58 and 4-59).

REPAIR.

a. If blockage of check valve (Figure 4-59) is indicated, clean out check valve (para. 4-10).

b. Clean out orifice (Figure 4-58 and 4-59).

c. Repair or replace any damaged components.

REASSEMBLY.

NOTE

Cable replacement is performed at Direct Support Maintenance.

a. Install orifice (Figures 4-58 and 4-59).

b. Install check valve (Figure 4-59).

c. Install elbows (6, Figures 4-58 and 4-59 and 8, Figure 4-60).

INSTALLATION.

a. Refer to Figures 4-58 and 4-59 and install the backwash air solenoid and air blanket valves as follows:

(1) Install orifice into valve body.

(2) Install check valve onto orifice (Figure 4-59).

(3) If removed, install bracket (11) using capscrews (8), Iockwashers (9) and washers (10).

(4) Install valve (7) on bracket (11) and secure with capscrews (3), Iockwashers (4) and washers (5).

(5) Install air tubing (2) and connect plug (1).

b. Refer to Figure 4-60 and install the safety valve solenoid valve as follows:

(1) If removed, install bracket (18) and secure with twocapscrews (15), Iockwashers (16) and washers (17).

(2) Position valve (14) under bracket (18) as shown.

(3) Install star washer (13) and solenoid body (12).

(4) Install spring plate (11) and push down on it to snap into locked position. Install cap (10) on shaft of valve (14).

(5) Slip connector body (8) over cable terminals (4) and with cable terminals protruding from connector body (8). turn connector body (8) into solenoid body (12).

(6) Install bushing (7) and retainer (6) on connector body (8) and tighten nut (5).

(7) Secure terminals (4) to solenoid body (12) with screws (3).

(8) Install cover (2) and secure with two screws (1).

4-52. MEDIA FILTER AIR BLANKET LEVEL INDICATOR ASSEMBLY. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Testing. e. Reassembly. f. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No,):
Tool Kit, General Mechanics Automotive (1)
Multimeter (2)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Suitable Tags
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

CAUTION

Observe specific Cautions in the text.

REMOVAL.

a. Disconnect plugs on level switches (15, 17 and 19).

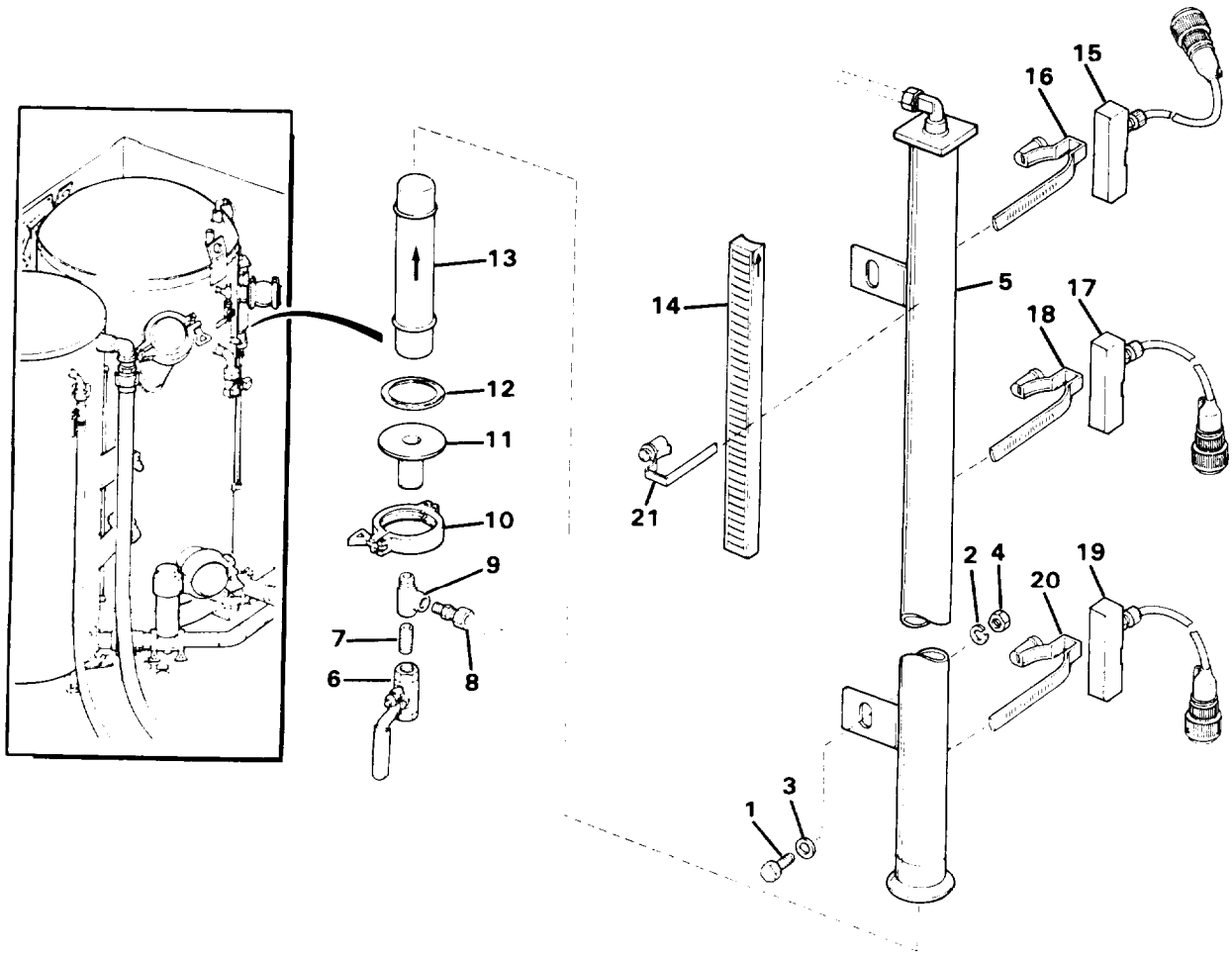


Figure 4-61. Media Filter Air Blanket Level Indicator Assembly

b. Disconnect tubing at the top of chamber (5) and from fitting (8) by loosening and removing tubing compression nuts.

c. Remove float chamber (5) by removing capscrews (1), Iockwashers (2), washers (3) and nuts (4).

DISASSEMBLY.

NOTE

Level switches must be installed in the exact position as removed.

a. Tag the switches (top, middle, bottom) locations and carefully mark the top of level switches(15, 17 and 19) on chamber (5). Also mark the top of the two indicators(14) on chamber (5).

b. Remove level switches(15, 17 and 19) by loosening the screws in clamps (16, 18 and 20).

c. Remove sight indicators (14) by loosening screws in the four clamps (21).

d. Remove valve (6), nipple (7), fitting (8) and tee (9) by turning counterclockwise.

CAUTION

To avoid damage, do not allow fIoat to fall out of chamber.

e. Open clamp (10) and remove cap (11) and gasket (12).

f. Remove float (13).

REPAIR.

a. Replace faulty or damaged parts with like serviceable parts.

b. Repair pipe fitting leaks by installing antiseize tape on the pipe threads.

c. Clean out any filter media in chamber (5) or in tubing attached to fitting (8) or the tubing attached to the top of chamber.

TESTING.

a. Use float(13) and slowly run it up or down flag indicators(14) to turn all flags white before installing on chamber (5).

b. Attach a multi meter set to ohms x 1 to the A and B pins of each switch (1 5, 17, 19). Hold the individual switches in the position shown in Figure 4-61 (wires up or down on the switch). Switch (1 5) should show no continuity (open) and switches (17) and (19)should show continuity (closed). Use float (13)to change the switch to open or closed as indicated above if they are not in the correct position by running it past switches until they change position.

REASSEMBLY.

CAUTION

Do not overtighten clamps. This could cause indicators and switches to crack.

NOTE

Level switches must be correctly positioned in relation to sight indicator for proper operation. Switches must be installed (180° from the sight indicators) with the wires as shown in Figure 4-61. Switch (15) wires up and switches (17 and 19) wire down.

a. Install level switches(15, 17 and 19) by means of clamps(16, 18 and 20). Locate the switches by means of tags and marks made during disassembly.

b. Install sight indicators (14) with clamps (21). Be sure indicators(14) are located in relation to the marks made during disassembly and that the marked tops of the indicators are at the top of the assembly.

NOTE

Arrow on float must point up.

c. Install float(13) with arrow pointing up, gasket (12), cap (11) and secure in place with clamp (10).

d. Install tee (9), fining (8), nipple (7) and valve (6). Be sure to cover all male threaded surfaces with antiseize tape, wrapped clockwise when viewing the fining.

INSTALLATION.

a. Install chamber (5) using capscrews (1), lockwashers (2), washers (3) and nuts (4).

b. Connect tubing at top of chamber (5) and at fitting (8). Tighten tubing compression nuts.

c. Connect plugs on level switches to power cables.

4-53. MEDIA FILTER ASSEMBLY. This task covers:

a. Service. b. Disassembly. c. Repair. d. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit General Mechanics Automotive (1)
Steel Rule

Materials/Parts:
Media, Coarse (Appx E, Sec II, Item 55)
Media, Fine (Appx E, Sec II, Item 56)
Sand, Garnet (Appx E, Sec II, Item 60)
Tape, Antiseize (Appx E, Sec II, Item 67)
Disposable Container
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
Media filter air blanket assembly removed (para. 4-52)

Personnel Required: 2

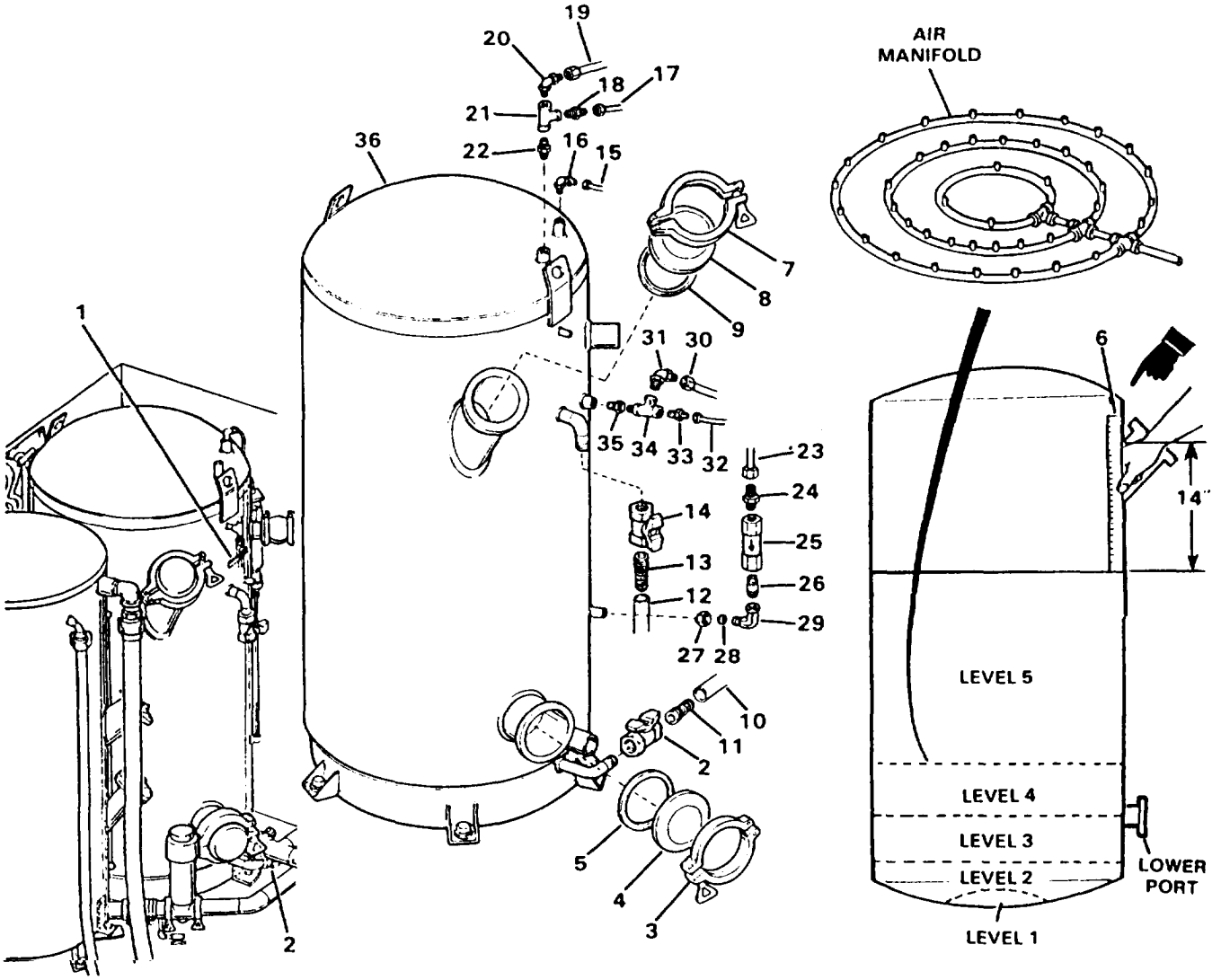


Figure 4-62. Media Filter Assembly

SERVICE.

NOTE

Cover the floor of the van with a tarpaulin, plastic sheeting or other water resistant material to minimize clean up after removing the filter media. Use disposable containers such as plastic garbage bags to remove spent media.

a. Refer to Figure 4-62 and remove media from tank (36) as follows:

NOTE

Valves are open when handles are parallel to lines.

(1) Open vent valve (1).

(2) Open drain valve (2) and drain filter.

NOTE

Refer to the media level diagram at the right side of Figure 4-62. Levels 1 and 2 are support gravels for the finer filter materials above. These gravels are not normally replaced. If the gravel levels 1 and 2 become plugged, notify direct support maintenance.

(3) Remove clamp (3), cap (4) and gasket (5) and scoop out the level 3, 4 and 5 media through the lower port.

(4) Remove media down to level 2.

b. Replace the media in the filter as described below and shown in Table 4-7, Filter Loading Requirements.

Table 4-7. Filter Loading Requirements

Level No.	Description	Depth	Approx. Cu. Ft.	Approx. Wt. Lbs.
1	Gravel, Coarse	—	1.0	100
2	Gravel, Coarse	5.2”	2.0	200
3	Sand, Garnet	5.8”	3.6	500
4	Media, Fine Filter	8.9”	5.2	650
5	Media, Coarse Filter	26.7”	15.6	400

(1) Remove clamp (7), cap (8) and gasket (9).

(2) Load level 3 through the top port and level it with the chemical mixing paddle or other suitable stick. Note in Figure 4-62 that the level goes about 1/2 way across the lower port. The level 3 media should be banked lower at the port to keep from running out of the port.

NOTE

Install beaded side of gaskets toward the media filter,

(3) Clean the gasket sealing surfaces carefully at the lower port and cap (4) and install gasket (5), cap (4) and clamp (3).

(4) Load level 4 through the top port and level it with the chemical mixing paddle or other suitable stick.

NOTE

It is important that level 4 does not cover the air manifold in the filter. Load this level carefully and level it frequently (between installing bags of media). The top of level 4 will be just below or at the air manifold rings if level 3 was carefully removed during the media removal procedure.

(5) Load level 5 through the top port. Leveling of level 5 is not necessary.

(6) To ensure the media filter is correctly loaded, measure from the top of the media bed to the top of the upper port, using steel rule (6). The distance measured should be from 10 to 14 inches.

(7) Clean the gasket sealing surfaces carefully at the upper port and cap (8) and install gasket (9), cap (8) and clamp (7).

c. Clean all spilled media from the floor of the ROWPU, hosing down the deck if necessary.

DISASSEMBLY.

NOTE

Tag all tubing to facilitate reassembly.

a. Refer to Figure 4-62 and disassemble the media filter assembly as follows:

(1) Open vent valve (1).

(2) Open drain valve (2) and drain filter.

(3) Remove clamp (3), cap (4), and gasket (5) from tank (36).

NOTE

Do not do step 4 below if there is media in the filter unless it is required to repair a leaking gasket. Media may come out and extra care is required to make sure gasket area is clean before reassembly. If media must be removed, proceed as described in service procedure above.

(4) Remove clamp (7), cap (8) and gasket (9).

(5) Remove hose (12), fitting (13), and valve (14).

(6) Remove hose (10), fitting (11) and valve (2).

(7) Refer to para. 4-24 for general air tubing removal procedure. Remove air tubing (15) from elbow (16) and elbow (16) from tank.

(8) Remove air tubing (17) from adapter (18). Remove adapter from tee (21).

(9) Remove elbow (20), tee (21) and adapter (22).

(10) Remove air tubing (23) from adapter (24).

(11) Remove adapter (24), check valve (25) and nipple (26).

(12) Turn compression nut (27) off tank and remove compression nut (27) and ferrule (28) from elbow (29).

(13) Remove tubing (30) from elbow (31) and tubing (32) from nipple (33).

(14) Remove elbow (31) and nipple (33) from tee (34).

(15) Remove tee (34) and adapter (35).

REPAIR.

a. Clean out check valve (25) as described in para. 4-10.

b. Replace damaged check valve (26).

c. Replace damaged air fittings (para. 4-24).

d. Repair by replacing any unserviceable component.

e. Replace any damaged valves, fittings and tubing.

f. Use antiseize tape on threads of male fittings.

g. Clean valve (2 and 6) bores if plugged.

REASSEMBLY.

a. Install adapter (35) on tank and tee (34) on adapter (35).

b. Install nipple (33) on tee (34).

c. Install elbow (31) on tee (34).

d. Install elbow (29) and ferrule (28) on compression nut (27). Install assembled items (27 thru 29) by tightening compression nut (27) on tank outlet. Elbow (29) must point up as shown.

e. Install nipple (26) on elbow (29).

NOTE
When installing check valve, be sure the seat is pointing downstream.

f. Install check valve (25), with arrow down as shown, on nipple (26) and adapter (24) on check valve (25).

g. Install adapter (22) on tank fitting.

h. Install tee (21) on adapter (22).

i. Install elbow (20) and adapter (18) on tee (21).

j. Install elbow (16) on tank.

k. Install tubing (15, 17, 19, 23, 30 and 32) as described in para. 2-24.

l. Install valve (14), fitting (13), and hose (12).

m. Install valve (2), fitting (11), and hose (10).

n. If media has been removed, replace as described in s ervice steps d and e above.

CAUTION
Be sure gasket seats on the filter and cap are clean before installing gaskets and caps.

o. Install gasket (9) with beaded side toward media filter. Install cap (8) and clamp (7).

p. Install gasket (5), cap (4) and clamp (3).

q. Close drain valve (2).

r. Close vent valve (1).

4-54. CLEAN/FLUSH TANK ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Test. d. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Multimeter (2)
Hand Riveter (2)
Wire Stripper (16)
Heat Gun (16)
Equipment Condition:
ROWPU shutdown. Low pressure piping removed (para. 4-42). Tank drained.
Wires disconnected at junction box No. 3 (para. 4-32).

Materials/Parts:
Sealant, Silicone (Appx E, Sec II, Item 63)
Tape, Antiseize (Appx E, Sec II, Item 67)
Varnish, Electrical (Appx E, Sec II, Item 73)
Gaskets (TM 10-4610-232-24P)
Preformed Packings (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

General Safety Instructions:
WARNING
Observe specific Warnings and Cautions in text.

WARNING
Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

DISASSEMBLY.

a. Disconnect hose (1, Figure 4-63) and hose (2) from tank.
b. Turn elbow (5) out of tank.
c. Remove coupling (3) with attached dust cap from elbow (5) and remove gasket (4).
d. Turn elbow (8) out of tank.
e. Remove coupling (6) with attached dust cap, from elbow (8) and remove gasket (7).
f. Loosen tube nuts (9) and remove tube (10).
g. Remove tube stiffeners (11) from tube (10).
h. Remove elbows (12) from tank.
i. Loosen nuts (13) until free of fittings (18 and 19).
j. Remove preformed packing (14) and seals (15).
k. Remove nuts (13) and tubing (16) with ferrules (17) attached.
l. Remove fittings (18 and 19).

CAUTION
Do not damage switch wires.

NOTE
Wires are covered with shrink tubing. If necessary, remove shrink tubing by carefully slitting it with a knife.

m. Unscrew nut (20). Slide retainer (21) and bushing (22) off wires (23) attached to level switch (31).
n. Remove silicone sealant from bore of elbow (25). Unscrew elbow (25) and slide it off wires (23).
o. Remove four capscrews (26), lockwashers (27), nuts (28), washers (29) and lockwashers (30).

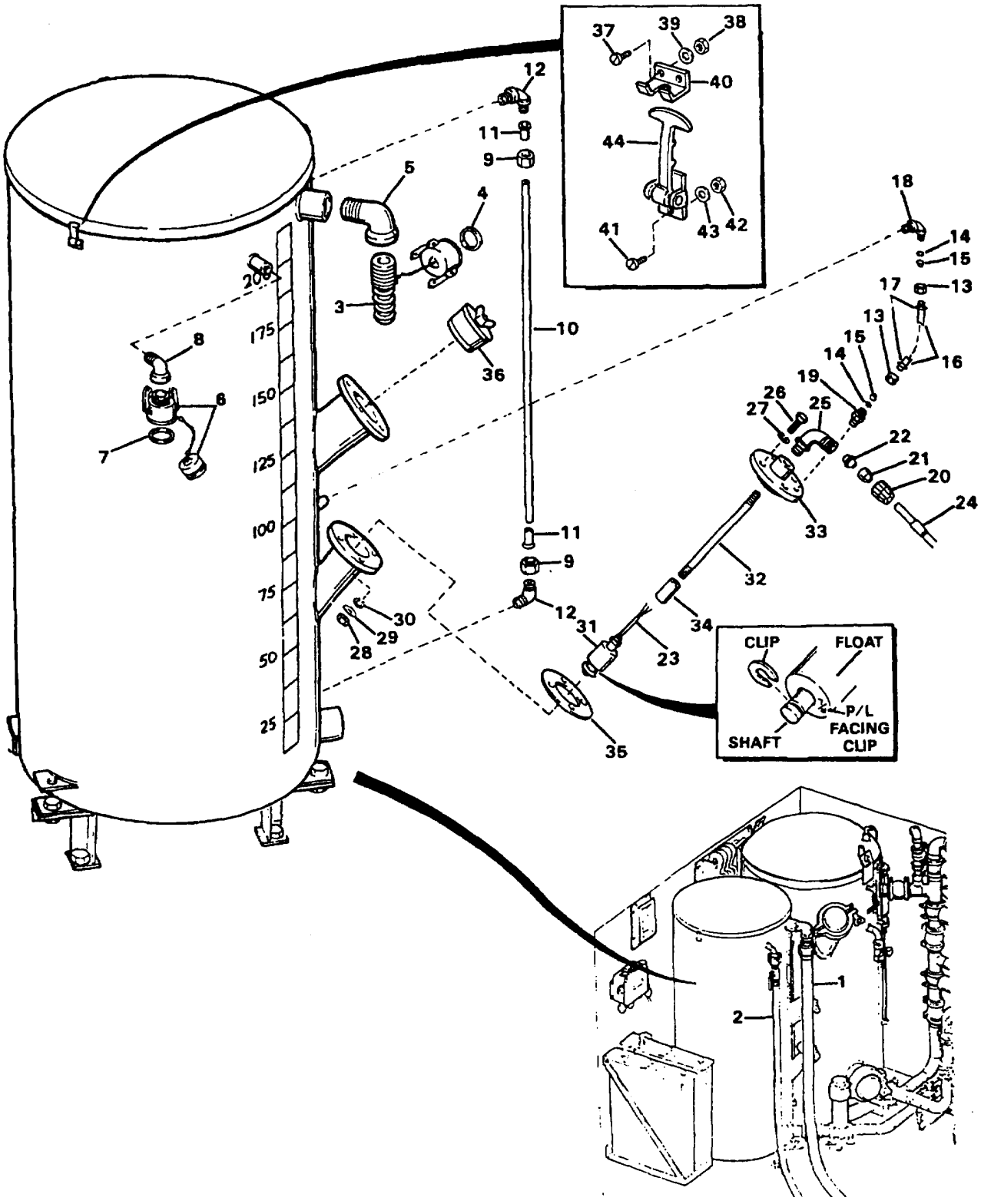


Figure 4-63. Clean/Flush Tank Assembly

p. Unscrew and pull level switch (31), with attached wires (23) free of items (32, 33 and 34).

q. Remove nipple (32) from cover (33) and remove adapter (34) from nipple (32). Remove gasket (35).

r. Remove chemical port cap (36) by loosening the wing nut on the cap.

s. Unlatch rubber latch (44) from bracket (40) and remove two capscrews (37), nuts (38) and washers (39). Remove latch bracket (40).

t. Remove two capscrews (41), nuts (42) and washers (43) and remove rubber latch (44).

REPAIR.

a. Repair all unserviceable components by replacement.

CAUTION
Do not overtighten fittings. This can crack the tank or ruin threads on fittings.

b. Repair leaks at pipe threads by using two wraps of antiseize tape on male fittings.

c. Replace wire markers (para. 4-10).

d. Replace chemical port cap (36) if it will not seal.

NOTE
Preformed packings, ferrules and seals are not individually replaceable. When replacing tubing or fittings these items are replaced as a "kit" or subassembly. Sections of tubing with ferrules must be cut off if tubing is repaired rather than replaced.

e. Replace tubing (10 and 16) if necessary.

f. Repair damaged dust caps (para. 4-11).

g. Repair leaks in shrink wrap (24) around wires (23) by removing the level switch (31) and reassembling as described in the following reassembly procedure.

TEST.

a. Hold switch (31) with clip pointing downward and the wires (23) pointing upward as shown in Figure 4-63.

b. Refer to the inset on Figure 4-63 and locate letters P/Len float. P/L must be at clip end of shaft. If not, remove clip, and reposition float on shaft with P/L at clip end. Reinstall clip.

c. Attach a multi meter set to ohms x 1 to the black wire and either one of the other two wires.

d. Check for continuity between the two wires while holding the float down with the wires pointing down and the float bottomed out on the switch shaft. If the circuit is open, attach the multimeter to the other colored wire.

e. The black wire is No. 324. Attach a wire marker (para. 4-10).

f. If the meter shows continuity, then the other tested wire is No. 342 and the third wire is No. 348. Attach wire markers (para. 4-10).

g. If the multi meter does not show continuity, then the other tested wire is No. 348 and the third wire is No. 342. Attach wire markers (para. 4-10).

h. Check the operation of the switch as follows:

(1) Wires up/float down .....324 to 342 = continuity; 324 to 348 = open

(2) Wires up/float up .....324 to 342 = open; 324 to 348 = continuity

REASSEMBLY.

CAUTION
Do not overtighten fittings. This can crack tank or ruin threads on fittings.

NOTE
Use antiseize tape on all male fittings.

a. If removed, install mounting bracket (44) and secure with capscrews (41), nuts (42) and washers (43).

b. Install latch bracket (40) and secure with capscrews (37), nuts (38) and washers (39).

c. Install cap (36).

d. Clean flange at lower chemical pod and install gasket (35).

e. Slide wires (23) through adapter (34) and tighten threads of level switch (31) into adapter (34).

f. Slide wires (23) through nipple (32) and tighten nipple (32) into adapter (34).

g. Install the elbow (25) on the cover (33). Fill bore of elbow (25) with silicone sealant.

h. Slide wires (23) through assembled cover (33) and elbow (25) and tighten nipple (32) with assembled adapter and limit switch (31) into cover (33).

i. Install gasket (35) on lower chemical port flange.

j. Insert switch (31) with items (34, 32, 33 and 25) attached into chemical port.

k. With elbow (25) pointed down as shown, secure the cover (33) to the flange on the chemical port with four capscrews (26), lockwashers (27), nuts (28), washers (29) and lockwashers (30).

l. If it was removed, install new shrink tubing on wires (23) as follows:

(1) Slide wires (23) through a new piece of shrink tubing (24). Make sure the new tubing is long enough to reach the junction box and that the wires stick out at least ten inches from the end of the tubing.

(2) Push the tubing on the wires until one end of it goes into elbow (25).

WARNING
Heat gun is extremely hot.

(3) Apply heat with the heat gun and shrink the tube onto the wires.

m. Install fittings (18 and 19).

n. Install nuts (13), new ferrules (16), new seals (15) and preformed packings (14) on tubing (17).

o. Insert assembled tubing (items 13 thru 17) into fittings (18 and 19).

p. Hand tighten nuts (13) into fittings (18 and 19), ferrules (16), will lock tubing in place.

q. Apply antiseize tape and install elbows (12) into tank.

r. Install tube stiffeners (11) into tube (10).

s. Install tube (10) in elbows (12) and tighten tube nuts (9).

t. Install gasket (7) and install coupling (6), with attached dust cap, into elbow (8).

u. Install elbow (8) into tank.

v. Install gasket (4) and install coupling (3), with attached dust cap, into elbow (5).

w. Install elbow (5) in tank.

x. Connect wires (23) at junction box no. 3 (para. 4-32).

y. Connect hose (1) and hose (2) to tank.

4-55. POLYELECTROLYTE AND SEQUESTRANT TANK ASSEMBLES. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Test. e. Reassembly. f. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit General Mechanics Automotive (1)
Multimeter (2)
Stripper, Wire (16)
Terminal Strip Tool (16)
Heat Gun (16)

Materials/Parts:
Sealant, Silicone (Appx E, Sec II, Item 63)
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:

ROWPU shutdown. Cable disconnected at junction box No, 3 (para. 4-32).

Personnel Required: 2

General Safety Instructions:

WARNING

Do not wear loose clothing or jewelry while working on equipment.

WARNING

Protect eyes and skin from direct contact with chemicals. Be especially careful when opening containers to avoid chemicals and chemical fumes. Wash hands thoroughly with soap and water after handling chemicals or components exposed to chemicals.

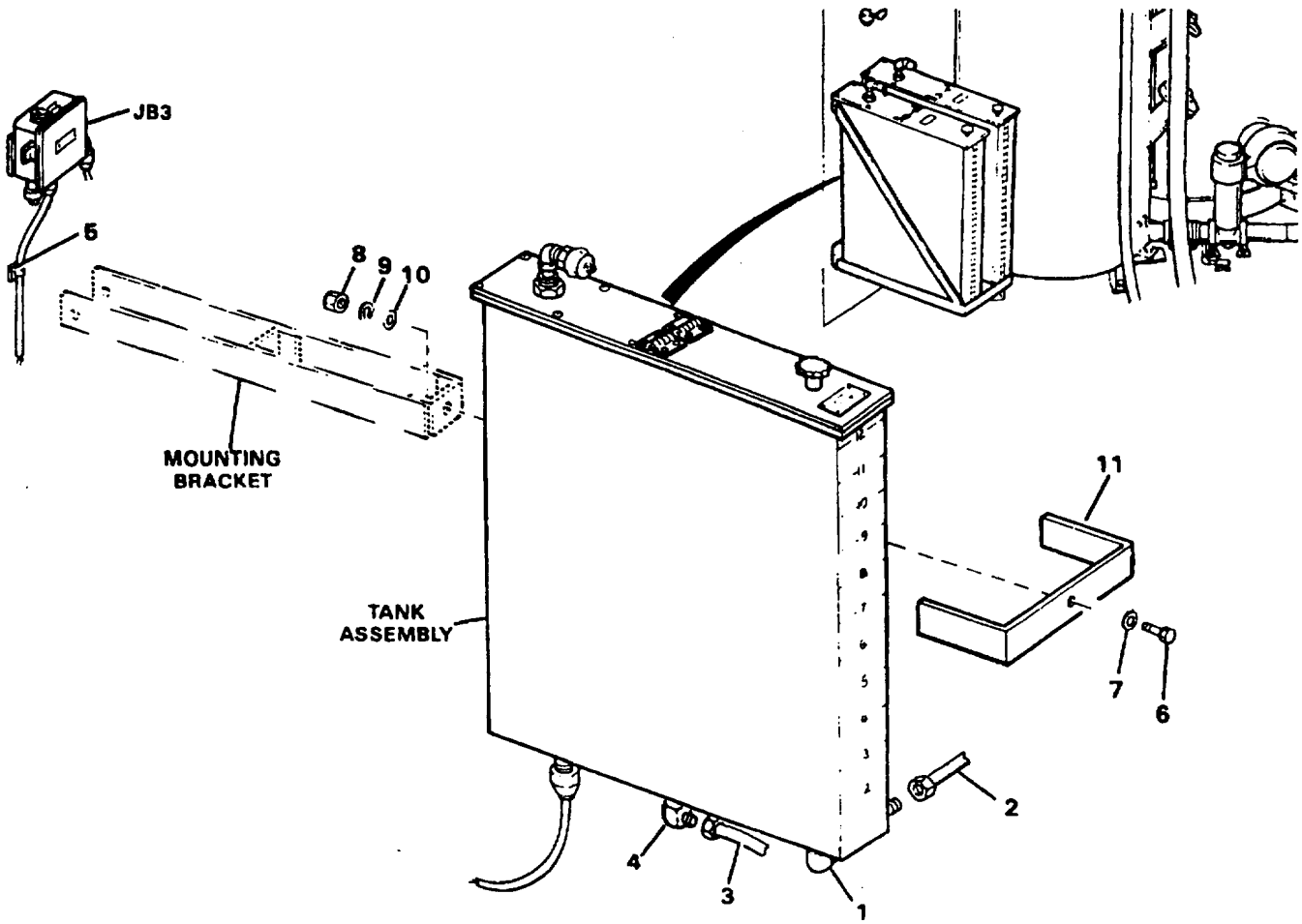


Figure 4-64. Polyelectrolyte and Sequestrant Tank Assemblies (sheet 1 of 2)

REMOVAL.

NOTE
The polyelectrolyte and sequestrant tank assemblies are identical with the exception of nameplates and other minor differences which are noted in text. The following removal, disassembly, repair, test, reassembly and installation procedures apply to both the polyelectrolyte and sequestrant tanks.

a. Open drain valve (1, Figure 4-64, sheet 1) and drain the tank.
b. Disconnect tubing (2) at the drain valve (1).
c. Disconnect tubing (3) from elbow (4).
d. Refer to para. 4-32 and disconnect wires at junction box JB3.
e. Cut the plastic cable ties (5) which secure the wires to the wall of the ROWPU.
f. Remove capscrew (6), washer (7), nut (8), lockwasher (9) and flat washer (10). Remove bracket (11).
g. Lift the polyelectrolyte or sequestrant tank assembly from its mounting bracket.

DISASSEMBLY.

a. Remove eight screws (12, Figure 4-64, sheet 2), nuts (13), washers (14) and two hinges (15). Cover (16) will now be free.
b. Remove capscrew (17), washer (18) and knob (19).

NOTE
Two nameplates are shown. One is for the polyelectrolyte tank and the other is for the sequestrant tank.

c. Remove screws (20), nuts (21) and washers (22). Nameplate (23) will now be free.
d. Remove six screws (24), washers (25), nuts (26) and washers (27). Cover (28) is now free. Lift cover (28) and disconnect tube nut (39) from fitting (38).
e. Remove dust cover (29), gasket (30) and quick disconnect (31). Remove elbow (32) and nipple (33).
f. Remove nut (34) and remove items (35, 36, 37 and 38) as an assembly.
g. Remove fitting (38) from bushing (37) and sealing ring (35) from adapter (36).
h. Unscrew tube nut (40) from elbow fitting (53) and remove items (40 thru 46) as an assembly.
i. Remove tube nuts (40) and ferrules (41) in three places. Tubes (42 and 45) are now free,
j. Remove inlet strainer (43), primer fitting (44) and elbow (46).
k. Remove elbow (51) and nut (52),
l. Remove items (53 thru 57) as an assembly.
m. Remove elbow fitting (53), nipple (54), bushing (55), bulkhead fitting (56) and sealing ring (57).

NOTE
Wires are covered with shrink tubing.

n. Loosen nut (58) and slide nut (58), retainer (59) and bushing (60) off wires (68). If necessary, remove the shrink tubing (69) by carefully slitting it with a knife. Do not damage wires (68).
o. Unscrew body (61) from bulkhead fitting (66) and slide body (61) and sealing washer (62) off the end of wires (68).
p. Remove nut (63).
q. Remove items (64 thru 67) as an assembly.

r. Remove the silicone sealant from the bottom of bulkhead fitting (66).

s. Remove level switch (64) from bushing (65) and pull wires (68) through items (65, 66 and 67).

t. Remove bushing (65) from bulkhead fitting (66) and remove sealing ring (67).

REPAIR.

a. Repair all unserviceable components by replacement.

b. Repair leaks at pipe threads using two wraps of antiseize tape on male fittings.

c. Repair leaks around nuts (52 and 63) by tightening nuts. If that does not work, replace sealing rings (62 and 57).

d. Wires (68) are enclosed in shrink wrap tubing (69), Repair leaks into the shrink wrap (69) tubing by putting antiseize tape on all pipe fittings Also, fill bottom hole in fitting (66) with silicone sealant.

e. Replace gasket (30) if damaged or missing.

f. Replace inlet strainer (43) is plugged.

g. Replace damaged or inoperative level switch (64) and wires (68) as an assembly.

NOTE

If level switch assembly must be replaced, proceed with test procedures. If the switch is being reused, proceed to Reassembly.

a. Hold switch (64) with clip (72) pointing upward and wires (68) pointing downward as shown in Figure 4-64, sheet 2.

b. Refer to the inset on Figure 4-64, sheet 2 and find letters P/Len float. P/L must be at clip (72) end of shaft (71). If not, remove clip (72), and reposition float (70) on shaft (71) with P/L at clip end. Reinstall clip (72).

c. Turn the switch float (70) over so the letters P/L are up and reinstall the float (70) and clip (72) on the switch shaft (71).

d. Attach a multimeter set to ohms x 1 to the black wire and either one of the other two wires.

e. Check for continuity between the two wires while holding the switch (64) with the wires (68) pointing down and the float (70) bottomed out on the switch shaft (71). If the circuit is open, attach the multimeter to the other colored wire.

f. The black wire is No. 324. Attach a label (para. 4-10).

g. When the meter shows continuity, the other tested wire is No. 342 and the third wire is No. 344 (sequestrant tank switch is No. 346 and the third wire for the sequestrant tank is No. 342). Attach wire labels (para. 4-10).

h. Check the operation of the switch (64) as follows:

(1) Wires (68) down/float (70) down.....324 to 342 = continuity
Polyelectrolyte tank.....324 to 344 = open
Sequestrant tank.....324 to 346 = open

(2) Wires (68) down/float (70) up.....324 to 342 = open
Polyelectrolyte tank.....324 to 344 = continuity
Sequestrant tank.....324 346 continuity

NOTE

Reassemble all connections without using excessive force on plastic fittings.

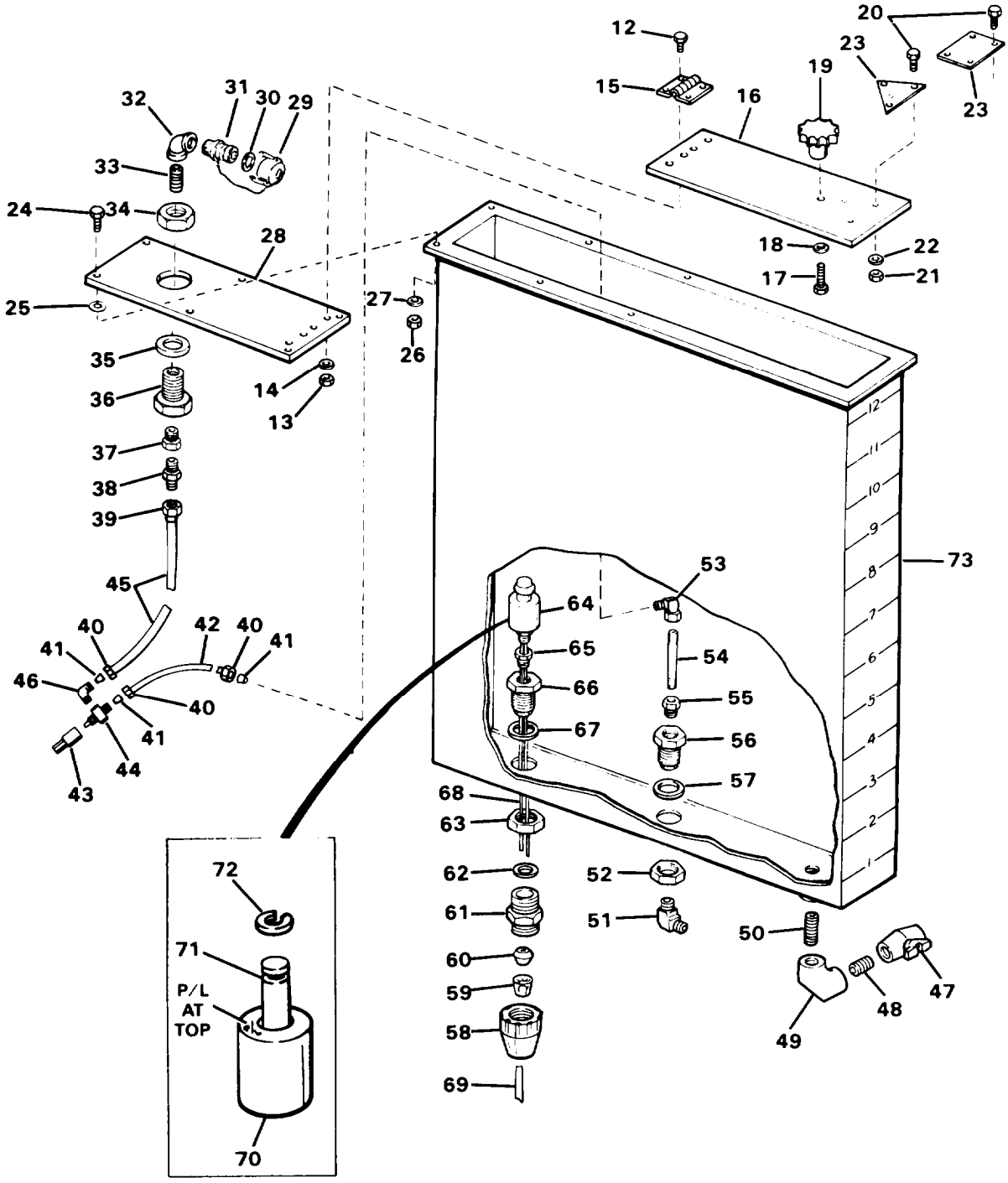


Figure 4-64. Polyelectrolyte and Sequestrant Tank Assemblies (sheet 2 of 2)

REASSEMBLY.

a. Put antiseize tape on level switch (64) and bushing (65) threads. Install switch (64) into bushing (65) and install this assembly into bulkhead fitting (66).

b. Fill the bore of fitting (66) with silicone sealant.

c. Install sealing ring (67) on fitting (66) and install items (64 thru 67) in the tank as an assembly, with wires (68) protruding through the bottom of the tank.

d. Install nut (63) over wires (68) and install seal ring (62) on body (61). Tighten nut (63) securely to prevent leaks. Install body (61) into the bore of fitting (66).

NOTE

Proceed with step e only if new switch or new shrink wrap tubing on wires is being installed. Otherwise, proceed to step f.

e. Install new shrink tubing (69) on wires (68) as follows:

(1) Slide wires (68) through a new piece of shrink tubing (69). Make sure the new tubing is long enough to reach the junction box and that the wires stick out at least ten inches from the end of the tubing.

(2) Push the shrink tubing (69) on the wires until one end of it goes into body (61).

(3) Apply heat with the heat gun and shrink the tubing (69) onto wires (68).

f. Slide bushing (60), retainer (59), and nut (58) over wires (68) and screw nut (58) onto body (61).

g. Reassemble inlet strainer, primer fitting (44), tubes (42 and 45) and elbow (46) with tube nuts (39 and 40) and ferrules (41), elbow (53), nipple (54), bushing (55), fitting (56) and seal ring (57) and install in tank (73) as a unit.

h. Install nut (52) to secure the assembly in place, Tighten securely to prevent leaks. Install elbow (51).

i. Install nipple (50), elbow (49), nipple (48) and drain valve (47).

j. Reassemble fitting (38), bushing (37), fitting (36) and gasket (35) and secure in position on cover (28) with nut (34).

k. Install nipple (33), elbow (32), quick disconnect (31), dust cover (29) and gasket (30) on cover (28).

l. Install cover (28) and secure with screws (24), washers (25), nuts (26) and washers (27).

NOTE

The polyelectrolyte plate is triangular and the sequestrant plate is rectangular. Secure with screws, nuts and washers.

m. Install the appropriate nameplate (23) (polyelectrolyte or sequestrant).

n. Install knob(19) and secure with capscrew (17) and washer (18).

o. Place cover(16) on tank (73) and secure two hinges(15) to covers (16 and 28) using eight screws, nuts (13) and washers (14).

INSTALLATION.

a. Refer to Figure 4-64, sheet 1 and place the subassembled tank on the mounting bracket.

b. Install bracket (11) and secure with capscrew (6), flat washer (7), nut (8), lockwasher (9) and flatwasher (10).

c. Refer to para. 4-32 and connect the wires to JB3.

d. Install new tie wraps (5) (para, 4-10).

e. Install tubes (3 and 2).

4-56. CHEMICAL TANKS FRAME. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP,

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics(1)

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU Shutdown.
Polyelectrolyte and sequestrant tanks removed (para. 4-55).

DISASSEMBLY.

a. Remove two nuts(1, Figure 4-65), two lockwashers (2), four washers(3) and two capscrews (4). Remove restraint rod (5) from restraint bracket (6).

b. Remove capscrew (7), Iockwasher (8), and washer (9), Remove restraint bracket (6).

c. Remove two capscrews (10), two lockwashers (11), two washers (12), two nuts (13), and two washers (14). Remove kick bracket (15).

d. Remove six capscrews (16), six Iockwashers (17), six washers (18), and frame (19).

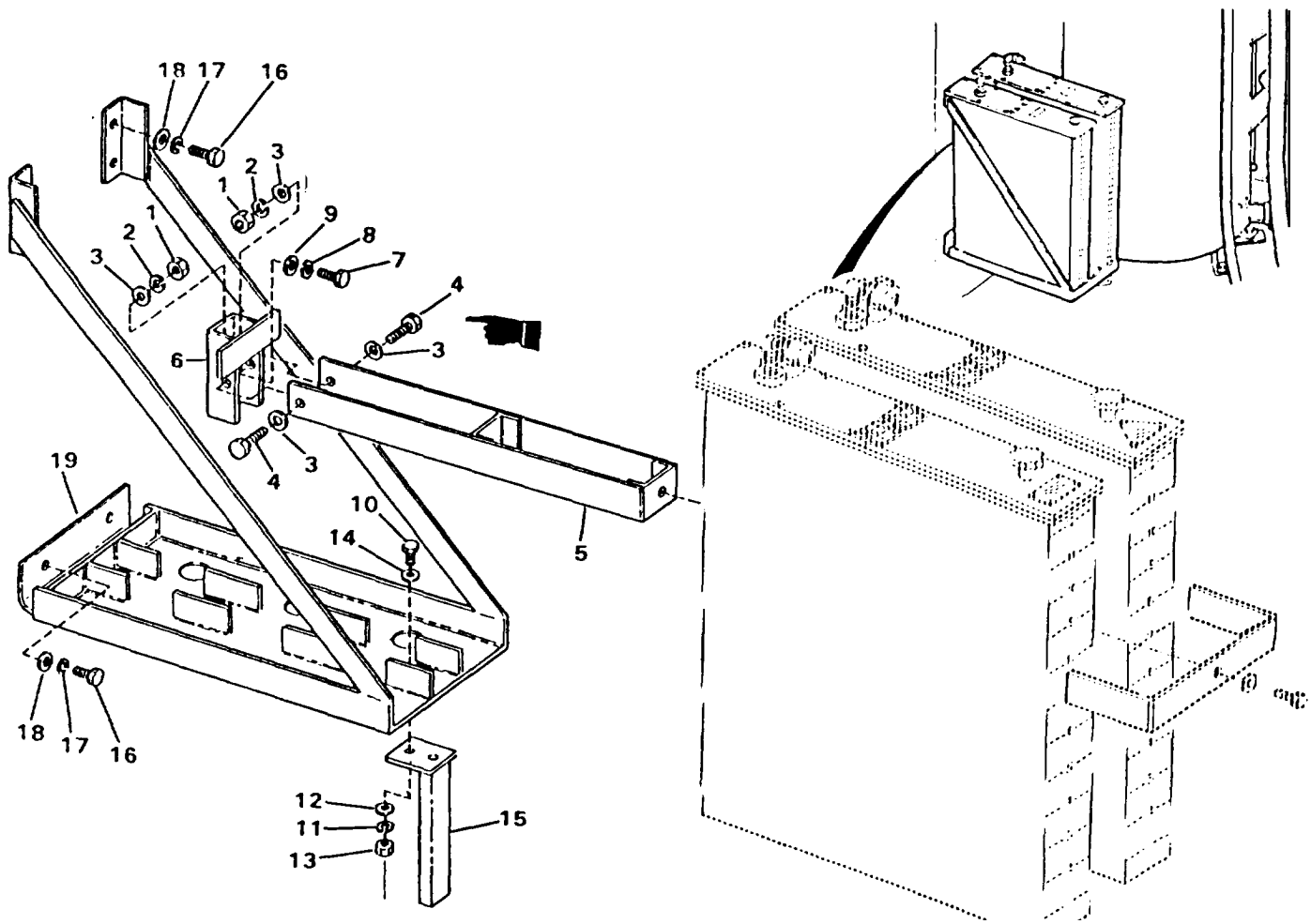


Figure 4-65. Chemical Tanks Frame

REPAIR.

Replace damagad structural components which cannot be repaired by straightening.

REASSEMBLY.

a. Position frame (19) on wall, secure with six capscrews (16), six lockwashers (17), and six washers (18).

b. Position kick bracket (15) on frame (19), secure with two capscrews (10), twolockwashers(11), two washers (12), and two nuts (13).

c. Position restraint bracket (6) on wall, secure with capscrew (7), lockwasher (8), and washer (9).

d. Position restraint rod(5) on bracket (6). Secure with two capscrews (4), two lockwashers (2), four washers(3) and two nuts (1).

4-57. SAMPLE TROUGH ASSEMBLY. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Antiseize Tape (Appx E, Sec II, Item 67)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.
Sample lines tubing drained

NOTE

This procedure is typical for all the valves; only one is shown for clarity.

REMOVAL.

a. Tag and remove five input tubes (1, Figure 4-66) from elbows (3) by loosening tube fitting nuts (2).

b. Loosen drain line clamp (4) and remove drain line (5) from bottom of sample trough (9).

c. Remove four screws (6), lockwashers (7) and washers (8) and remove sample trough (9).

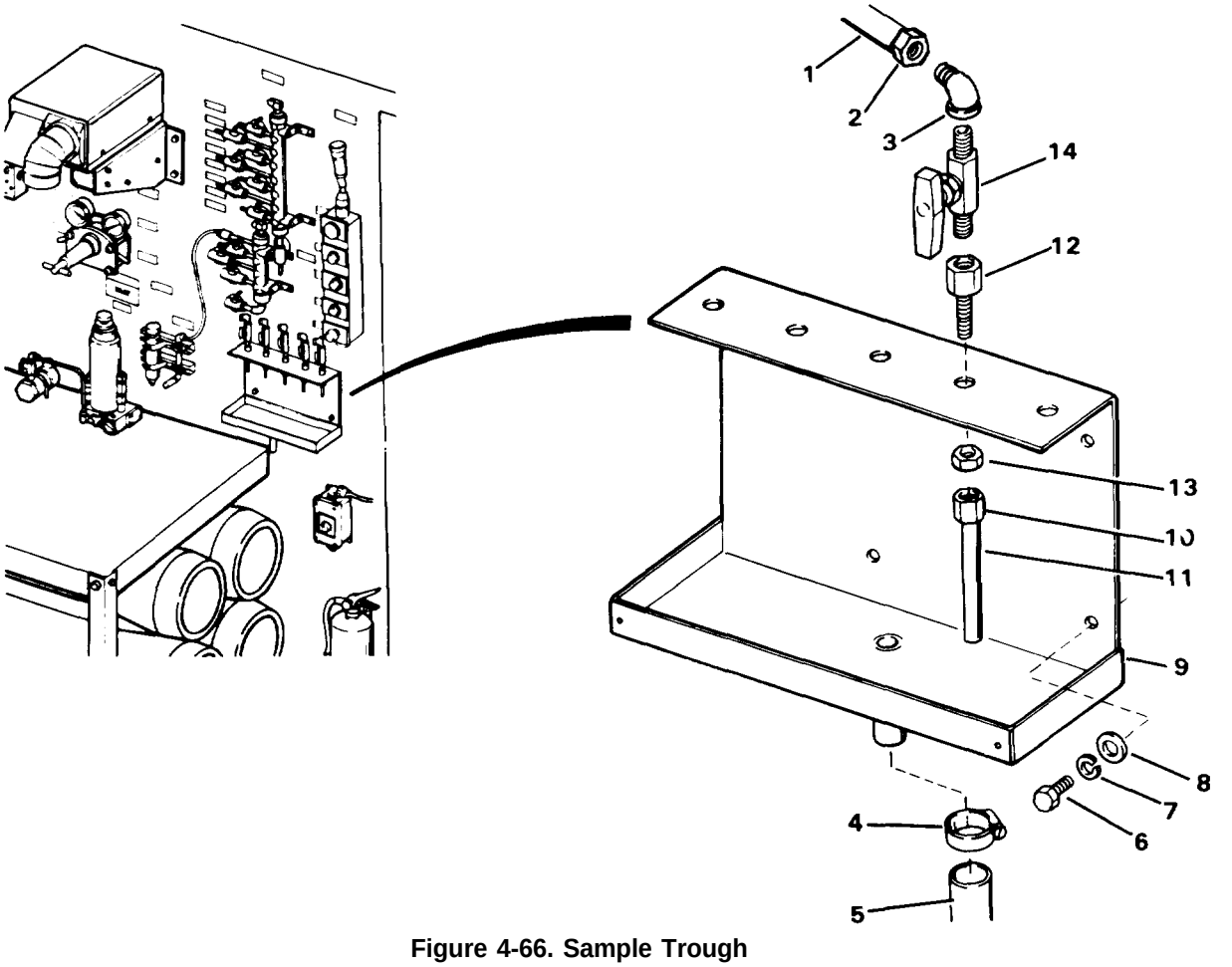


Figure 4-66. Sample Trough

DISASSEMBLY.

a. Remove tubing nuts (10) and tubes (11) from fittings (12).

b. Remove nuts (13) from fittings(12) and remove fittings from sample trough (9)

c. Remove adapter elbows (3) from valves (14).

d. Remove valves(14) from fittings (12).

REPAIR.

a. Repair leaks by tightening loose fittings and applying antiseize tape to threads.

b. Replace any damaged parts, tubing or tubing fittings.

c. Repair sample trough by straightening,

d. Replace any valve that leaks when shutoff.

REASSEMBLY.

a. Install adapter elbows (3) to valve (14).

b. Install fittings(12) on valves (14).

c. Install fittings (12) in trough (9) and secure with nuts (13).

d. Install tubes (11) with nuts (10) to fittings (12).

INSTSALLATION.

a. Install assembled sample trough to wall with four screws (6), lockwashers (7) and flat washers (8).

b. Secure drain line (5) with clamp (4) to bottom of trough (9).

c. Secure five tube lines (1) to elbows (3) with tubing nuts (2).

All data on pages 4-235 thru 4-241 deleted.

4-60. DIESEL HEATERS. This task covers:

a. Adjust. b. Removal. c. Repair. d. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Stripper, Wire (16)
Crimper, Hand Terminal (16)

General Safety Instructions:

WARNING
Observe specific Warnings in the text.

Materials/Parts:
Sealant, Silicone (Appx E, Sec II, Item 63)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

WARNING
Electrical power to the heater must be maintained while testing heater. Do not touch electrical wires and components while testing heater. Severe injury from electrical shock could result.

WARNING
Make sure electrical power to the unit is turned off while doing mechanical work on heater. Failure to do so could result in serious injury from electrical shock or moving parts.

NOTE
There are two identical diesel heaters in the ROWPU. One is located behind the main control panel, the other is mounted to the right of the panel. The following procedures apply to both.

ADJUST.

WARNING
The ignition power supply of the heater generates high voltages that could cause severe injury or death. Use extreme caution when making adjustments to the heater. Turn heater OFF before doing any mechanical procedures. DO NOT remove any parts other than those listed in the procedure.

a. Carburetor Adjustment - POWER OFF (Refer to Figure 4-69).

(1) Loosen four cover screws (1) and two cover latches (2).

(2) Remove cover (3) by lifting up and out.

b. Carburetor Adjustment - POWER ON.

NOTE
The screw on fuel needle may be covered with silicone seal.

(1) Start and run heater, if heater does not hold in the run mode, you may have to back out the fuel needle (3A) approximately 3/4 turn counterclockwise to achieve more fuel flow.

(2) When the heater is running, adjust the setting of the fuel needle (3A) so the heater burns evenly and smoothly with no smoke visible in the exhaust.

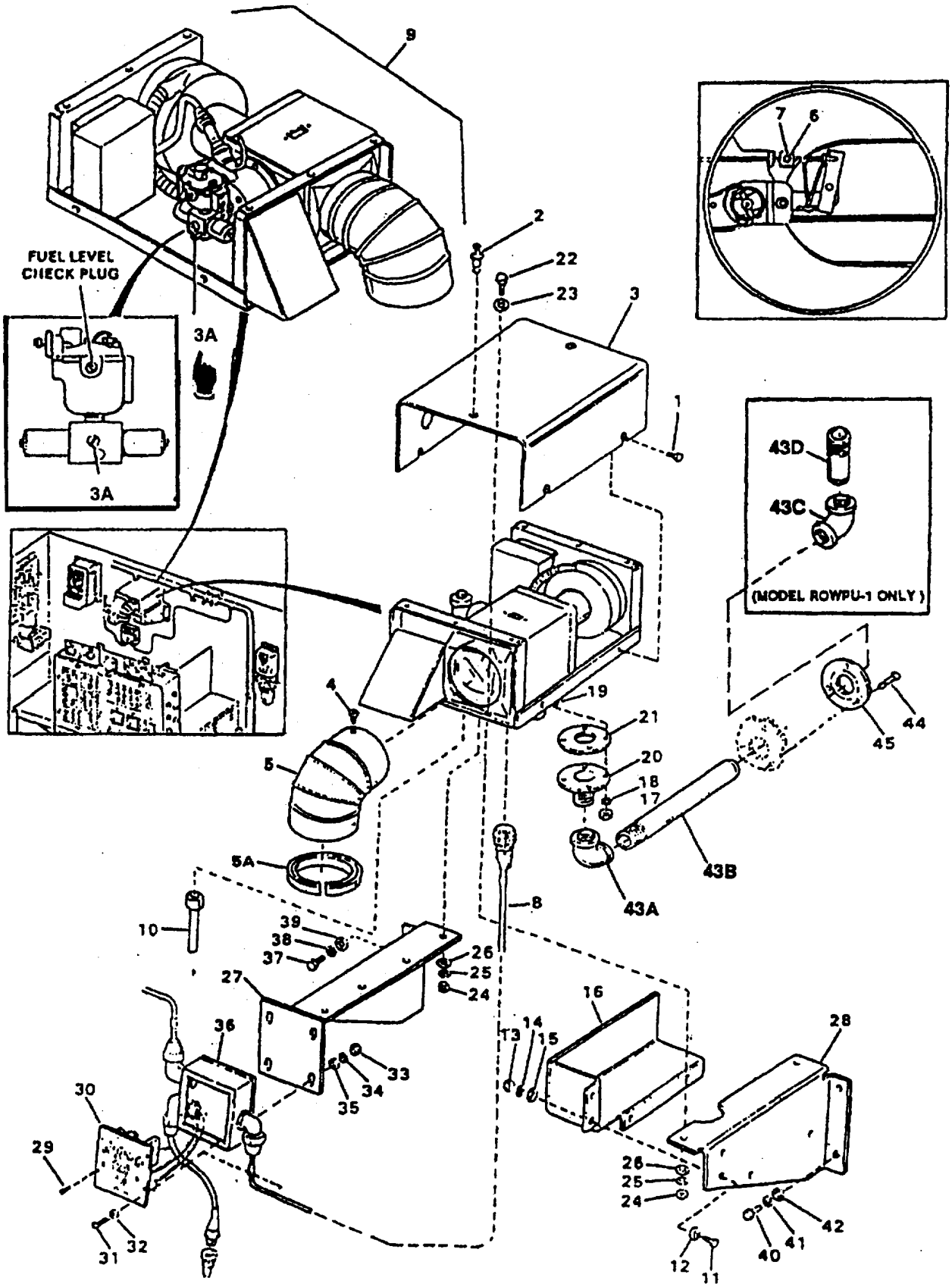


Figure 4-69. Diesel Heaters

(3) Cover screw with silicone sealant to prevent movement of screw by vibration.

c. Hold Fire Thermostat Adjustment (Refer to Figure 4-69).

NOTE
Hold fire thermostat adjustment maintains the minimum heat level required to keep the heater circuitry operational.

(1) With power off, remove elbow (5) by removing screws (4). Remove profile trim (5A) from elbow (5).

NOTE
Position stop to provide the lowest practical control range.

(2) With power on, start the heater. Move stop to the left to increase the temperature in the control range, or proceed as follows:

(3) Move stop (7) to the right to decrease the temperature in the control range.

(4) Tighten setscrew (6) after adjusting stop (7).

REMOVAL.

WARNING
Electrical power must be off at the source prior to any disassembly. Failure to do so could result in severe injury or death.

WARNING
If heater has been operated recently, allow it to cool before proceeding. Exhaust heat could cause severe burns and/or present a fire hazard.

a. Disconnect heater power cable (8) at the base of the heater assembly (9).

b. Disconnect fuel line (10) at base of heater assembly (9).

c. Remove four capscrews (11), washers (12), nuts (13), lockwashers (14) and washers (15). Remove exhaust shroud (16).

NOTE
Do not remove the exhaust pipe from the ROWPU wall unless required.

d. Remove four nuts (17) and washers (18) from studs (19). Pull down on flange (20) to separate the exhaust flange (20) from the heater assembly (9). If necessary, remove gasket (21).

e. Remove four capscrews (22), washers (23), nuts (24), lockwashers (25), and washers (26) (two from bracket (27) and two from bracket (28).).

f. Remove heater assembly (9) as an assembly.

g. Remove four capscrews (29), remove the control box cover (30).

h. Disconnect and tag wires.

i. Remove four capscrews (31), lockwashers (32), nuts (33), lockwashers (34) and washers (35) and remove control box (36).

j. Remove four capscrews (37), lockwashers (38), washers (39), and remove bracket (27).

k. Remove two capscrews (40), lockwashers (41), washers (42) and remove bracket (28).

k.1. If necessary, on Model ROWPU-1, remove elbow (43C) and nipple (43D) from ROWPU wall.

l. If necessary, remove elbow (43A) and pipe (43B) from ROWPU wall.

m. If necessary, drill out rivets (44) and remove flange (45). (46) DELETED.

REPAIR.

a. Check for loose wires.

b. Check for damage to air tube hose.

INSTALLATION.

a. Install flange (45) and secure with three rivets (44). (46) DELETED.

WARNING

Exhaust fumes can kill operating personnel. Be sure that the drain hole on elbow is pointed downward to keep water from collecting in exhaust pipe.

a.1. Install pipe (43B) and elbow (43A) into ROWPU wall.

b. On Model ROWPU-1 install nipple (43D) and elbow (43C) into ROWPU wall.

c. Install bracket (28) and secure with two capscrews (40), lockwashers (41) and washers (42).

d. Install bracket (27) and secure with four capscrews (37), lockwashers (38) and washers (39).

e. Install control box (36) and secure with four capscrews (31), lockwashers (32), nuts (33), lockwashers (34), and washers (35).

f. Connect wires as tagged.

g. Install control box cover (30) and secure with four capscrews (29).

h. Position heater assembly (9) and secure with capscrews (22), washers (23), nuts (24), lockwashers (25) and washes (26).

i. Install gasket (21) and exhaust flange (20) on studs (19) and secure with nuts (17) and washers (18).

j. Install exhaust shroud (16) and secure with four capscrews (11), washers (12), nuts (13), lockwashers (14) and washers (15).

k. Connect fuel line (10) at base of heater assembly (9).

l. Connect heater power cable (8) to base of heater assembly (9).

m. Assemble profile trim (5A) to elbow (5). Assemble elbow (5) to heater with three screws.

n. Align slots on cover (3) with four cover screws (1) and install cover (3). Tighten two cover latches (2) and four screws (1).

4-61. DIESEL HEATER FUEL PUMP AND FUEL LINES: This task covers:

a. Testing. b. Service. c. Removal. d. Disassembly. e. Repair. f. Reassembly. g. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.)
Tool Kit, General Mechanics Automotive (1)
Materials/Parts
Tape, Antiseize (Appx E, Sec II, Item 67)
Drain Pan
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)
Suitable Tags

Equipment Condition:
Heater shutdown.
Fuel line disconnected at generator set (para. 2-31).
General Safety Instructions:

WARNING
Observe specific Warnings in the text.

WARNING
Fuel can be dangerous. Wear rubber gloves to protect hands and some type of eye protection. Fuels can be absorbed through skin. Immediately flush skin with soap and water if contacted by fuel; flush eyes with water only.

WARNING
Electrical power to the heater must be maintained while testing heater. Make sure not to contact live wires while testing heater. Severe injury from electrical shock could result.

WARNING
Make sure electrical power is off before doing mechanical work on unit. Failure to do so could result in serious injury from electrical shock.

TESTING.

NOTE
Fuel pumps cannot be tested if electrical current is interrupted at the heaters.

a. Refer to item (53, Figure 2-4) and manually reset the heater circuit breaker to be sure power is not interrupted at the circuit breaker.

b. Check all power connections to be sure they are tight.

c. Check power at the heater, 28 VDC is required.

d. Check power to the fuel pumps.

SERVICE - FUEL PUMPS.

WARNING
Be sure that fuel line is disconnected at the generator set.

a. The pump fuel filters in fuel pumps (21 and 27, Figure 4-70) should be cleaned or replaced as required. Proceed as follows:

(1) Remove three capscrews (41) and cover (42).

(2) Remove gasket (43). Discard gasket if damaged and replace with serviceable gasket.

(3) Remove filter (44).

(4) Clean the filter in diesel fuel and dry the filter. When clean, light should be visible through the filter (44). If not, replace the filter.

(5) Install filter (44), gasket (43) and cover (42). Secure with three capscrews (41).

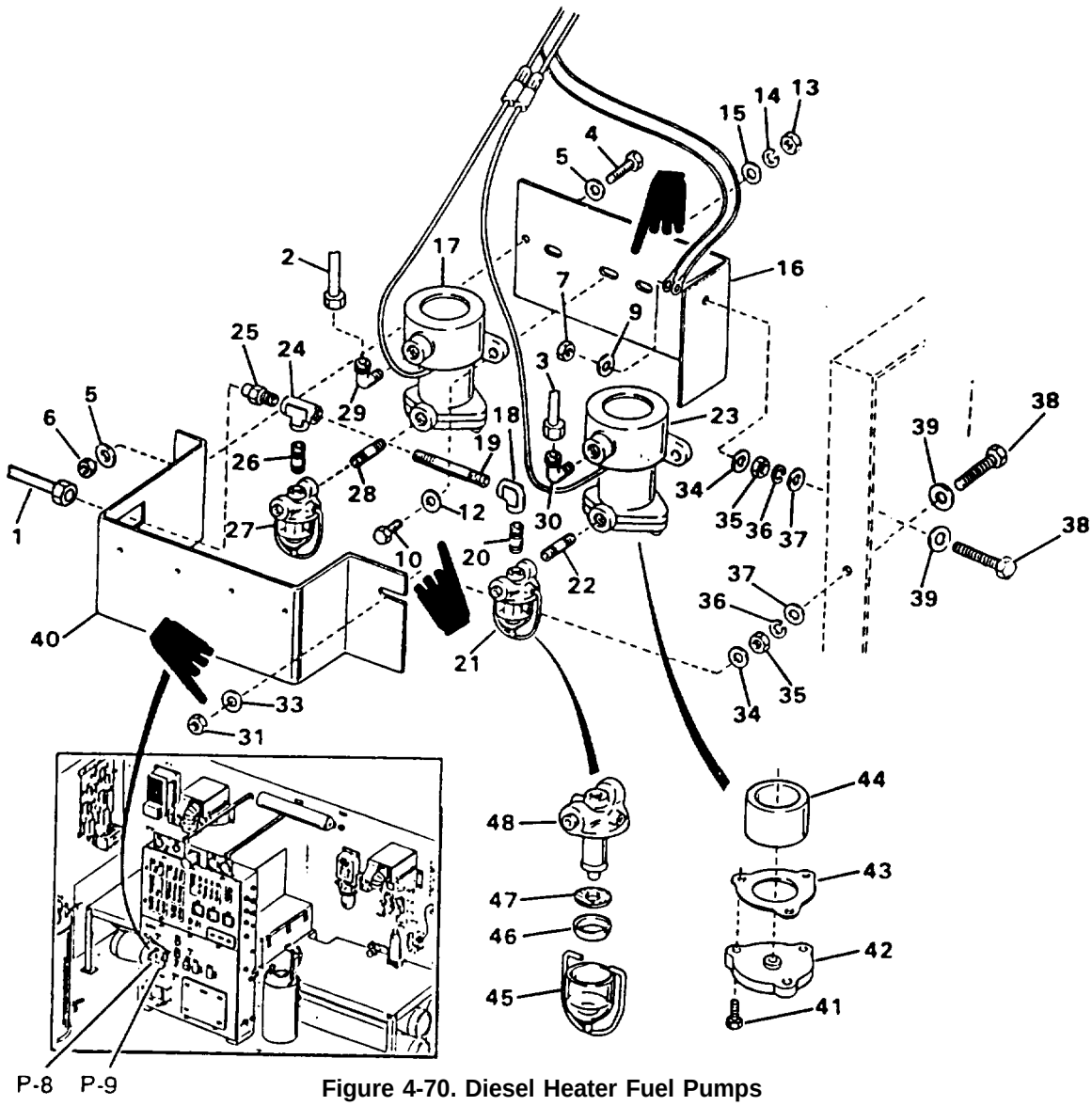


Figure 4-70. Diesel Heater Fuel Pumps

b. Clean the screen in filters (21 and 27) as follows:

(1) Tilt the bail wire on filter bowl (45) and remove the bowl.

(2) Remove gasket (46) and screen (47). Clean the screen in diesel fuel.

(3) Clean the bowl (45) by wiping with a rag.

(4) Install screen (47), gasket (46) in cover (48), Install bowl (45) and secure with the bail wire.

REMOVAL – FUEL PUMPS.

WARNING

Fuels can be dangerous. Wear rubber gloves to protect hands and some type of eye protection. Fuels can be absorbed through the skin. Immediately flush skin areas with soap and water. If fuel gets in eyes, flush with water only. Failure to do so may cause serious injury.

a. Disconnect plugs P-8 and P-9.

b. Disconnect fuel line (1). Catch any fuel that may drain from line in a drain pan.

c. Tag and disconnect fuel lines (2 and 3). Catch fuel in a pan.

d. Loosen nut (31). Remove capscrew (4), flat washers (5) and nut (6) and remove cover (40).

NOTE

The following procedure will remove ground wires.

e. Remove locknuts (7), (8) DELETED, and washers (9). Remove pump and bracket assembly (16).

DISASSEMBLY – FUEL PUMPS.

a. Remove capscrews (10), (11) DELETED, washers (1 2), nuts (1 3), Iockwashers (14) and washers (15).

b. Remove pump assembly(17 and 23) from bracket (16).

c. Holding the pump assembly (17), unscrew t he elbow(18) from nipple (19).

d. Remove nipple (20) and fuel bowl (21). Remove nipple (22) from fuel Pump (23) and bowl (21).

e. Remove nipple(19) from tee (24) and fitting (25) from tee (24).

f. Remove nipple (26) from tee (24) and fuel bowl (27).

g. Remove fuel bowl (27) from nipple (28) and remove nipple from fuel pump (17).

h. Remove elbows (29 and 30) from fuel pumps(17 and 23).

i. If needed, loosen and remove locknut (31), (32) DELETED, washers (33 and 34), nuts (35), Iockwashers (36), washers (37), capscrews (38) and washers (39).

REPAIR - FUEL PUMPS.

a. Repair all damaged or unserviceable parts by replacement.

b. Replace damaged or leaking fuel lines.

REASSEMBLY – FUEL PUMPS.

a. If removed, install washers (39), capscrews (38), washers (37), Iockwashers (36), nuts (35), washers (33 and 34), and locknut (31). (32) DELETED.

b. Install elbows (29 and 30) in pumps (17 and 23).

c. Install nipples (22 and 28) into fuel pumps (17 and 23).

d. Install nipple (26) into tee (24) and fuel bowl (27). Install fitting (25) into tee (24).

e. Install fuel bowl (27) onto nipple (28) and install to pump body (17).

f. Thread nipple(19) into tee (24).

g. Install elbow (18) to nipple (20). Install nipple (20) into fuel bowl (21).

h. Install fuel bowl (21) to nipple (22) and install into pump body (23).

i. Holding the pump assemblies, thread elbow (18) onto nipple (19).

j. Place assembled pumps onto bracket (16)and fasten with capscrews (10), (11) DELETED, washers(12), nuts (13), lockwashers(14) and washers (15).

INSTALLATION — FUEL PUMPS.

a. Install pump assembly into position and place ground wires onto threaded end of capscrew (38). Fasten pump and bracket assembly (16) with locknuts (7) and washers (9). (8) DELETED.

b. Place cover into position and fasten with nut (31), (32) DELETED, and washer (33) and installing capscrews (4), washers (5) and lock nut (6).

c. Check tags on fuel lines (2 and 3) and install lines at proper connections.

d. Connect plugs P-8 and P-9.

REMOVAL – FUEL LINES.

a. Disconnect fuel line (1, Figure 4-71).

b. Remove bulkhead fining as follows:

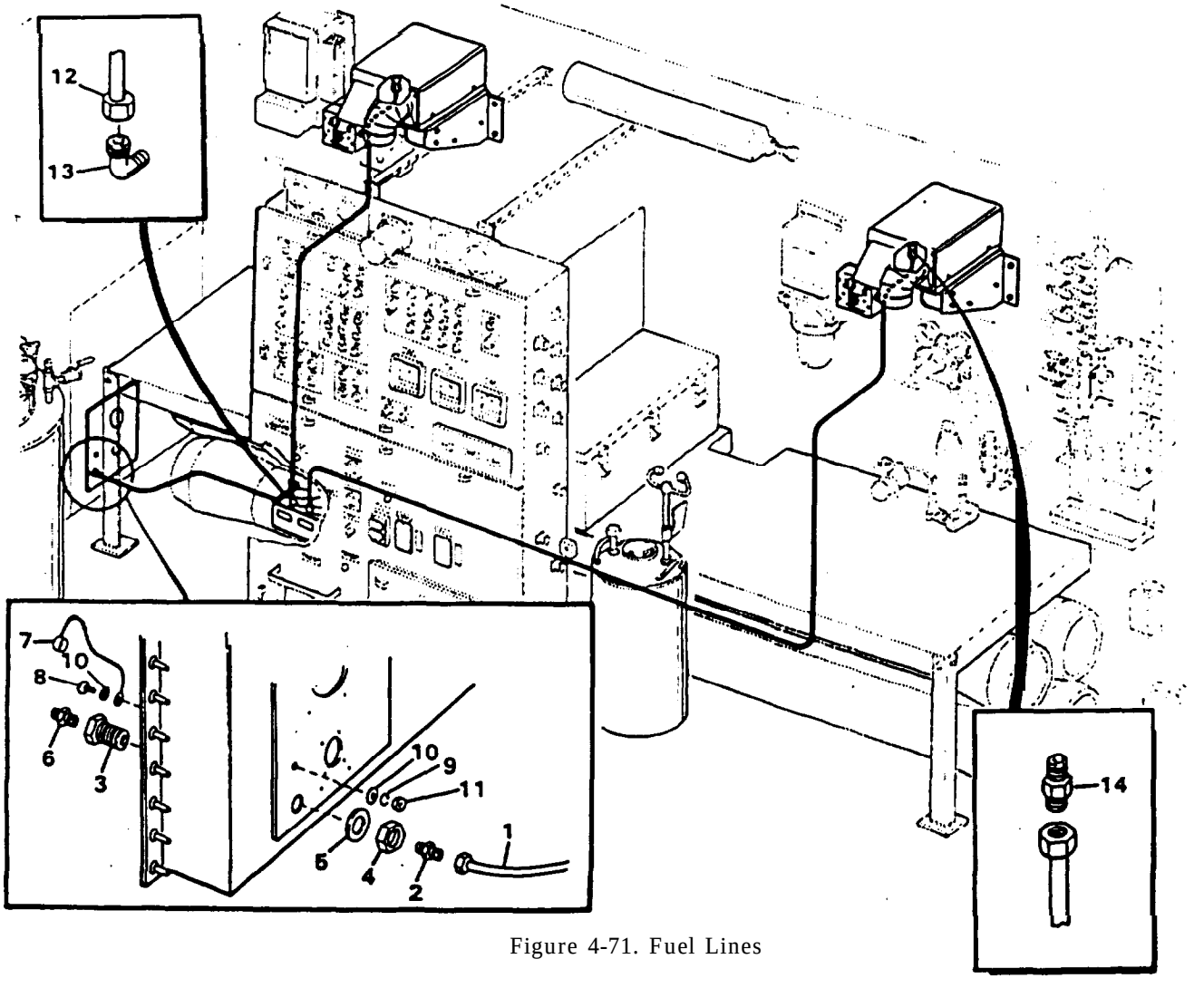


Figure 4-71. Fuel Lines

(1) Remove nut (4) and washer (5). Remove bulkhead fitting assembly (3).

(2) If necessary, remove flare tube fittings (2 and 6).

(3) Remove cap (7) by removing capscrew (8). lockwasher (9), washer (10) and nut (11).

(4) Remove lines (12) from fuel pump fittings (13).

(5) Remove fuel lines from fitting (14) at heater.

(6) Cut and remove tie wraps (para. 4-10). Remove fuel lines.

REPAIR - FUEL LINES.

a. Repair damaged or unserviceable components by replacement.

b. Replace damaged fuel lines.

INSTALLATION - FUEL LINES.

a. Place fuel lines into position and secure fitting (14) at heater connector end.

b. Connect fuel line end (12) onto fitting (13) at fuel pumps.

c. Position/dress fuel lines and secure with tie wraps (para. 4-10).

d. Secure cap (7) with capscrew (8). lockwasher (9) washer (10) and nut (11).

e. If removed, install flare fittings (2 and 6) into bulkhead fitting (3).

f. Install bulkhead fitting (3) through wall of ROWPU and secure with washer (5) and nut (4).

g. Fasten line (1) to fitting (2).

4-62. THERMOSTATS. This task covers:
a. Removal b. Disassembly c. Repair d. Adjustment e. Reassembly f. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Heat Gun (16)
Crimper Hand (1 6)

Materials/Parts:
Tape, Electrical (Appx E, Sec II, Item 68)
Ties (Appx E, Sec II, Item 71)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)

Equipment Condition:
HEATER POWER SUPPLY ON/OFF switch (Figure 2-72) on main control panel OFF.
General Safety Instructions:

WARNING

Observe specific Warning in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in severe injury from electrical shock.

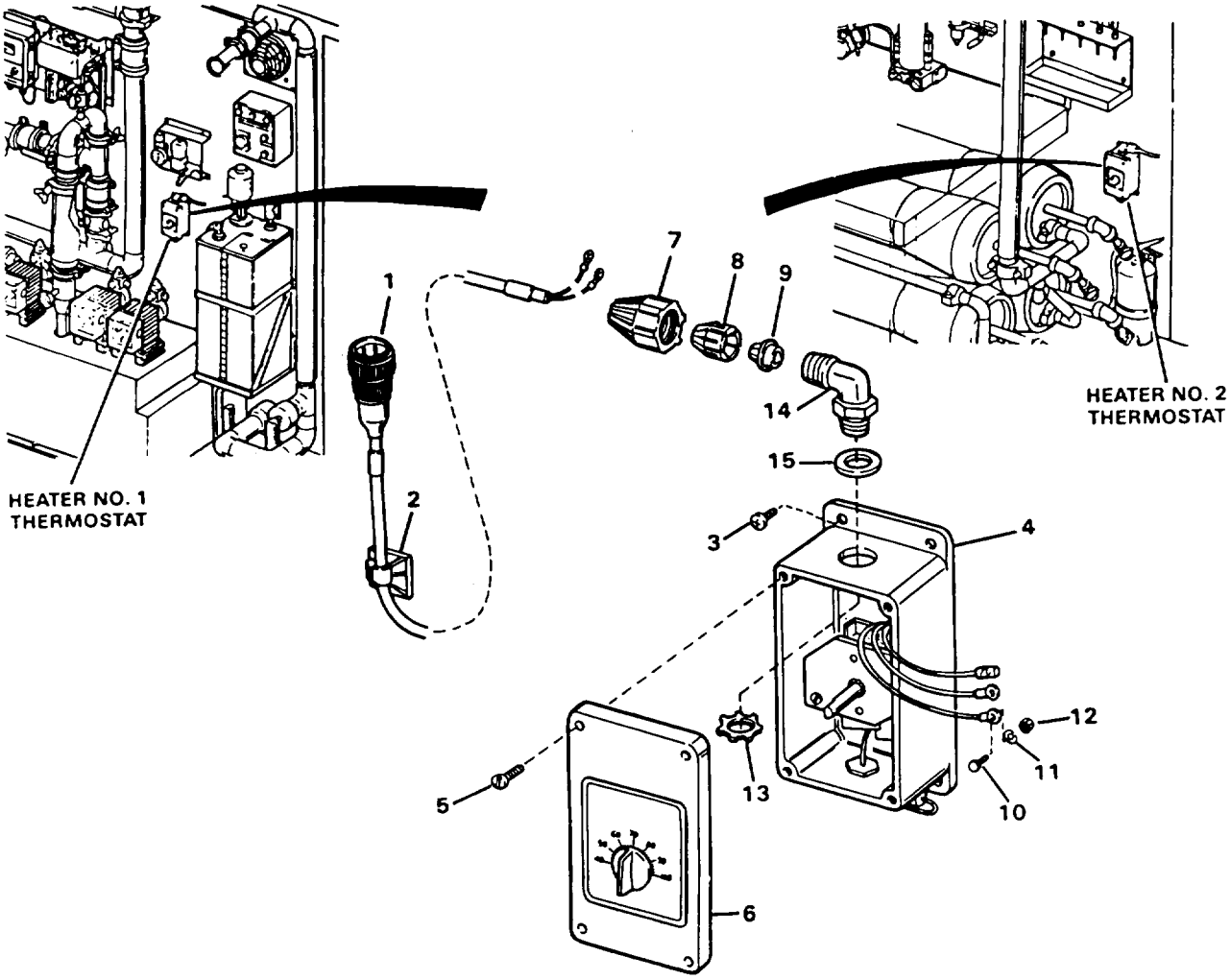


Figure 4-72. Thermostats **(Sheet 1 of 3)** Components
(MODELWTA-060 ONLY)

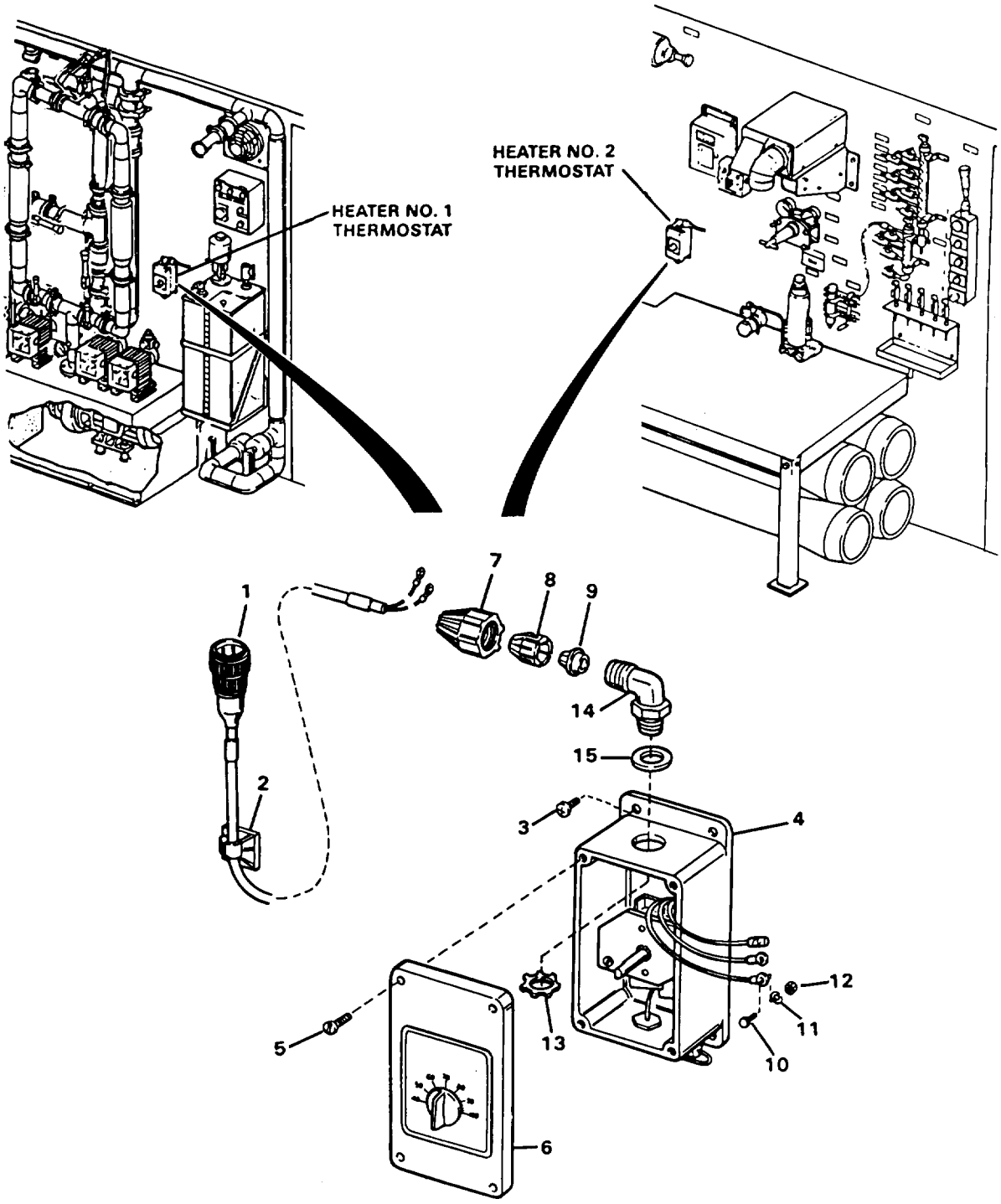


Figure 4-72. Thermostats **(Sheet 2 of 3)** Components
(MODEL ROWPU-1 ONLY)

INSPECTION.

NOTE

The following procedure applies to both heater No. 1 and heater No. 2 thermostats, with the exceptions noted in text.

a. Refer to Figure 4-72 and inspect the thermostats and cables for visual signs of damage.
b. Check to see that each thermostat is operative by turning the thermostat to its full up or full down positions and observing whether or not the heaters turn off or on as called for by the thermostat.

REMOVAL

a. Disconnect cable (1) from the power input cable.
b. Cut tie wraps (2) to release the cable from the ceiling and walls of the ROWPU.
c. Remove four screws (3) and remove assembled thermostat with the cable (1) attached.

DISASSEMBLY.

a. Remove four screws (5) and remove cover (6) from the thermostat housing.
b. Unscrew nut (7) and slide nut (7), retainer (8) and bushing (9) back on cable (1).
c. Refer to Figure 4-72, sheet 2 and tag and disconnect wires from cable (1) to the thermostat (4) control leads by removing capscrew (10), lockwasher (11) and nut (12). Use a knife to remove the electrical tape and shrink wrapping which encloses each connection.
d. Remove conduit nut (13) and remove elbow (14) and sealing ring (15). Do not attempt to further disassemble the thermostat.

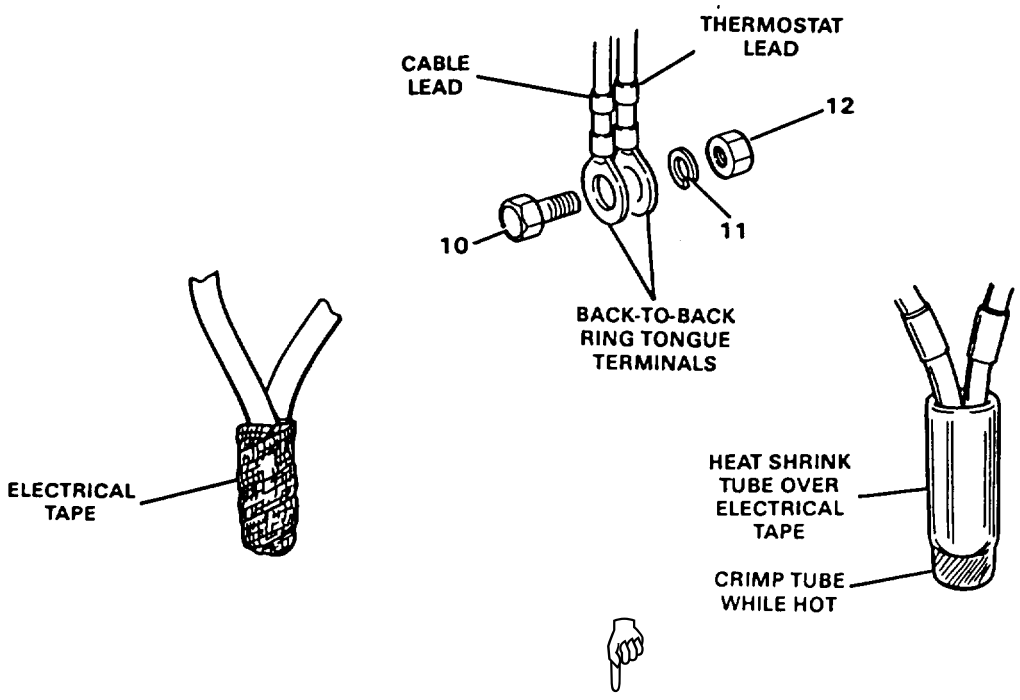


Figure 4-72. Thermostats **(Sheet 3 of 3)** Components

REPAIR.

a. Repair loose or damaged ring tongue connectors (para. 4-10).

b. Replace damaged cable assembly(1).

c. Replace wire markers (para. 4-10).

d. Replace thermostat (4) if inoperative.

REASSEMBLY.

a. Install elbow (14) and sealing ring (15) and secure in position with conduit nut (13).

b. Slide nut(7), retainer(8) and bushing (9) on cable assembly(l) and insert the cable wires through elbow (14) into the thermostat box (4). Orient the assembled cable adapter to the right for heater No. 1 thermostat and to the left for heater No. 2 thermostat.

NOTE

If installing a new thermostat, perform step c; otherwise proceed to step d.

c. Crimp a ring tongue terminal on each of the thermostat leads (para. 4-10).

d. Cut down the blue thermostat lead (not used), Bend the lead back upon itself and tape it with electrical tape.

e. Connect the following leads together, see Figure 4-72, sheet 2:

(1) Heater thermostat No.1 . . . . . Cable 430 to thermostat black; Cable 431 to thermostat red

(2) Heater thermostat No.2 . . . . . Cable 432 to thermostat black; Cable 433 to thermostat red

f. Attach each set of leads together using capscrew (10), nut(12) and Iockwasher(11).

g. Tape each thermostat/control lead combination with electrical tape.

h. Place shrink wrap tubing over each of the taped lead combinations and shrink the tubing with the heat gun. Crimp the ends of the tubing while still hot, using pliers.

i. Install cover (6) and secure with four screws (5).

INSTALLATION.

a. Position thermostat (4) on the ROWPU wall and secure with screws (3).

b. Route cable(1) to its heater and secure to the walls and ceiling with tie wraps (2) (para. 4-10).

c. Connect thermostat cable (1) to its power cable.

4-63. CARBON MONOXIDE MONITOR. This task covers:

a. Testing. b. Adjust. c. Repair.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Multimeter (2)
Terminal Strip Tool (2)
Test Kit, Carbon Monoxide Monitor (17)
Materials/Parts:
Fuse, DC, 0.5 amp Slow Blow (Appx E, Sec II, Item 41)

Equipment Condition:
Power supplied to CO Monitor.

General Safety Instructions:
WARNING
Observe specific Warning in text.

WARNING
Inhalation of carbon monoxide can cause serious illness or death.

TESTING.

a. Turn the screw (1, Figure 4-73) 1/4 turn clockwise and open the door.

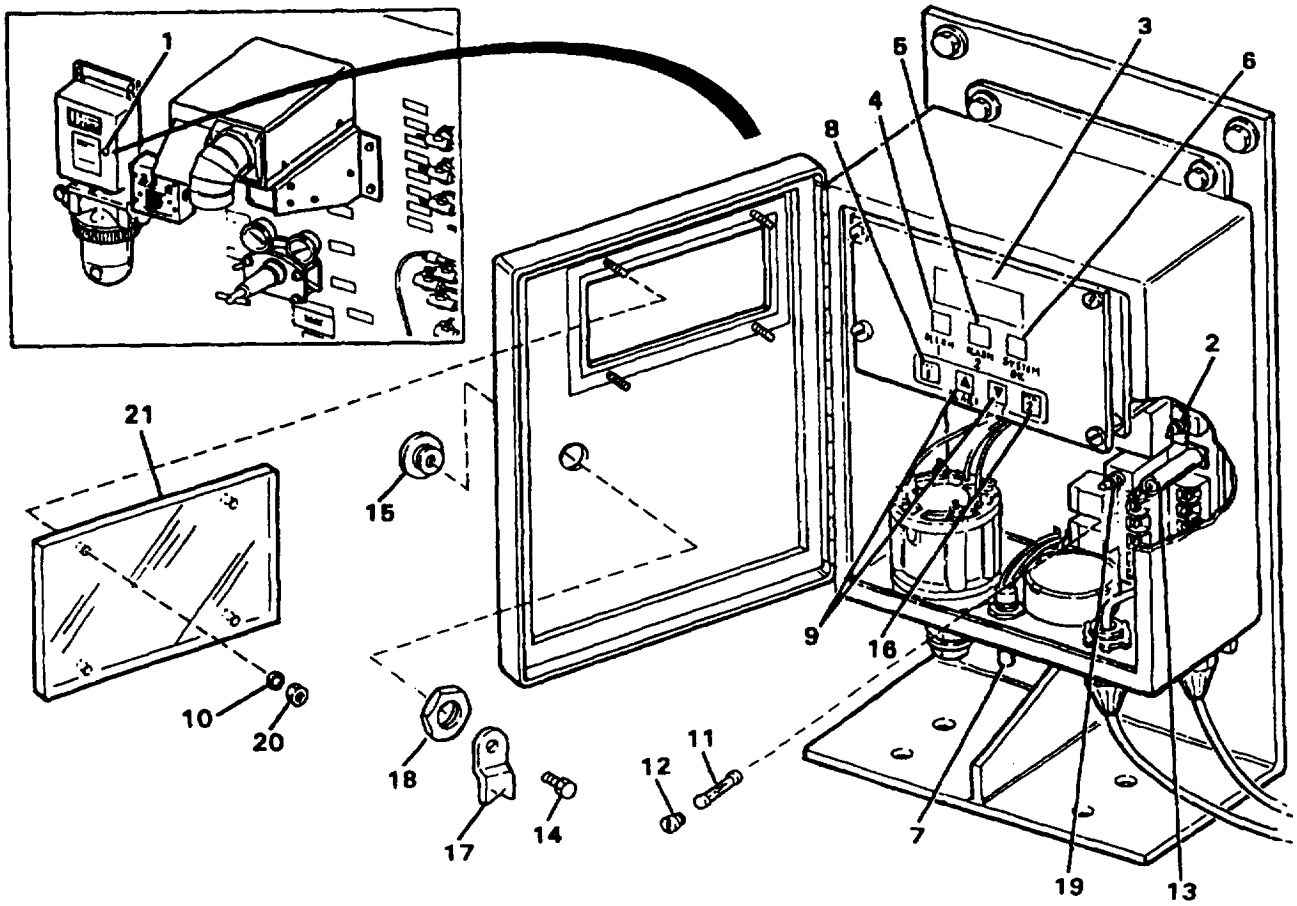


Figure 4-73. Carbon Monoxide Monitor

b. Turn the power switch (2) momentarily to "OFF", then "ON". Verify the following:

(1) The main display (3) momentarily lights and displays "8.8.8".

(2) The ALARM 1 (4), ALARM 2 (5), and the SYSTEM OK (6) momentarily light.

(3) If following the above test the green SYSTEM OK light (6) goes out, and the main display (3) reads "P-1" or "P-2", refer to the adjusting procedure below.

(4) If the audible alarm is on, press the alarm reset button (7) located on the bottom of the case.

c. Press the ALARM 1 button (8). The main display (3) should read "25". If display does not read "25", go to the adjusting procedures described below.

d. Press the ALARM 2 button (16). The main display (3) should read "50". If not, go to the adjusting procedures described below.

e. If the monitor is not operational:

(1) Press the circuit breaker (19) IN.

(2) Remove and check DC fuse (11) for continuity. (See repair section below.)

ADJUST.

a. Press and hold the ALARM 1 button (8) and read the main display (3). The display should read "25". ALARM 1 can be adjusted by:

(1) Hold the ALARM 1 button (8) down and press the "up/down" pushbuttons (16) to set the correct value. When the correct value is obtained, release the ALARM 1 button (8).

b. Press and hold the ALARM 2 button (16) and read the main display (3). The display should read "50". ALARM 2 can be adjusted by:

(1) Hold the ALARM 2 button (16) down and press the "up/down" pushbuttons (9) to set the correct value. When the correct value is obtained, release the ALARM 2 button (16).

c. Refer to para. 3-39 for retest procedures.

REPAIR.

a. Turn main circuit breaker at control panel to "OFF".

b. Disconnect DC power by disconnecting P2-J2, twist and pull electrical connector at the DC power supply.

c. Turn the cover slot (1) 1/4 turn clockwise and open door.

d. Turn the fuse cap (12) counterclockwise and remove the fuse cap (12) and fuse (11) from the fuse holder (13).

(1) Test the fuse using a multimeter set to the OHMS x 1 scale. Replace the fuse if it has no continuity.

(2) Replace fuse (11), insert into the cap (12).

(3) Insert into the fuse holder (13) and turn counterclockwise.

e. Replace door window (21) by removing nuts (20) and washes (10). Place new window (21) into position, install washers (10) and secure with nuts (20).

f. Repair latch by replacing damaged components (14, 15, 17 and 18).

4-64. STORAGE RACK AND STORAGE BOX. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

REMOVAL.

a. Storage Box (Figure 4-74).

(1) Open lid and prop open. Remove contents.

WARNING

Do not disconnect ground wire unless power is shut off.

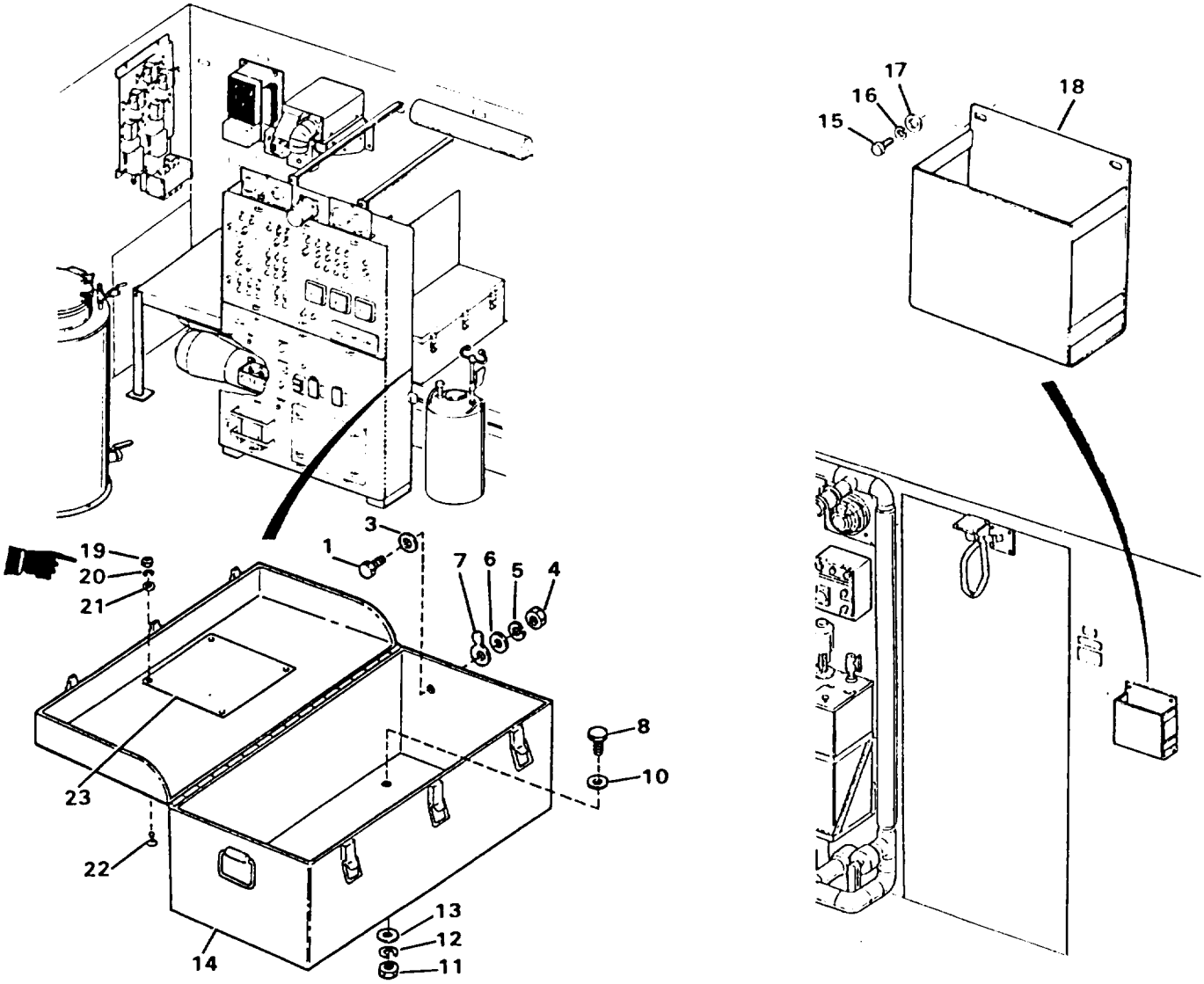


Figure 4-74. Storage Box and Rack

(2) Disconnect ground wire lug (7), which is attached to the accessory table by removing capscrew (1), (2) DELETED, washer (3), nut (4), lockwasher (5) and washer (6).

(3) Remove four capscrews (8), (9) DELETED, washers(10), nuts (11), lockwashers (12) and washers (13), Remove storage box (14).

b. Storage Rack (Figure 4-74). Remove twocapscrews (15), lockwashers (16) and washers (17) and lift storage rack (18) from wall.

DISASSEMBLY.

Remove four nuts (19), lockwashers (20), flat washers (21) and screws (22). Remove loading plan data plate (23).

REPAIR.

a. Replace damaged terminal (para. 4-10).

b. DELETED.

WARNING

Do not replace ground wire unless power is shut off.

c. Replace damaged ground wire (7).

d. Replace severely damaged storage box.

e. Replace severely damaged storage rack.

REASSEMBLY.

Assemble loading plan data plate (23) to underside of lid with four screws (22), flat washers (21), lockwashers (20) and nuts (19).

INSTALLATION.

a. Storage Box.

(1) Position box (14) on table and install four capscrews (8), washers (13 and 10), lockwashers (12), (9) DELETED, and nuts (11).

(2) Connect ground wire lug (7) by installing washer (3), (2) DELETED, capscrews (1), washer (6), lockwasher (5) and nut (4).

b. Storage Rack. Position rack(18) on wall and secure with two capscrews (15), lockwashers (16) and washers(17).

4-65. NBC FILTER ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Pipe Wrench (2)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
NBC filter disconnected from water purification system (para. 2-33).

General Safety Instructions:

WARNING

Avoid skin contact with spent NBC filter media. Use protective gear and face shield. Failure to do so could result in death.

DISASSEMBLY.

a. Refer to Figure 4-75, open vent valve (2) and drain valve (20) and drain the NBC filter.

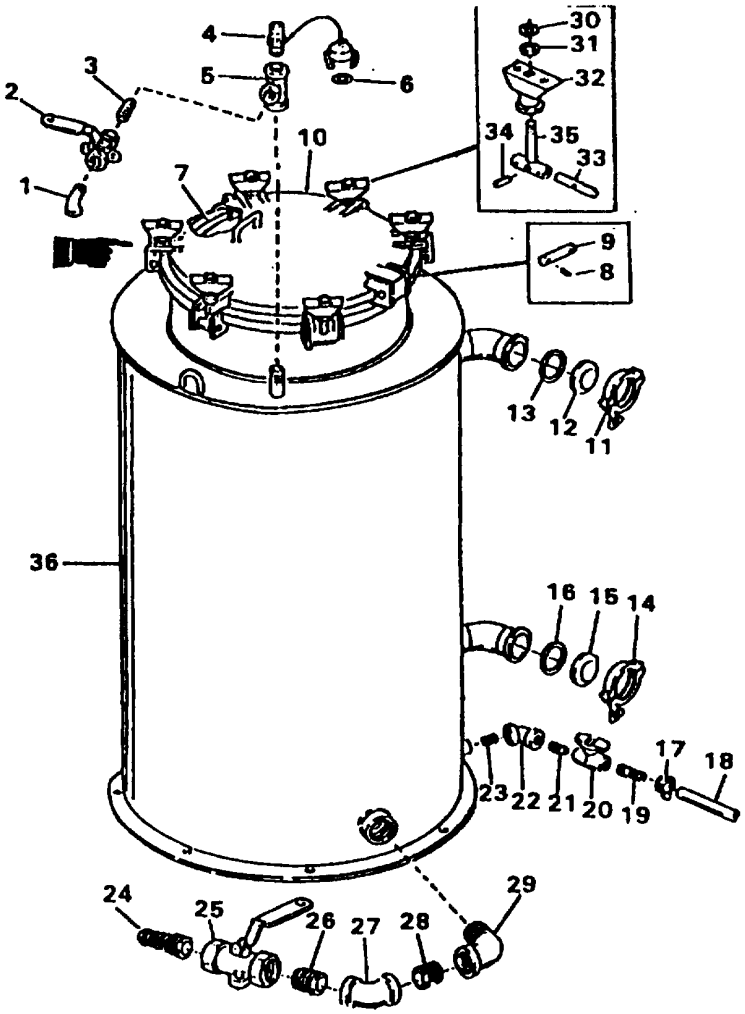


Figure 4-75. NBC Filter

b. Remove elbow (1), valve (2), nipple (3), quick disconnect and dust cap (4) and tee (5). Remove gasket (6) from dust cap (4).
c. Loosen wing nuts (32) on T-bolt (35) and swing cover (10) up to allow access to gasket (7).
d. If necessary, remove gasket (7). It will be necessary to pry the gasket out of its groove in cover (10).
e. If necessary, remove pins (8) and (9) and remove cover (10).
f. Remove clamp (11), cap (12) and gasket (13).
g. Remove clamp (14), cap (15) and gasket (16).
h. Remove clamp (17), hose (18), nipple (19), valve (20), nipple (21), elbow (22) and nipple (23).
i. Remove adapter (24), valve (25), nipple (26), elbow (27), nipple (28) and elbow (29).
j. If necessary, remove C-ring (30), washer (31) and wing nut (32). Drive out roll pin (33), remove pin (34) and T-bolt (35) is free.

REPAIR.

a. Repair leaking fittings using antiseize tape.
b. Replace damaged gaskets and damaged or missing pads.
c. Be sure gasket seating surfaces are clean before attempting to install gaskets.
d. Clean the groove carefully to allow reinstallation of a new gasket.

REASSEMBLY.

NOTE
Use antiseize tape on all male pipe threads.

a. If removed, install T-bolts (35) and secure with pin (34) and roll pin (33). Install wing nut (32) and secure with washer (31) and C-ring (30).
b. Clean out the bore in the tank into which elbow (29) fits and install elbow (29), nipple (28), elbow (27), nipple (26), valve (25) and fitting (24).
c. Install nipple (23), elbow (22), nipple (21), valve (20), nipple (19). Install hose (18) on nipple (20) and secure with clamp (17).
d. Install gasket (16) on cap (15) and secure with clamp (14).
e. Install gasket (13) on cap (12) and secure with clamp (11).
f. If removed, install gasket (7) in cover (10)
g. Place cover (10) on top of tank (36) and install pins (9 and 8).
h. Tighten wing nuts (32) around the perimeter of the tank.
i. Install gasket (6) in dust cap (4) and install tee (5), quick disconnect and dust cap (4), nipple (3), valve (2) and elbow (1).
j. Install media (para. 3-29).

4-66. NBC FILTER HOSES. This task covers:

a. Removal. b. Repair. c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

WARNING

Avoid skin contact with spent NBC filter media. Use protective gear and face shield. Failure to do so could result in death.

REMOVAL.

a. Disconnect hoses (1 thru 3, Figure 4-76) (para. 2-33).

b. Disconnect hose (4) (para. 4-65).

REPAIR.

a. Repair hoses (para. 4-25).

b. If hoses cannot be repaired, replace.

INSTALLATION.

a. Connect hoses (1 thru 3) (para. 2-33).

b. Connect hose (4) (para. 4-65).

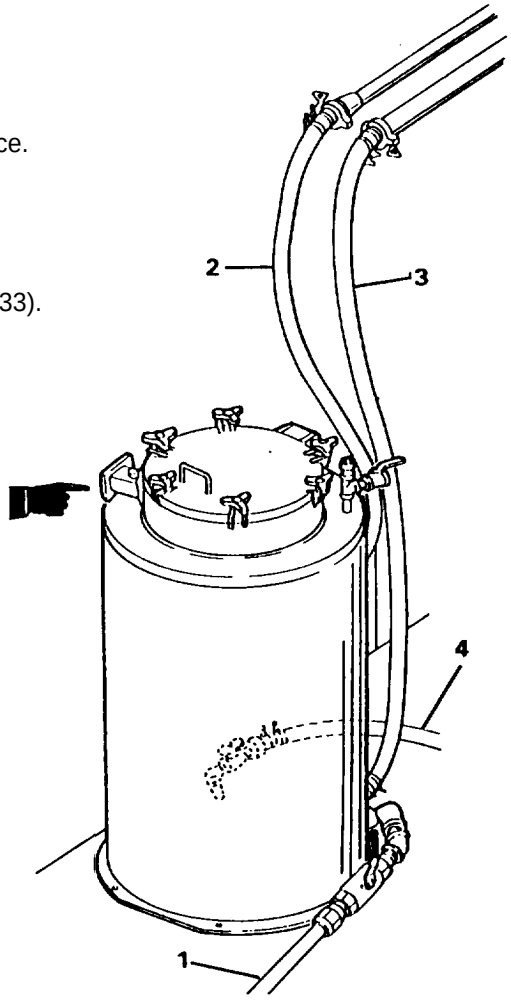


Figure 4-76. NBC Filter Hoses

4-67. AIR DRYER. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1,

Materials/Parts:
Suitable Tags
Tape, Antiseize (Appx E, Sec II, Item 67)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Air tubing and fittings removed (para. 4-24).

REMOVAL.

a. Remove capscrew (2), two washers (2A) and nut (3) securing clamp (4).

b. Remove clamps (4) and cushions (5).

c. Remove air dryer (6). Remove valve (6A) from air dryer (6).

d. If necessary to remove channel (10), remove four capscrews (7), lockwashers (8), washers (9) and channel (10).

INSTALLATION.

a. Install channel (10) using capscrews (7), lockwashers (8) and flat washers (9) if necessary.

b. Install valve (6A) on air dryer (6).

c. Install air dryer (6) using cushions (5) and clamps (4).

d. Secure clamps (4) with capscrew (2) two washers (2A) and nut (3).

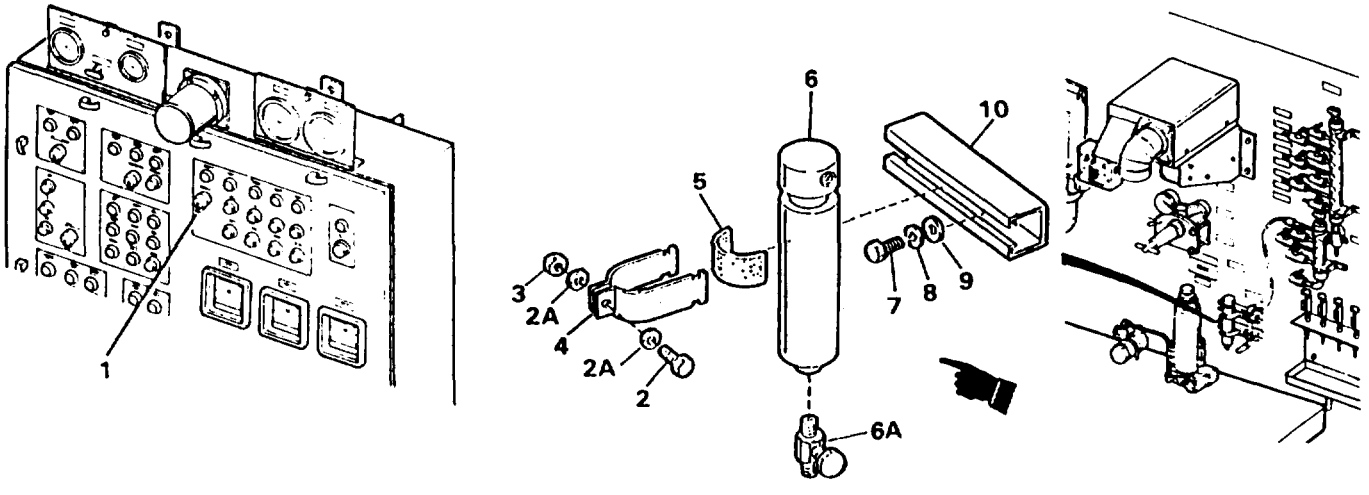


Figure 4-77. Air Dryer

4-68. AIR MANIFOLDS AND AIR BLOCK VALVES. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Adjustment. e. Reassembly. f. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Soap (Appx E, Sec II, Item 65)
Suitable Tags
Suitable Tags (10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

General Safety Instructions:

WARNING
Observe specific Warnings and Cautions in the text.

WARNING
High pressure air. Do not work on air manifolds until air pressure is fully vented. Pressures in system can result in serious injury or death.

REMOVAL.

WARNING
Relieve air compressor circuit pressure before attempting to do work on air system. Failure to do so could result in serious injury or death.

a. Turn AIR COMPRESSOR ON/OFF switch (1) to OFF.

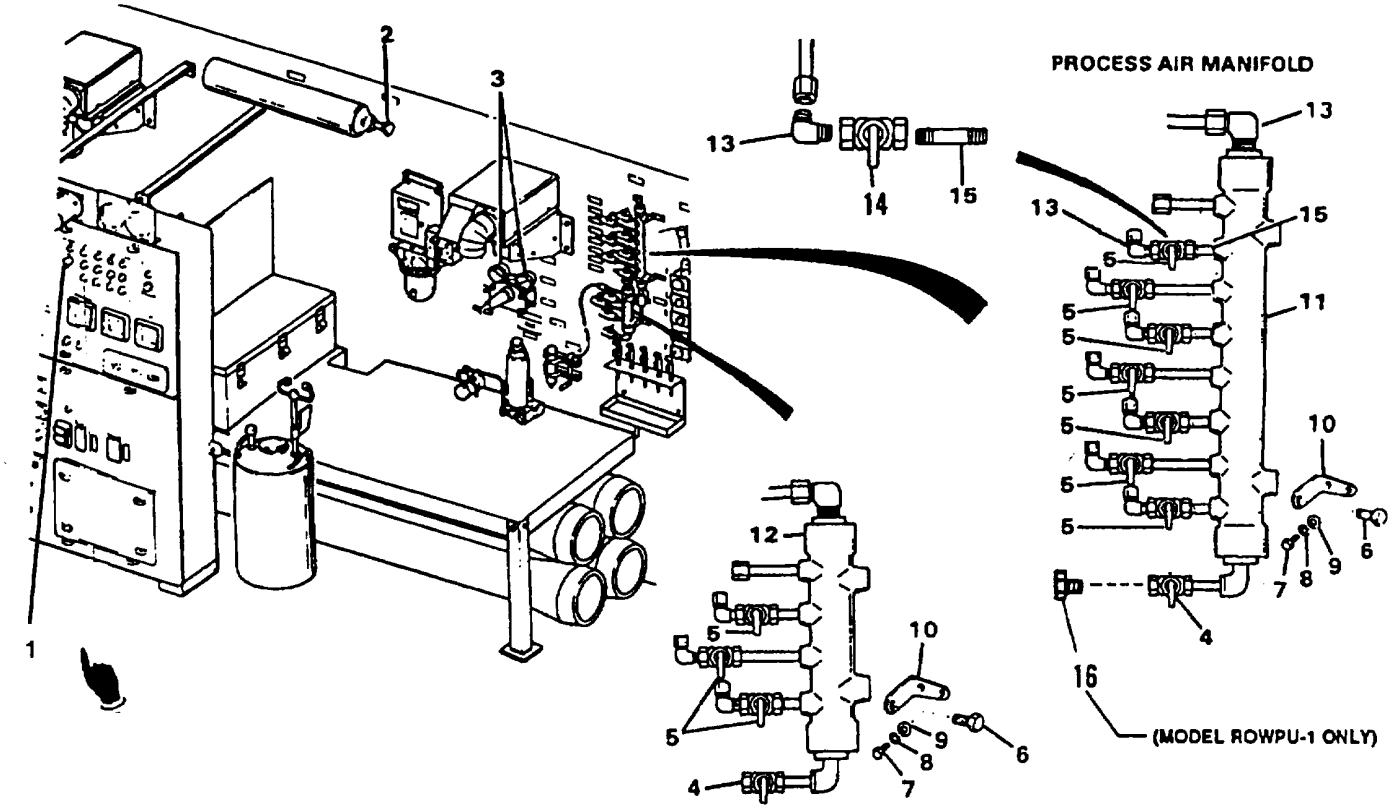


Figure 4-78. Air Manifolds and Air Block Valves

b. Close air tank valve (2) to shut off air supply.

c. Open all block valves (5) on process air manifold (11) or utility air manifold (12).

■ c.1. On Model ROWPU-1, remove plug (16).

WARNING
Air pressure gage on air regulator must read zero before disconnecting any air line fitting, otherwise injury may occur.

d. Open manifold bleed valves (4).

e. Check air pressure gages (3). They should read zero.

f. Tag and remove individual air tubing as necessary (para. 4-24).

g. Remove capscrews (6) and remove manifolds.

h. If necessary, remove capscrews (7), lockwashers (8), washers (9) and brackets (10).

REPAIR.

CAUTION
Do not over tighten threaded parts, plastic parts will crack.

a. Replace elbows (13), block valves (14) and nipples (15) as necessary. Turn counterclockwise to remove.

b. Replace manifolds (11 and 12) if cracked or damaged.

c. Tighten loose fittings and apply antiseize tape where required to stop leaks.

d. Replace any unserviceable item.

INSTALLATION.

a. If removed, install brackets (10) with capscrews (7), lockwashers (8) and washers (9).

b. Install manifold (11 or 12) with capscrews (6).

c. Install removed air tubing (para. 4-24).

■ c.1. On Model ROWPU-1, install plug (16).

d. Open all block valves (5).

e. Close manifold bleed valves (4).

f. Open air tank valve (2).

g. Turn air compressor (1) ON.

h. Check for leaks using soapy water solution. Air bubbles indicate leaks.

4-69. VENT FAN (for ROWPU Serial No. 16461 thru 16555). This task covers: (MODEL WTA-060 ONLY)

a. Service. b. Removal. c. Disassembly. d. Repair. e. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
- Tool Kit, General Mechanics Automotive (1)
- Stripper, Wire (16)
- Crimper, Hand, Connector (16)

Materials/Parts:
- Tape, Electrical (Appx E, Sec II, Item 68)
- Tape, Friction (Appx E, Sec II, Item 69)
- Twine (Appx E, Sec II, Item 72)
- Varnish, Electrical (Appx E, Sec II, Item 73)
- Suitable Tags
- Lockwashers (TM 10-4610-232-24P)
- Washers (TM 10-4610-232-24P)

Equipment Condition:
- Fan switch turned to OFF position (Figure 4-79).

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

WARNING

Do not wear loose clothing or jewelry while working on equipment.

NOTE

Tag all wires before disconnecting.

NOTE

This task covers ROWPU Serial No. 16461 thru 16555. ROWPU Serial No. 16556 and up are covered in para. 4-69.1.

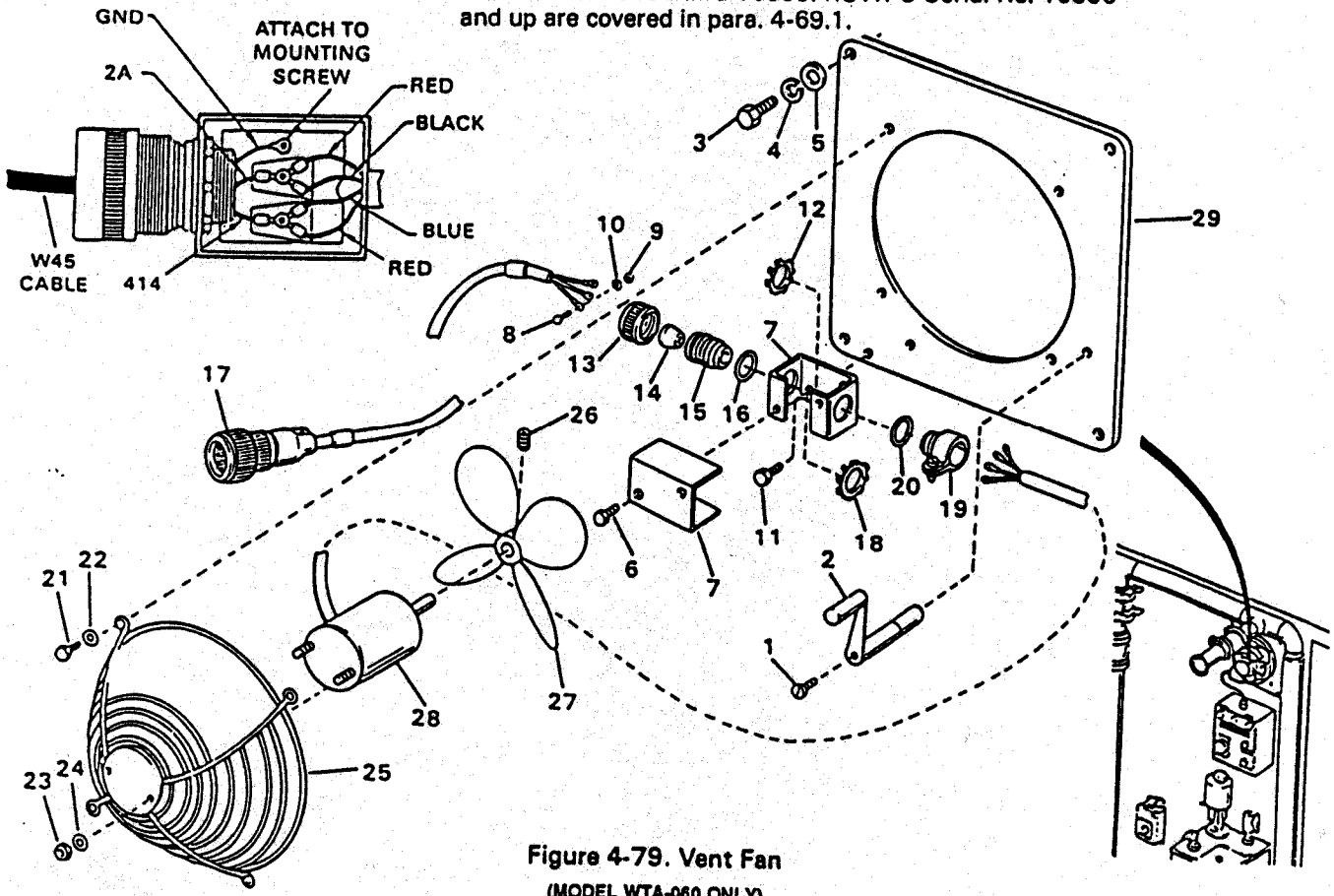


Figure 4-79. Vent Fan
(MODEL WTA-060 ONLY)

SERVICE.

Refer to LO 10-4610-232-12 and lubricate the vent fan.

REMOVAL.

a. Refer to Figure 4-79 and remove the vent fan as follows:

(1) Turn the fan switch on switch panel No. 2 to the OFF position.

(2) Disconnect cable (17) at switch panel No. 2.

(3) Remove screw (1) and handle (2).

(4) Remove four capscrews (3), Iockwashers (4) and washers (5) and remove the fan assembly from the ROWPU wall as a unit.

DISASSEMBLY.

a. Remove two screws(6) and box cover(7). This item consists of two parts, a box and a cover, Disconnect wires from cable (17) by removing twine and electrical tape and removing screws (8), nuts (9) and Iockwashers(10) which connect cable (17) to motor (28) cable. The motor cable is part of the motor.

b. Remove groundcapscrew(11). Unscrew nut(13) and slide nut (13), bushing(14) and retainer (15) back on cable (17). Remove conduit nut(12) and pull cable (17) out of box(7). Slide nut (13), bushing (14) and retainer off cable (17). Sealing washer (16) will now be free.

c. Remove conduit nut (18), clamp(19) and sealing washer (20) and slide motor (28) cable out of box (7).

d. Remove four capscrews (21), washers (22), and two nuts (23) and washers (24) and remove fan guard (25). Motor and fan (28 and 27) are now free.

e. Remove setscrew (26) and remove fan (27) from motor (28). Panel (29) is now free.

REPAIR.

a. Replace motor if faulty.

b. Replace faulty cable (17).

c. Replace loose or damaged ring tongue connectors (para. 4-10).

a. Assemble fan (27) on motor (28) shaft and secure with setscrew (26).

b. Install motor (28) on fan guard (25) and secure with nuts (23) and washers (24).

c. Install the fan guard/motor assembly on panel (29) and secure with capscrews (21) and washers (22).

d. Install sealing ring (20) on clamp (19) and insert in box (7). Secure in position with conduit nut (18). Insert motor (28) cable into box (7).

e. Slide nut (1 3), bushing (14) and retainer(15) on cable (17) and place sealing washer(16) on retainer (1 5). Insert cable (17) into box(7), secure with conduitriut(12) and connect the wires as shown on the insert, using capscrews (8), nuts (9) and lockwashers (10). Varnish all connections. Tape all connections and tie with twine as shown in Figure 4-72. Connect the ground lead using capscrew(11), which also secures box (7) to panel (29).

f. Place cover portion of cover/box (7) on box and secure with screws (6).

g. Place the assembled unit on the ROWPU wall and secure in position with capscrews (3), Iockwashers (4) and washers (5).

h. Install handle (2) and secure in position with screw (1).

i. Connect cable (17) to switch panel No. 2.

4-69.1. VENT FAN (for Model WTA-060 Serial No. 16556 and up and for Model ROWPU-1). This task covers:

a. Service. b. Removal. c. Disassembly. d. Repair. e. Reassembly. f. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Stripper, Wire (16)
Crimper, Hand, Connector (16)

Materials/Parts:
Tape, Electrical (Appx E, Sec II, Item 68)
Tape, Friction (Appx E, Sec II, Item 69)
Twine (Appx E, Sec II, Item 72)
Varnish, Electrical (Appx E, Sec II, Item 73)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Fan switch turned to OFF position (Figure 4-79.1).

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

WARNING

Do not wear loose clothing or jewelry while working on equipment.

NOTE

Tag all wires before disconnecting.

NOTE

This task covers Model WTA-060 Serial No. 16556 and up and all Model ROWPU-1 units.

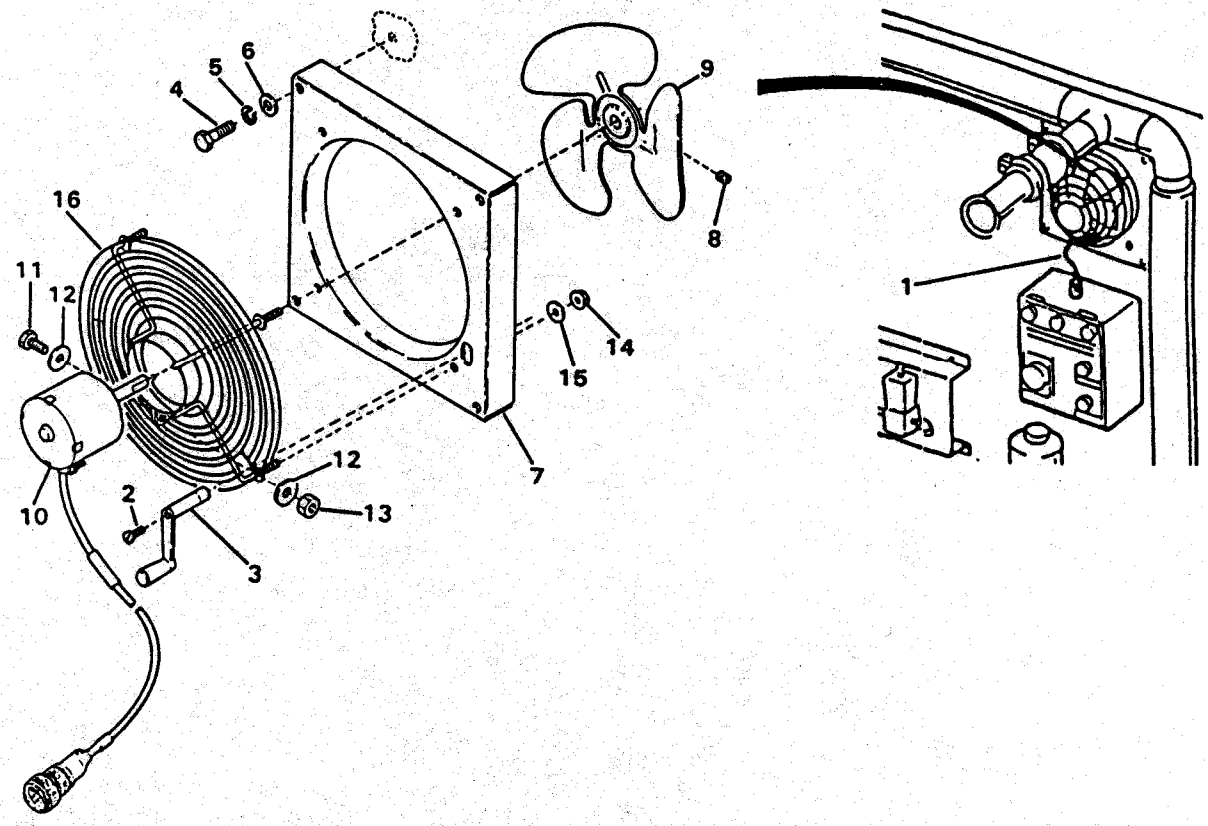


Figure 4-79.1. Vent Fan

SERVICE.

Refer to LO 10-4610-232-12 and lubricate the vent fan.

REMOVAL.

a. Refer to Figure 4-79.1 and remove the vent fan as follows:

(1) Turn the fan switch on switch panel No. 2 to the OFF position.

(2) Disconnect cable (1) at switch panel No. 2.

(3) Remove screw (2) and handle (3).

(4) Remove four capscrews (4), lockwashers (5) and washers (6) and remove the fan assembly (7) from the ROWPU wall as a unit.

DISASSEMBLY.

a. Loosen setscrew (8) and remove blade assembly (9) from motor (10) shaft.

b. Removecapscrew(11), two washers (12), and locknut(13) and remove motor (10).

c. Remove four locknuts(14) and washers(15) and remove fan guard (16).

REPAIR.

a. Replace blade assembly (9), if damaged.

b. Replace motor (10), if faulty.

c. Replace faulty cable(1).

REASSEMBLY.

NOTE

Be sure handle opening on fan guard and frame are aligned.

a. Install guard (16) and secure with four washers (15) and locknuts (14).

NOTE

Install motor so that cable is on the bottom.

b. Install motor (10) and secure withcapscrew(11), two washers (12), and locknut (13).

NOTES

- Be sure that end of blade assembly is flush with end of motor shaft.
- Be sure that setscrew is aligned with flat side of motor shaft.

c. Install blade assembly (9) on motor (10) shaft and secure with setscrew (8).

INSTALLATION.

NOTE

Be sure that handle opening is on lower right side.

a. Install fan assembly (7) and secure with four washers (6), lockwashers (5) and capscrews (4).

b. Install handle (3) and secure with screw (2).

c. Connect cable (1) to switch panel No. 2.

4-70. SUMP HEATERS. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Suitable Tags

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Disconnect the cable from power cable before working on unit. Failure to do so could result in serious injury or death from electrical shock.

WARNING

Wait until sump heater elements have cooled before handling them. Elements are hot and could cause severe burns.

NOTE

Not all sump heaters are identical, this is a typical procedure. If one sump heater is removed at the same time, tag before removing to facilitate installation.

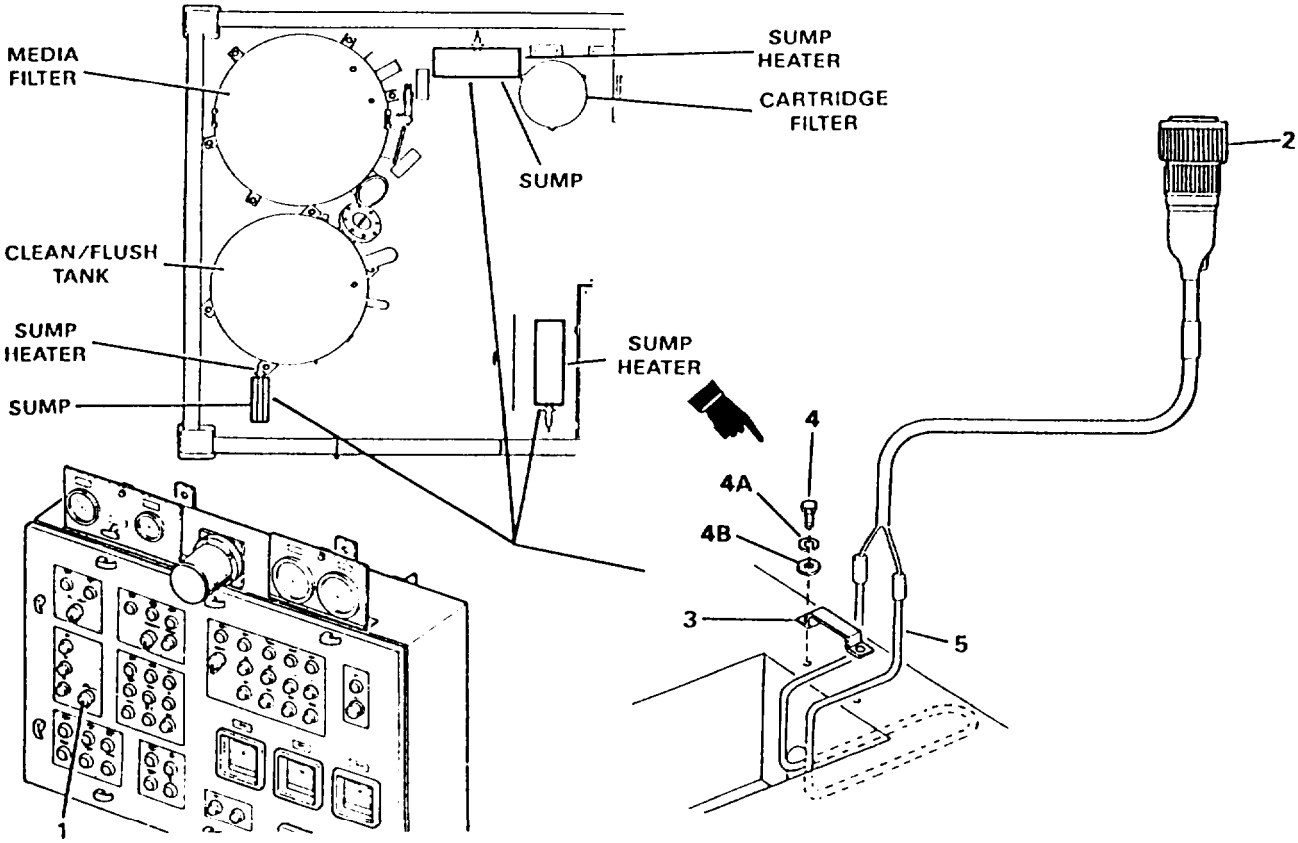


Figure 4-80. Sump Heaters

REMOVAL.

a. Move SUMP HEAT/PUMP HEAT OFF/ON switch (1) to OFF position.

b. Disconnect power cable (2).

c. Remove clamp (3) by removing two screws (4), lockwashers (4A) and flat washers (4B).

d. Remove heater elements (5).

INSTALLATION.

a. Install heater element (5) in sump.

b. Install clamp (3) using two screws (4), lockwashers (4A) and flat washers (4B).

c. Connect power cable (2).

d. If heat is required at sump heater, move SUMP HEAT/PUMP HEAT OFF/ON switch (1) to ON position.

4-71. WASTE WATER HOSES. Waste water hoses are illustrated in Figure 4-81. Replacement of hose gaskets is described in para. 3-8. Repair hoses as required (para. 4-11). Note that these hoses are connected to the ROWPU by a cam type coupling, an elbow and another coupling. Repair coupling gaskets by replacement, if required

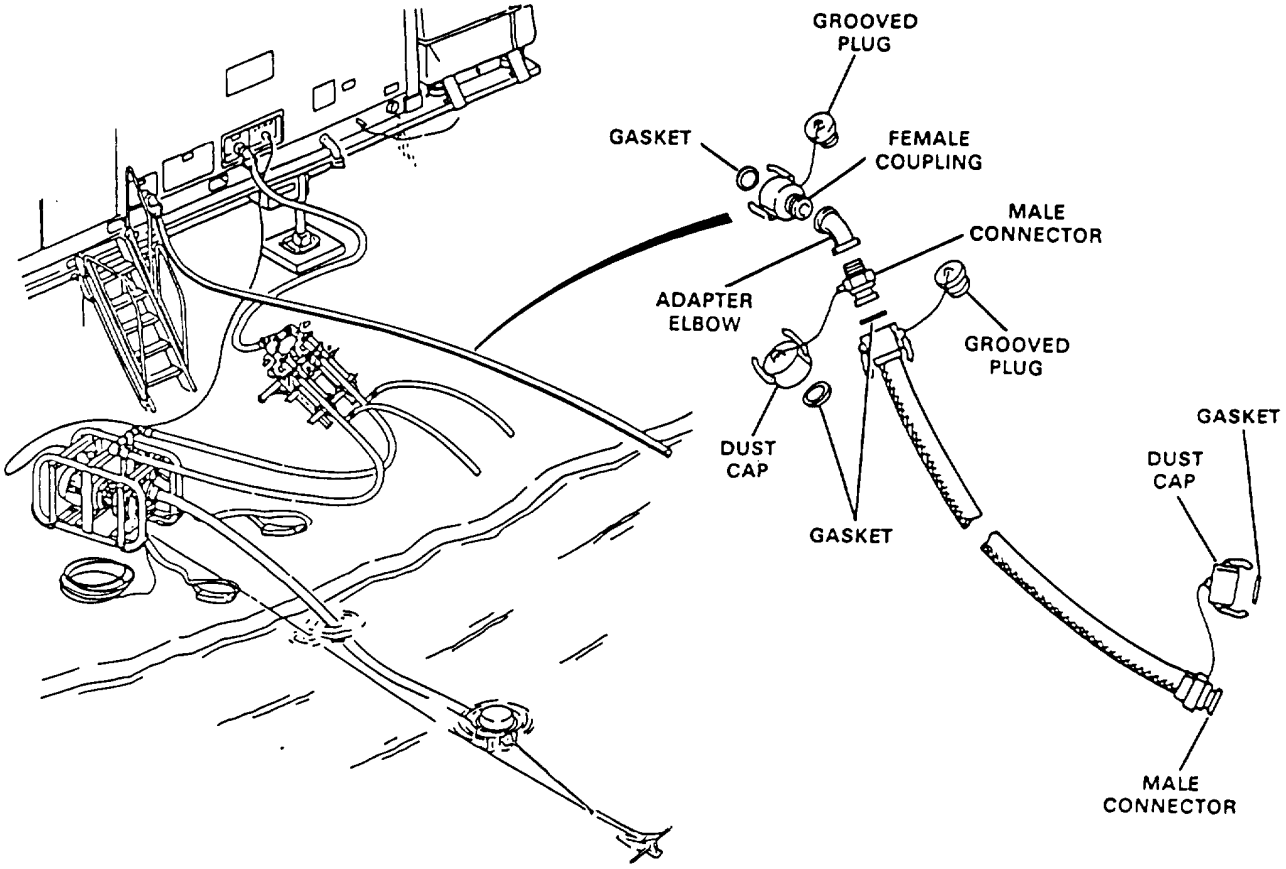


Figure 4-81. Waste Water Hoses **(Sheet 1 of 2)**
☛(MODEL WTA-060 ONLY)

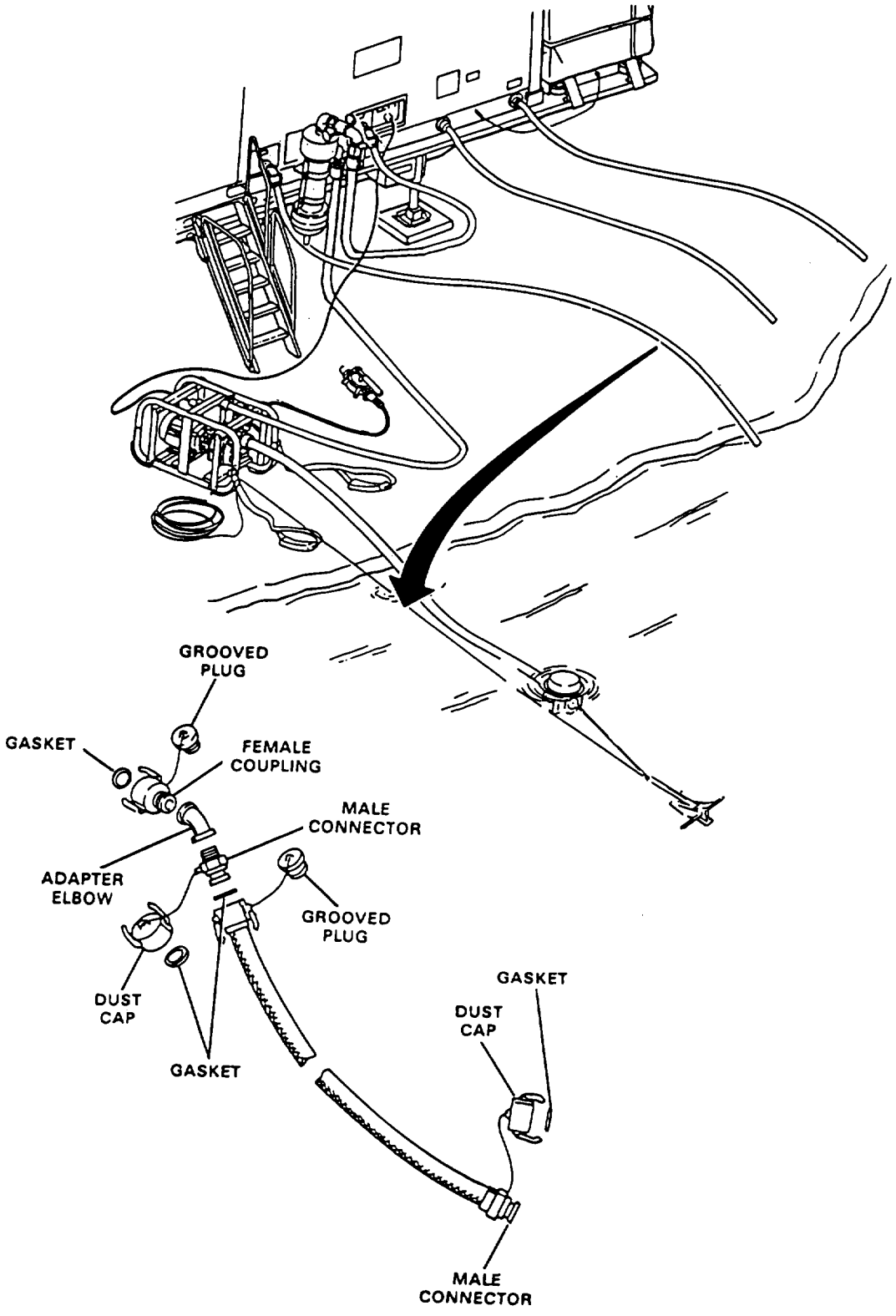


Figure 4-81. Waste Water Hoses **(Sheet 2 of 2)**

(MODEL ROWPU-1 ONLY)

4-72. LADDERS. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Tap and Die Set (2)

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Ladder removed from ROWPU.

NOTE

Remove only one ladder at a time to ensure access to ROWPU.

DISASSEMBLY.

a. Loosen wing nuts (1, Figure 4-82) on six handrail clamps (2) and remove handrails (3 and 4).

b. Remove capscrews (5), washers (6), nuts (7), lockwashers (8) and washers (9). Remove six handrail clamps (2).

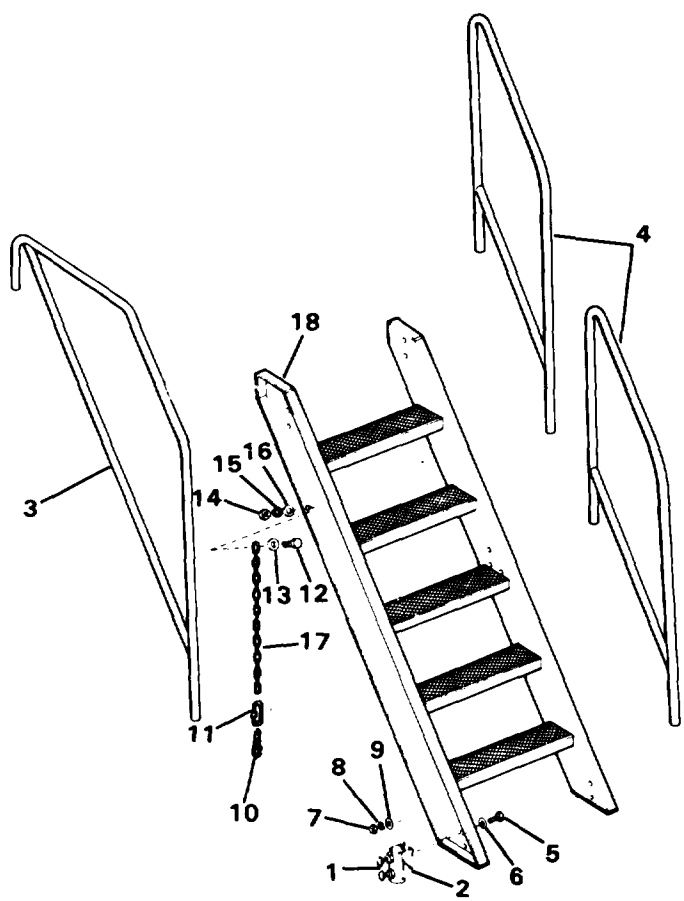


Figure 4-82. Ladders

c. Disconnect swivel snap (10) from rail on ROWPU trailer.

d. Loosen chain link (11) and remove swivel snap (10).

e. Remove capscrew (12), washer (13), nut (14), lockwasher (15) washer (16) and remove chain (17) from ladder (18).

REPAIR.

a. Repair by replacement of damaged components.

b. Repair damaged threads in handrail clamps (2) by running a tap through the hole.

c. Refer broken, welded or bent ladder to Direct Support Maintenance.

REASSEMBLY.

a. Prop ladder (18) in position against the ROWPU.

b. Install chain (17) using capscrew (1 2), washer (13), nut (14), lockwasher(15) and washer (16).

c. Install chain link (11) and snap swivel (10).

d. Place chain (17)aroundthe rail on the ROWPU trailer and tighten it in place using chain link (11) and swivel snap (10).

e. Install six handrail clamps (2) and secure with capscrews (5), washers (6), nuts (7), lockwashers (8) and washers (9).

f. Install handrails (3 and 4) and secure in place using wingnuts (1) on the six handrail clamps (2).

4-73. ACCESSORY TABLE. This, task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics (1)
Rivet Gun (2)

Materials/Parts:
Rivets (Appx E, Sec II. Item 59)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Storage Box removed (para. 4-64).
All materials normally stored on table removed.
Product hoses disconnected from manifold (para. 3-28).
Eyewash station removed (para. 4-22).
ROWPU shutdown.

DISASSEMBLY.

NOTE

The items shown in phantom on Figure 4-83 are removed at Direct Support because high pressure air components must be removed before these items can be removed. Removal of high pressure air components is not authorized at Unit level.

a. Divider Panel. Remove six nuts (1), Iockwashers (2), washers (3) and capscrews (4) and remove panel.

b. Channel Brace (5). Remove three capscrews (6), Iockwashers (7) and washers (8) and remove brace (5).

c. Filter Gate (9). Remove pin (10), lift and remove gate (9).

d. Table Panels.

(1) Remove all screws (12) and remove panel (11).

(2) Remove nuts (14), Iockwashers (15), washers(16) andcapscrews(17) and lift off panel (13).

(3) Remove the two tie down brackets (23) by removing nuts (19), Iockwashers (20) and washers (21).

(4) Remove capscrew (22) and tie down bracket (23).

(5) Remove four screws (24) and remove panel (18).

e. Remove locknut (25), fender washer (26), flat washer (26A) and bolt (27) to release hanger wire (28).

f. Remove nut (29), washer (30) and bolt (31) from control panel tab.

g. Remove locknuts (32), washers (33) and remove hanger straps (34) that suspend the RO element removal rods. Remove RO element rods and hook bolts (47).

h. Table leg.

CAUTION

Provide temporary support to this end of frame.

(1) Remove nuts (35), Iockwashers (36) and washer (37).

(2) Support frame with suitable blocking and remove capscrews (38) and washers (37).

(3) Remove leg (39).

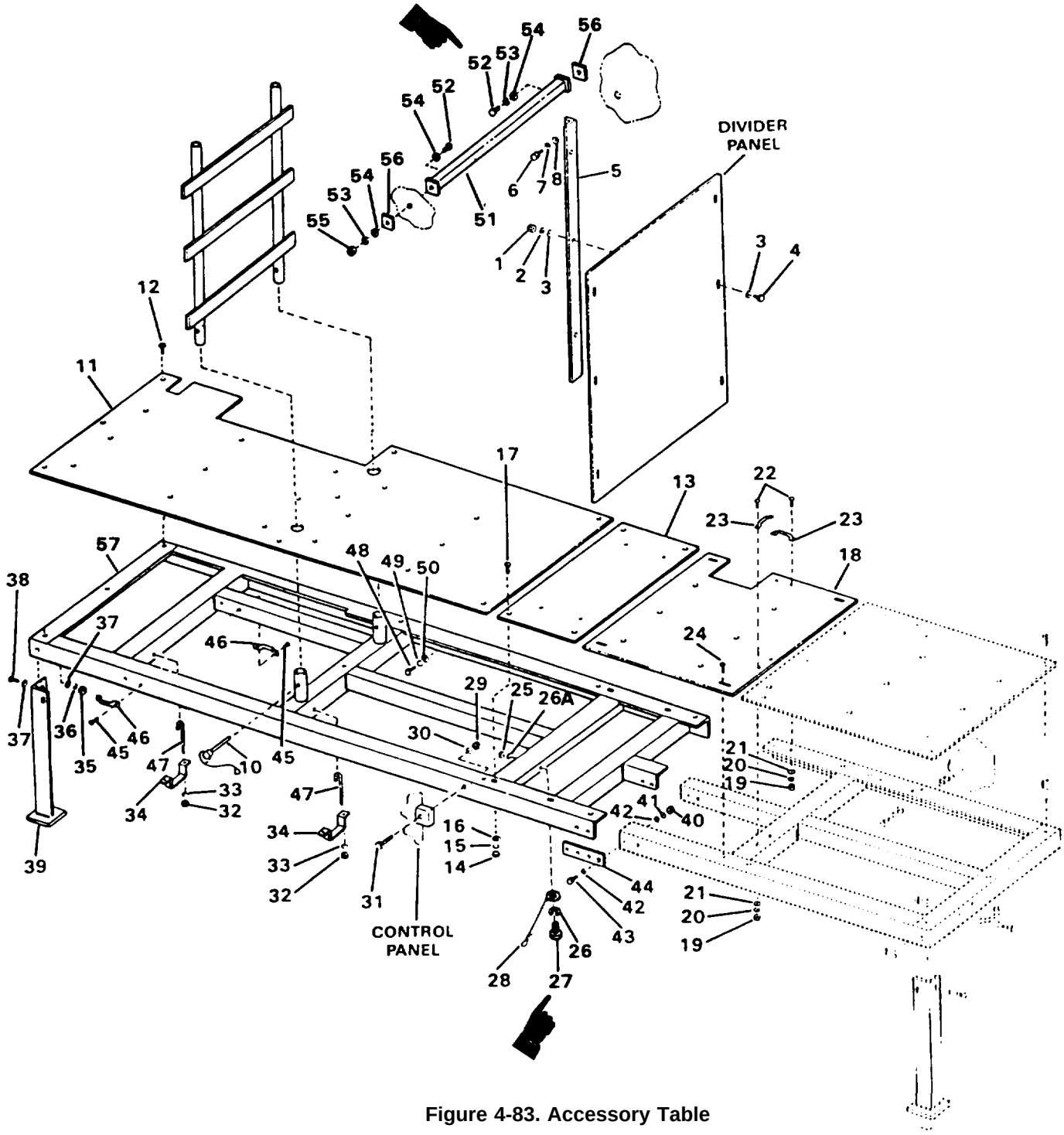


Figure 4-83. Accessory Table

i. Adjusting plate.

CAUTION

Provide temporary support to this end of frame.

(1) Remove nuts (40), lockwashers (41) and washers (42).

(2) Remove capscrews (43), washers (42) and remove plate (44).

j. Tie down brackets (46). Drill out rivets (45) (para. 4-10) and remove tie down brackets (46).

k. Frame structure (57).

(1) Remove capscrews (48), lockwashers (49) and washers (50).

(2) Lift frame assembly out of position.

l. Remove capscrews (52), lockwashers (53), washers (54), locknut (55), vibration pads (56) and remove support bar (51).

REPAIR.

a. Replacement of unserviceable parts.

b. Straightening of bent or cracked metal.

c. Clean and paint as needed.

REASSEMBLY.

a. Place frame (57) into position and support.

(1) Install and secure washers (50), lockwashers (49) and capscrews (48).

(2) If bar (51) was removed, place bar (51) and vibration pads (56) in position and secure with locknut (55), washers (54). lockwashers (53) and capscrews (52).

b. Install and secure tie down brackets (46) and rivets (45) in place (para. 4-10).

c. Position adjusting plate (44). Install and secure capscrews (43), lockwashers (41), washers (42) and nuts (40).

d. Place leg (39) into position. Install and secure capscrews (38), washers (37), lockwashers (36) and nuts (35).

e. Install hook bolts (47) and place RO element removal rods and hanger straps (34) in position. Secure with locknuts (32) and washers (33).

f. Line up frame hole to control panel tab, Secure with bolt (31), washer (30) and nut (29).

g. Install hanger wire (28). Secure with bolt (27), flat washer (26A), fender washer (26) and locknut.

h. Place panel (18) into position. Secure by installing screws (24).

(1) Place tie down brackets (23) in position.

(2) Install and secure capscrews (22), washers (21), lockwashers (20) and nuts (19).

i. Place panel(13) onto frame. Install and secure with capscrews (17), lockwashers (15), washers (16) and nuts (14).

j. Place panel(11) onto frame. Install and secure with screws (12).

k. Place filter gate (9) into position and secure by installing retaining pin (10).

l. Hold channel brace (5) in position. Secure by installing capscrews (6), lockwashers (7) and washers (8).

k. Place divider panel in position. Secure by installing capscrews (4), washers (3), lockwashers (2) and nuts(1).

4-74. ACCESS PANELS AND SEALS. This task covers:

a. Removal. b. Repair. c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill. Ref Code (No.):
Tool Kit, General Mechanics (1)
Riveter, Blind, Hand (2)
Rivnut Repair Kit(15)
Ladder, 15 ft.

Materials/Parts:
Rivets (Appx E, Sec II, Item 59)
Glue
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-460-232-24P)

Equipment Condition:
ROWPU shutdown.
Power cable removed (para. 4-27).
Fuel line disconnected (para. 4-61).
28 VDC cable removed (para. 4-27).

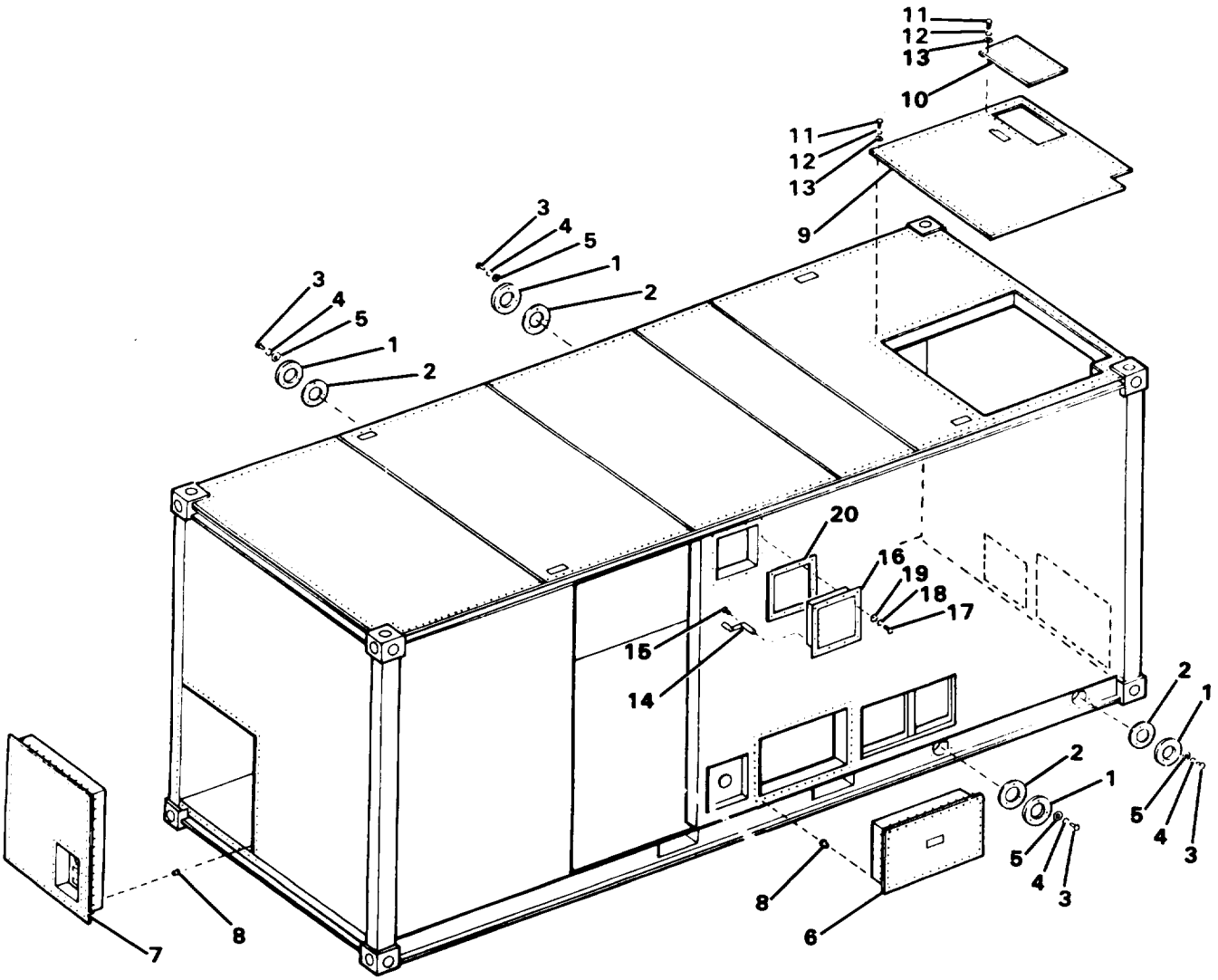


Figure 4-84. Access Panels and Seals

REMOVAL.

NOTE

There are two collars on each side of the ROWPU.

a. Drain Outlet Seal Collars (1, Figure 4-84).

(1) Remove capscrews (3), Iockwashers (4) and washers (5).

(2) Remove seal collar (1), then carefully remove gasket (2).

b. RO Element Access (7) and Pump Access (6).

(1) Covers use spring loaded, secured fasteners. Depress fasteners lightly and turn 1/4 turn counterclockwise.

(2) Fastener receptacle (8) remains in ROWPU frame. Do not remove fastener receptacle (8) unless they are damaged.

c. Media Access Covers (9 and 10).

(1) Remove capscrews (11), Iockwashers(12) and washers (1 3).

(2) Lift cover carefully to avoid damaging the gasket seal material.

d. Vent Assembly, Panel (1 6).

(1) From inside the ROWPU, remove handle retaining screw(15) and remove handle (14).

(2) From outside ROWPU, removecapscrews(17), washers (18 and 19).

(3) Remove vent assembly (16) and gasket (20) using care to avoid damage to gasket and sealing areas.

REPAIR.

a. Replace gasket material glued to panels, if damaged.

b. Replace damaged rivets and nameplates (para. 4-10).

INSTALLATION.

a. Drain Outlet Collars(1).

(1) Install gasket (2) and collar (1), Align holes.

(2) Install washers (5), Iockwashers (4).

(3) Install capscrews (3) and tighten.

b. RO Element Access Panel (7).

(1) Check gasket strips fastened to panel. Replace or repair as needed.

(2) Hold panel in position and depress a fastener into its receptacle and turn 1/4 turn clockwise. Repeat this procedure until all fasteners are in this “locked” position.

c. Media Filter Access Covers (9 and 10).

(1) Check that gasket strip material is secure and not damaged.

(2) Set cover into position, align fastener holes.

(3) Secure by installing washers (13), Iockwashers (12) andcapscrews (11).

d. Vent Assembly, Panel.

(1) Place gasket (20) and vent (16) into position and align holes.

(2) Secure by installing washers(18 and 19) andcapscrews(17).

(3) From inside the ROWPU, place handle (14) onto shaft and secure with retaining screw (15).

4-75. DOORS. This task covers:

a. Service. b. Adjust. c. Repair.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Riveter, Blind, Hand (2)
Ladder, 15 ft.

Materials/Parts:
Rivets (Appx E, Sec II, Item 59)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

SERVICE.

Lubricate hinges, door latch rollers and friction points per lube order LO 10-4610-232-12.

ADJUST.

a. Refer to Figure 4-85 and adjust main doors and door lock mechanisms to obtain easy opening, closing, and latching, as required.

b. Check that upper latch(1) and lower latch (2) mechanisms have not loosened and shifted in position. Adjust and secure capscrews (3), Iockwashers (4) and washers (5) as needed.

c. Check that tie rod fasteners(6) have not loosened or worn, allowing excess motion. Tighten fasteners as needed.

d. Check hinge fasteners (7) for tightness.

e. Check door main latch (8) for any play or looseness. It is retained with capscrews (9), Iockwashers (10) and washers (11), tighten as needed.

f. Check door striker(12) for tightness. It is secured with capscrews (13), Iockwashers(14) and washers (15).

g. Check that recessed latch mechanism (16) has not loosened. It is fastened with capscrews (17).

REPAIR.

a. Check that upper latch(1) and lower latch (2) mechanisms have not loosened and shifted in position. Adjust and secure capscrews (3), Iockwashers (4) and washers (5) as needed.

b. Check that tie rod fasteners (6) have not loosened or worn, allowing excess motion. Tighten fasteners as needed.

c. Check hinge fasteners (7) for tightness.

d. Check door main latch (8) for any play or looseness. It is retained with capscrews (9), Iockwashers (10) and washers (11), tighten as needed.

e. Check door striker (12) for tightness. It is secured with capscrews (13), Iockwashers(14) and washers (15).

f. Check that recessed latch mechanism (16) has not loosened. It is fastened with capscrews (17).

NOTE

Repair is limited to the replacement of the following gaskets and/or components.

g. Recessed latch gasket (18). Remove capscrews (17), remove latch mechanism (16), gasket (18) and two each spacers (19 and 20). Do not remove screw inserts (21).

h. Door vent (22) and gasket (23). Remove capscrews (24), Iockwashers (25), washers (26) and remove door vent and gasket.

i. Repair damaged weather stripping (27) on top and sides of door.

(1) Drill out rivets (28) (para. 4-10) and remove retainer strip (29) and weather stripping (27).

(2) Install new weather stripping. Place retainer (29) into position and install rivets (28) (para. 4-10).

j. Replace damaged, missing or loose rivets.

k. Replace damaged fasteners and ground strap.

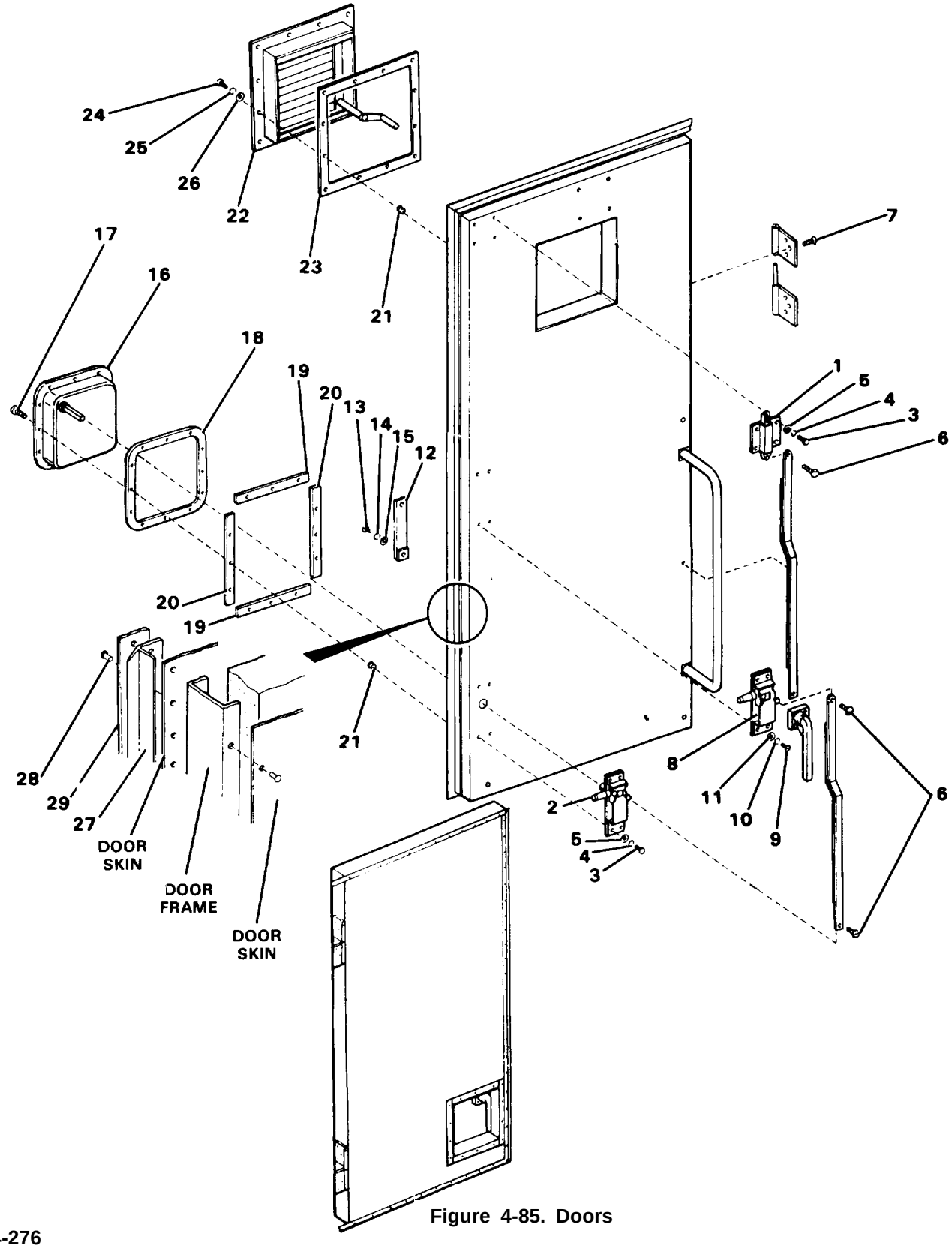


Figure 4-85. Doors

4-76. METAL OXIDE VARISTOR (MOV) JUNCTION BOX. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No,):
Tool Kit, General Mechanics Automotive (1)
Wire Stripper (16)
Crimper, Hand Terminal (16)

Materials/Parts:
Suitable Tags
Varnish, Electrical (Appx E, Sec II, Item 73)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Personnel Required: 2

Equipment Condition:
ROWPU shutdown.
Main Circuit Breaker CB1 turned off (73, Figure 2-4).

General Safety Instructions:

WARNING

Observe specific Warnings in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

REMOVAL.

a. Refer to Figure 4-86, sheet 1 and disconnect the seven power input cables (phantom) which are connected to the junction box.

b. Remove four capscrews (1), washers (2), nuts (3), lockwashers (4) and washers (5) and remove junction box (6).

DISASSEMBLY.

a. Loosen (do not remove) screws (7) and slide latch (9) to the side to open box (6) door. In the event that you loosen screw (7) too much, washer (8), latch (9), spring (10) and nut (11) will be free and must be reassembled as shown.

NOTE

Refer to Figure 4-86, sheet 2 for wiring details.

b. Tag and disconnect all wires from harnesses(18 thru 24) to the twelve MOVS (37). All connections to MOVS are made as shown in the typical connection view. Connections from each harness to the MOVs are individually shown in the seven connection views.

c. Remove four screws (12), nuts (13) and washers (14) for each harness (18 thru 24) to be removed. Dust caps (15, 16 and 17) are now free. Remove harnesses(18 thru 24).

d. Remove gaskets (25 thru 31).

e. Remove screw (32), washer (33) and panel (34).

f. Remove screws (35), lockwashers (36) and twelve MOVS (37).

g. If necessary, remove four drive screws (38). Nameplate (39) is now free.

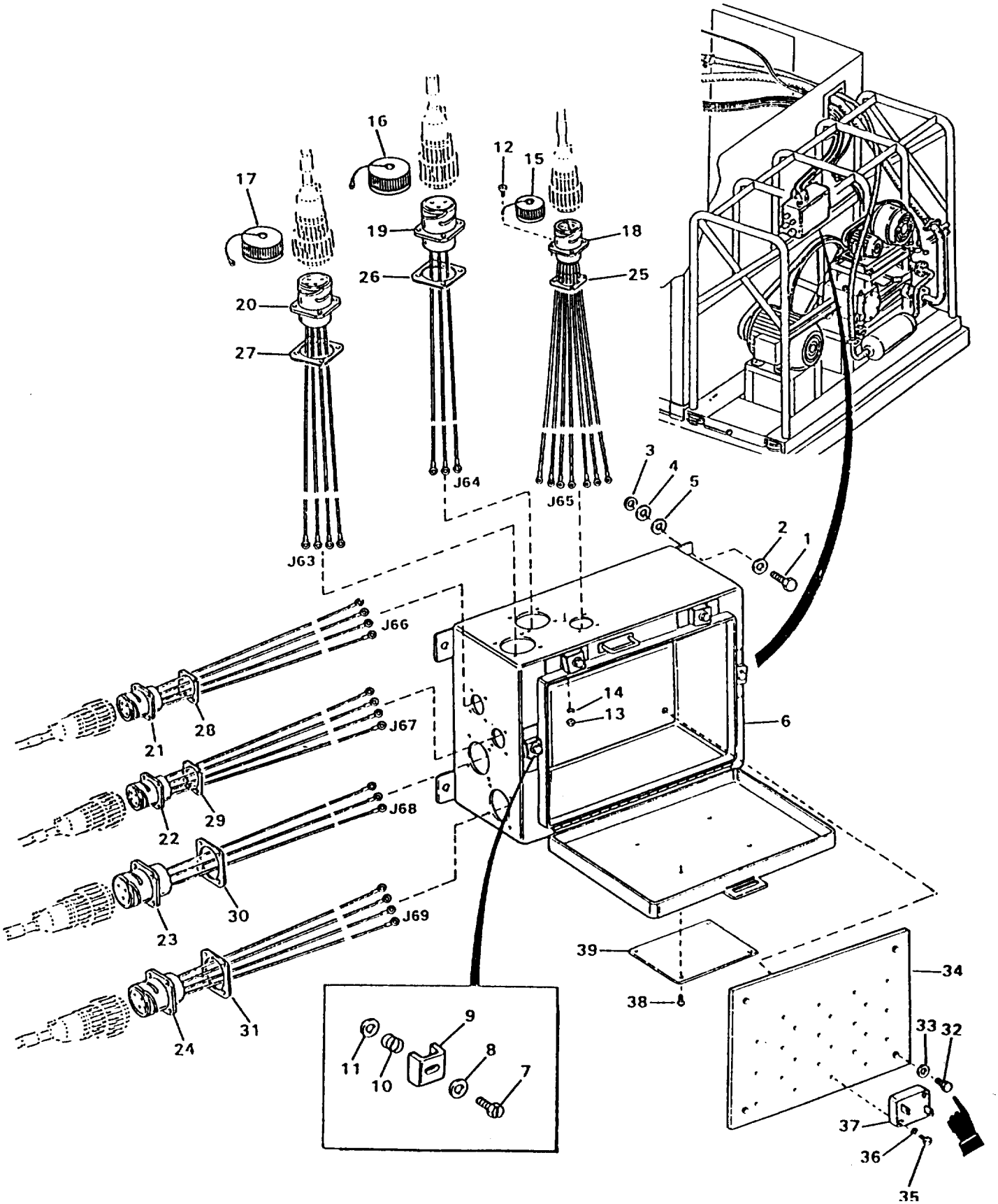


Figure 4-86. MOV Junction Box (sheet 1

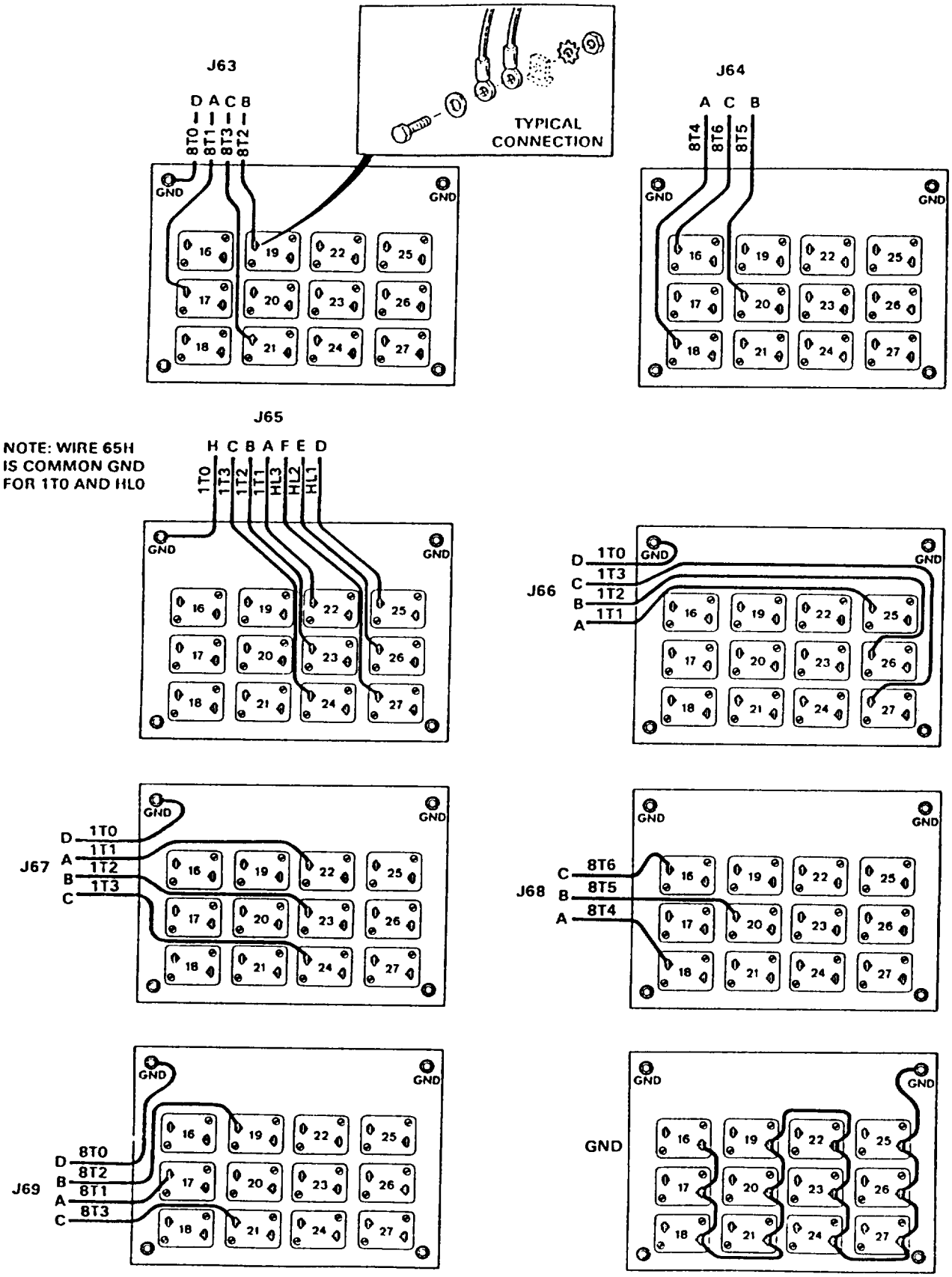


Figure 4-86. MOV Junction Box (sheet 2 of 2) Connections

REPAIR.

a. Repair by replacing damaged harness assemblies and missing or faulty components.

b. Replace nameplate (para. 4-10).

c. Replace loose or damaged ring tongue connectors (para. 4-10).

d. Replace wire markers (para. 4-10).

e. Replace damaged rivnuts.

REASSEMBLY.

a. If removed, install nameplate (39) and secure with drive *screws* (38).

b. Subassembly 12 MOVS (37) on panel (34) and secure with screws (35) and washers (36).

c. Install panel (34) in box (6) and secure with screws (32) and washers (33).

WARNING

This junction box contains 440 volt power. Be absolutely certain that wires are connected correctly and securely or injury or death may result. If there is any question as to where any wire should be connected, consult your supervisor.

d. Place gaskets (25 thru 31) on harnesses(18 thru 24) and pass the wires of each harness (one at a time) through the appropriate holes in box (6). Connect the wires in accordance with the tags placed during removal and sheet 2 of Figure 4-86.

e. Varnish the connections.

f. Secure harnesses(18 thru 24) with screws (12), washers(14) and nuts (13).

g. Install dust covers (15, 16 and 17).

h. Close box(6) cover and secure with four latches (9) by tightening screws (7). Reassemble screws (7), washers(8), latches (9), springs (10) and washers (11) within latch (9) if screws (7) were loosened too much.

INSTALLATION.

a. Place box (6) in position and secure with capscrews (1), washers (2), nuts (3), Iockwashers (4) and washers (5).

b. Install the cables on the junction box.

4-77. ELECTRIC HEATER. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. d. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
Electrical power disconnected from heater.
Circuit breaker CB17 turned off in main control (Figure 2-4).

Materials/Parts:
Varnish, Electrical (Appx E, Sec II, Item 73)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P]

General Safety Instructions:

WARNING

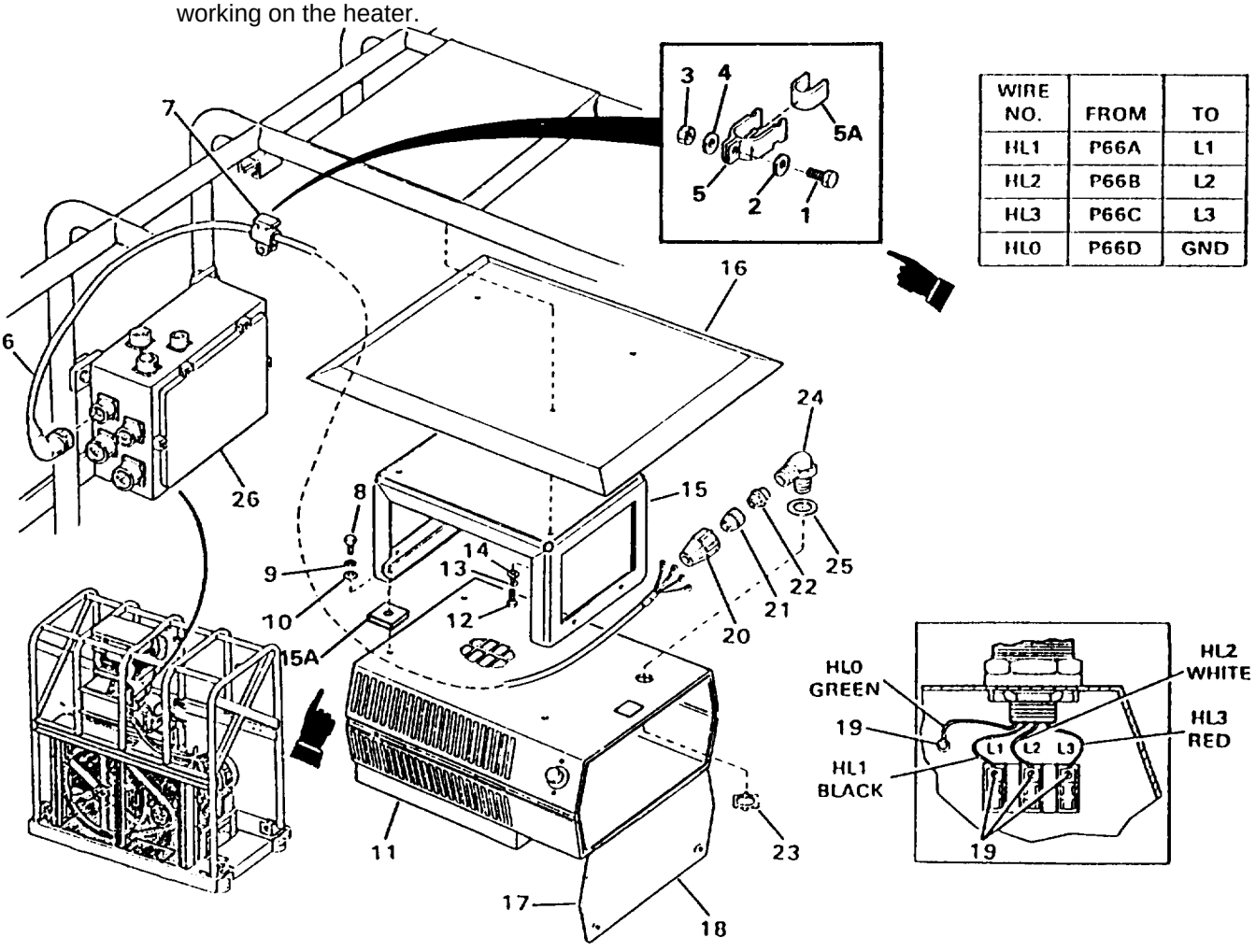
Observe specific Warnings in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock or moving parts.

WARNING

Unless circuit breaker CB17 is turned off, there will be power to the heater even though the ROWPU is shutdown. Be absolutely sure the circuit breaker is off before working on the heater.



WIRE NO.	FROM	TO
HL1	P66A	L1
HL2	P66B	L2
HL3	P66C	L3
HL0	P66D	GND

Figure 4-87. Electric Heater

REMOVAL.

a. Refer to Figure 4-87 and disconnect heater cable (6) at MOV box (26).

b. Remove capscrew (1), washer (2), nut (3), and washer (4). Remove cable and clamp (5) with cushion (5A).

c. Remove four capscrews (8), Iockwashers (9) and washers (10). Remove heater(11) and pad (1 5A).

d. Remove four capscrews (12), Iockwashers(13) and washers(14) and remove heater bracket (15) and cover (16).

DISASSEMBLY.

a. Turn cover fasteners (17) 90 degrees counterclockwise and open end cover (18) as shown.

b. Tag and disconnect four cable (6) wires by loosening captive screws(19) as shown on the insert on Figure 4-87.

c. Unscrew nut (20) and slide nut (20), retainer (21) and bushing (22) back on cable (6).

d. Unscrew conduit nut (23) and remove elbow (24) and sealing ring (25) from heater(11).

e. Pull cable (6) from the elbow (24) and slide nut (20), retainer (21) and bushing (22) off the cable.

REPAIR.

a. Replace cable (6) if damaged.

b. Replace damaged or missing hardware.

REASSEMBLY.

a. Place sealing ring (25) on elbow (24) and secure with conduit nut (23).

b. Slide nut (20), retainer (21) and bushing (22) on cable (6).

c. Place the ends of cable (6) through elbow (24) into heater(11) and connect the cable wires with captive screws (19) in accordance with the tags placed during removal and as shown on the insert on Figure 4-87. It is not necessary to tape electrical connections. Spray or brush connections with varnish.

d. Tighten nut (20) on elbow (24).

e. Close cover (18) and secure with cover fasteners (17).

INSTALLATION.

NOTE

Be careful to mount cover and bracket as illustrated in Figure 4-87. It is possible to mount these items backwards.

a. Install cover (16) and bracket (15) and secure with four capscrews (12), kxkwashers(13) and washers (14).

b. Install heater (11) with pads (15A) and secure with capscrews (8), Iockwashers (9) and washers (10).

c. Install cable (6) on MOV box (26).

d. Place cable clamp (5) with cushion (5A) on cable (6) and secure with screw (1), washer (2), nut (3) and washer (4).

4-78. AIR COMPRESSOR ASSEMBLY. This task covers:

a. Inspection. b. Service. c. Adjust.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Funnel (3)
Gage, Belt Tension (13)

Equipment Condition:
ROWPU operational for inspection.
Shutdown for servicing and adjusting.

Materials/Parts:
Preformed Packings (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

General Safety Instructions:

WARNING

•Observe specific Warning in text.

•Do not wear loose clothing or jewelry while working on equipment.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

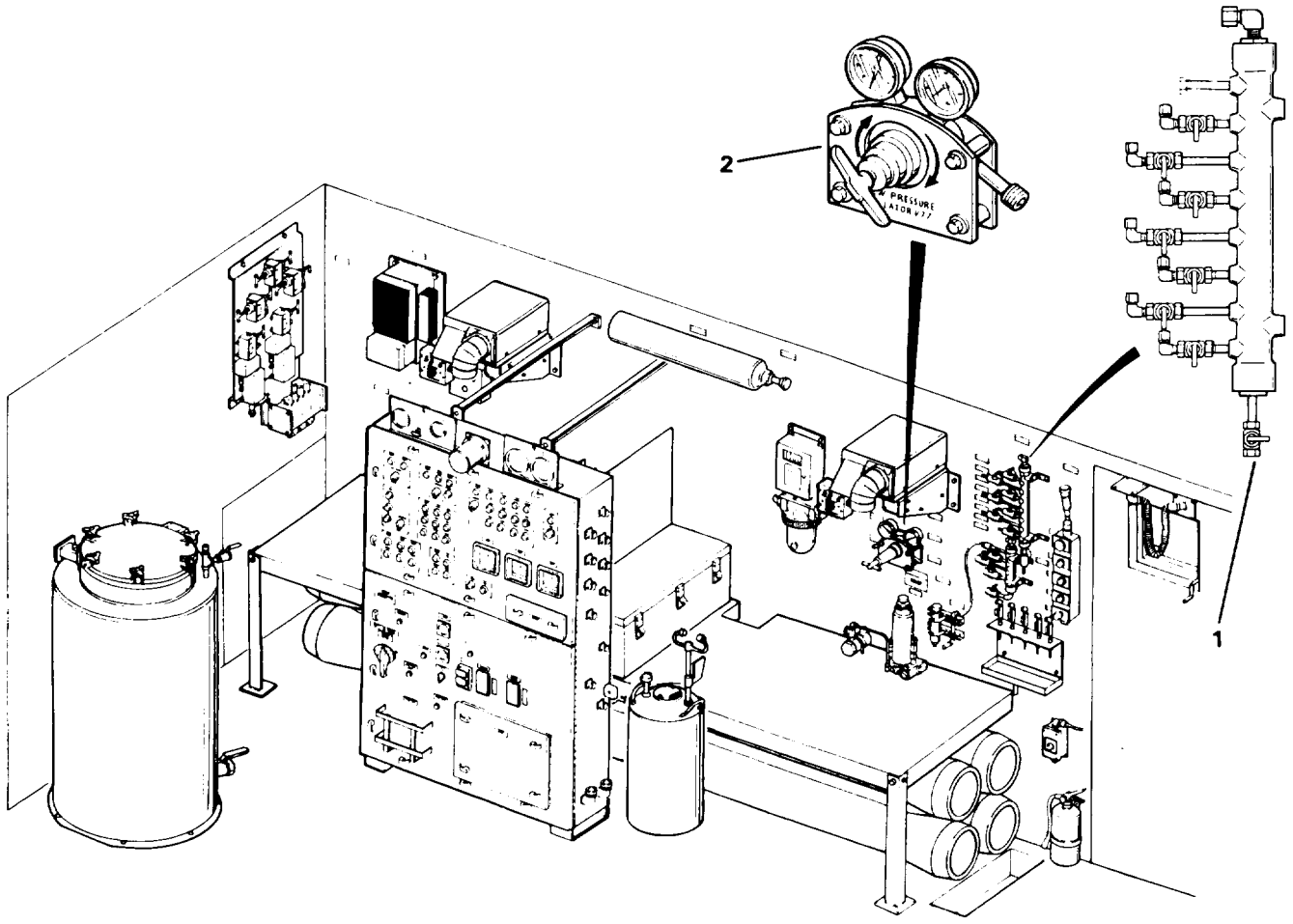


Figure 4-88. Air Compressor Inspection

INSPECTION.

a. Observe operation of the air compressor to make certain it starts and stops at the correct air pressure settings. Proceed as follows:

(1) Refer to Figure 4-88 and drain down system air pressure at the air manifold drain valve(1) while observing the system air pressure gage (2). The air compressor should turn on at approximately 1500 to 1550 psig (10340 to 10685 kPa). Then, close drain valve(1).

(2) Continue to watch the air pressure gages. The compressor should continue to operate until system air pressure is between 1750 and 1800 psig (12063 to 1210 kPa).

(3) Notify direct support if the air pressure at which the air compressor actuates is too high or too low.

WARNING

Shutdown the ROWPU before attempting to perform the rest of this inspection.

b. Loosen screw (3, Figure 4-89) and remove clamp (4) and air cleaner (5).

c. Remove two capscrews (6), washers (7), lockwashers (8) and guard (9).

d. Inspect the fan and sheave drive belts for cracks or signs of wear such as fraying or hardening.

e. Inspect the motor sheave for cracks or other damage.

f. Inspect the air compressor cooling fins for dirt buildup. Clean with a brush and compressed air.

SERVICE.

a. Refer to Figure 4-89 and change lubricating oil as follows:

(1) Remove dipstick (1).

(2) Place a suitable container beneath oil plug (2) and remove the oil plug. Allow oil to drain into the container.

(3) Replace plug (2).

(4) Using a funnel, refill the air compressor with lubricating oil through dipstick (1) opening. Refer to LO 10-4610-232-12.

(5) Reinstall dipstick (1).

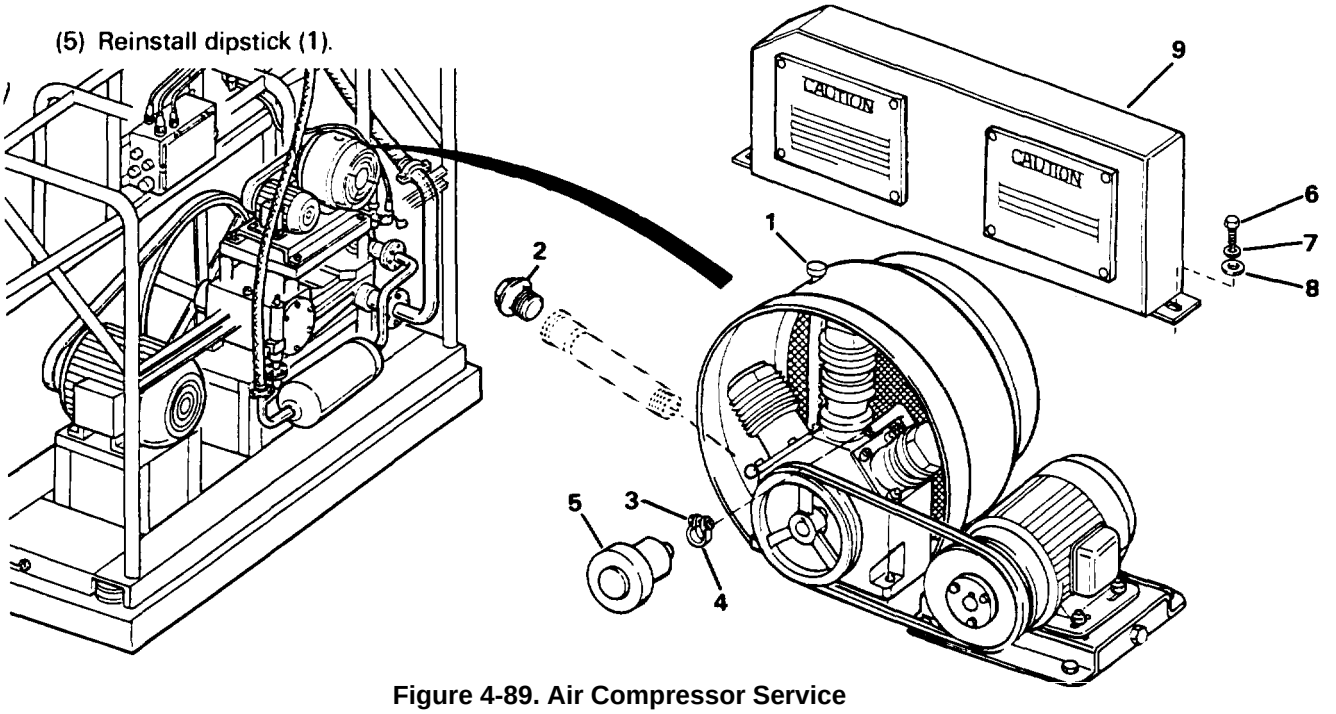


Figure 4-89. Air Compressor Service

ADJUST.

a. Adjust the air compressor cooling fan belt tension as follows:

WARNING

Shut down the air compressor and bleed off all pressure in the system before adjusting, Serious injury could result if this is not done.

(1) Refer to Figure 4-90 and remove two capscrews (1), washers (2), grommets (2A), nuts (3), washers (4), capscrew (5), washer (6) and grommet (6A). Remove compressor shroud.

(2) With your thumb, depress drive belt(8) at the center of the belt span. If You can depress the drive belt more than 0.4 inches (3 mm) the drive belt tension must be adjusted.

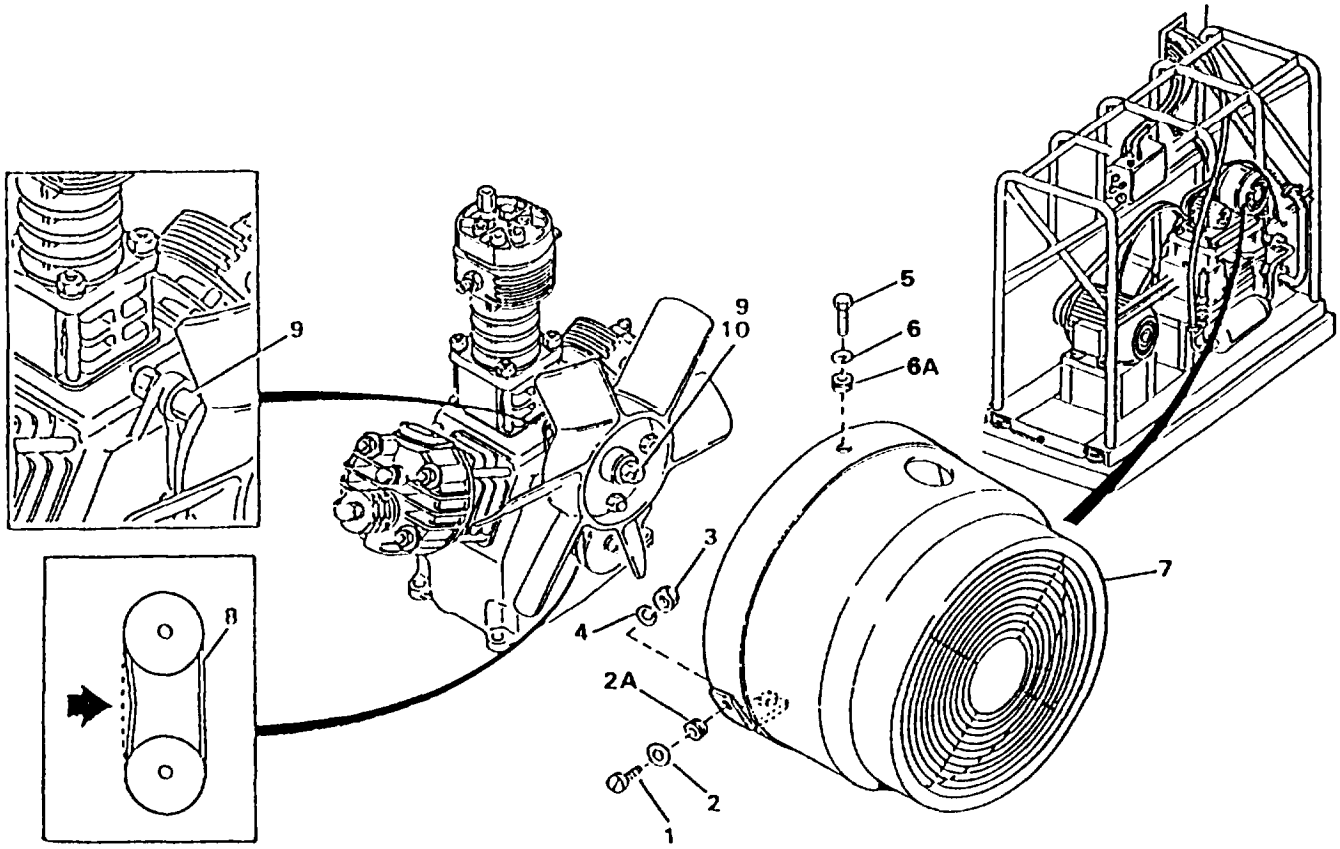


Figure 4-90. Adjusting Cooling Fan Belt Tension

(a) Loosen nut (10) and turn shaft (9) until fan belt tension is correct.

(b) Hold fan belt (8) and tighten nut (10) to maintain the desired belt tension.

b. Adjust air compressor sheave drive belt tension as follows:

(1) Refer to Figure 4-89 and loosen screw (3) and remove clamp (4) and fitler assembly (5).

(2) Remove two capscrews (6), washers (7) and lockwashers (8) and remove belt guard (9).

(3) Remove the straightedge (7, Figure 4-97) from the belt guard of the high pressure pump.

(4) Refer to Figure 4-91 and place the straightedge (1) between sheaves (2 and 3) as shown.

(5) Reset the top preformed packing (there are two preformed packings) on belt tension gage (4) so that it butts up against the bottom of the handle.

(6) Set the lower preformed packing on the (deflection) scale to 5/16 inch (0.79 cm).

(7) Place gage (4) in the center of belt (5) and press on the gage until the belt is deflected downward 5/16 inch. This can be judged by noting when the lower preformed packing on the gage lines up with the lower edge of the straightedge.

(8) Remove the gage and read the top (force) scale just beneath the upper preformed packing. The number beneath the upper preformed packing is the force in pounds which was required to deflect the belt 5/16 inch. The force should be between 3.7 and 5.4 ft-lbs.

(9) If drive belt tension is not between 3.7 and 5.4 ft-lbs. loosen four nuts (6) to allow the air compressor drive motor (8) to be moved.

(10) Turn jackscrew (7) clockwise (to the right) to tighten the drive belt. Turn counterclockwise (left) to loosen the drive belt.

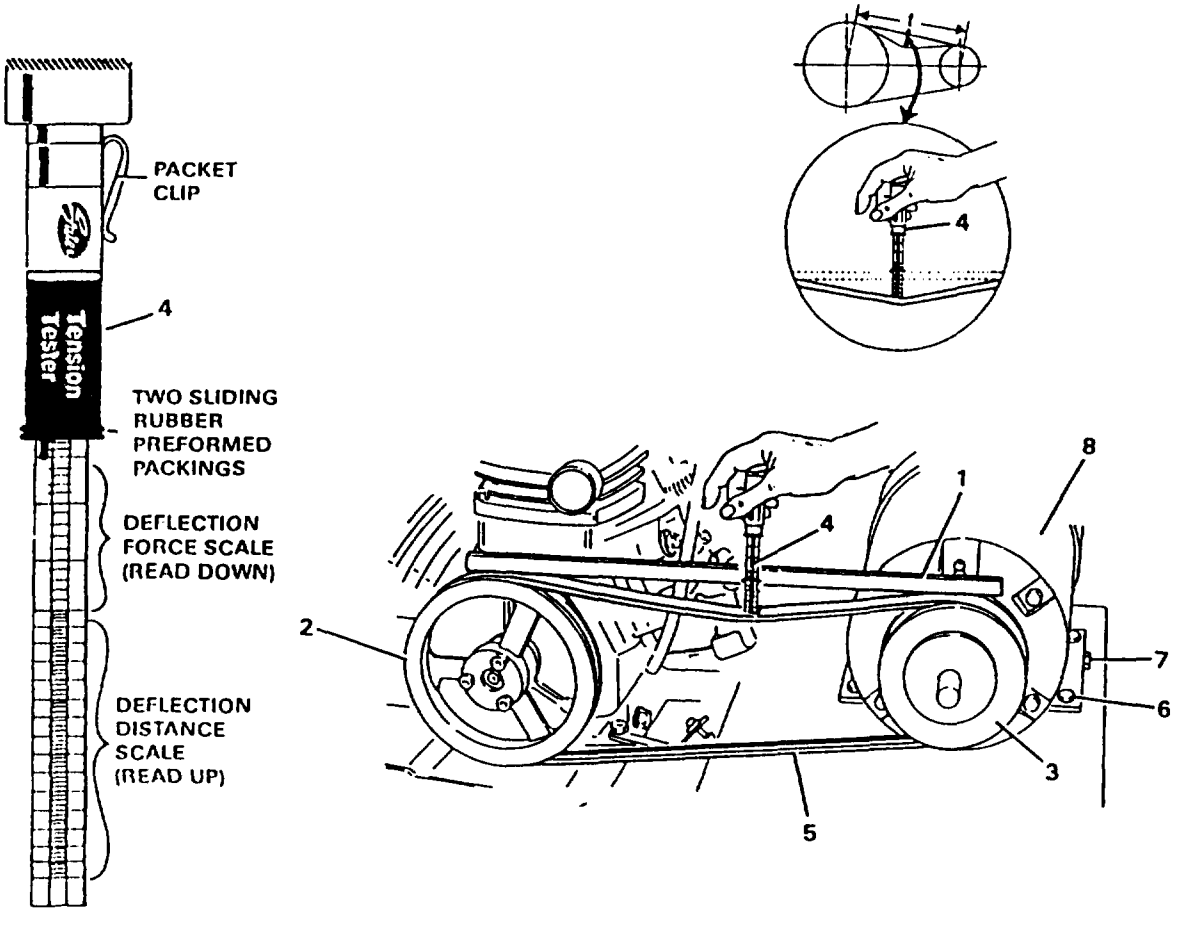


Figure 4-91. Air Compressor Drive Belt Adjustment

(11) Refer to Figure 4-92 and check the alignment of sheaves (2 and 3) by placing the straightedge (1) across the faces of the sheaves. If the sheaves are not aligned, move motor (4) to bring the sheaves into proper alignment.

(12) Recheck belt (5) tension as described above. Then tighten four nuts (6).

(13) Install belt guard (9, Figure 4-89) and secure with two capscrews (6), lockwashers (7) and washers (8). Install air filter (5), clamp (4), and secure with screw (3).\

(14) Return the straightedge to the high-pressure pump belt guard

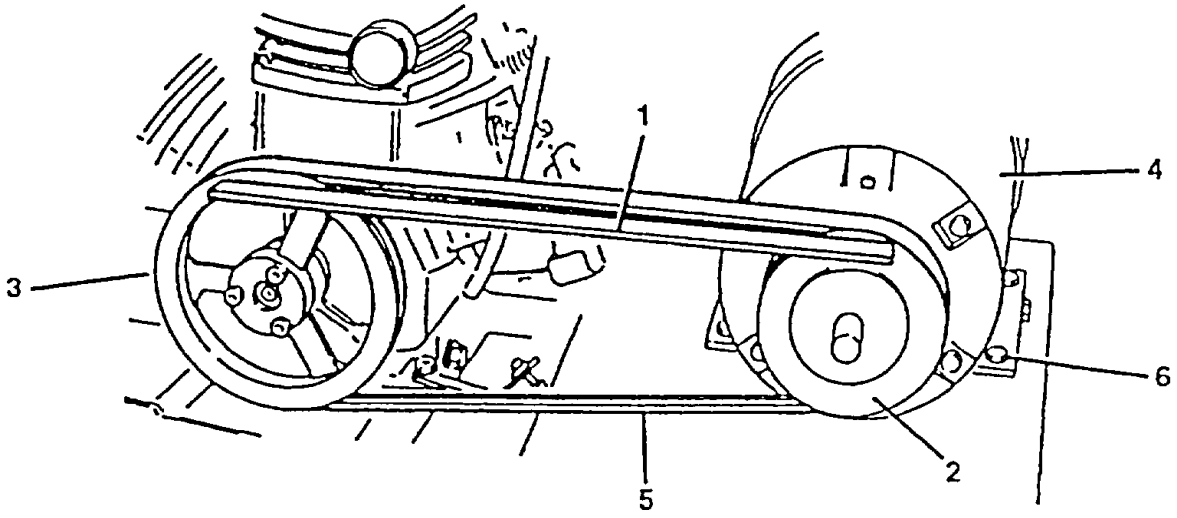


Figure 4-92. Air Compressor Sheave Alignment

4-79. AIR COMPRESSOR MOTOR. This task covers:

a. Removal. b. Repair. c. Installation.

INITIAL SETUP

Tools, see Appx B. Sec Ill. Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Torque (2)
Stripper. Wire (16)
Crimper, Hand Terminal (16)

Equipment Condition:
ROWPU shutdown.
Air compressor belt guard removed (para. 4-78).
Air compressor switch turned off (para. 4-78).
Air compressor circuit breaker CB2 turned off (para 4-78).

Materials/Parts:
Cloth, Emery (Appx E, Sec II, Item 28)
Grease (Appx E, Sec II,. Item 42)
Tape, Electrical (Appx E, Sec II, Item 68)
Twine (Appx E, Sec II. Item 72)
Varnish, Electrical (Appx E. Sec II, Item 73)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

REMOVAL

a. Disconnect cable (1, Figure 4-93, sheet 1) at the junction box.

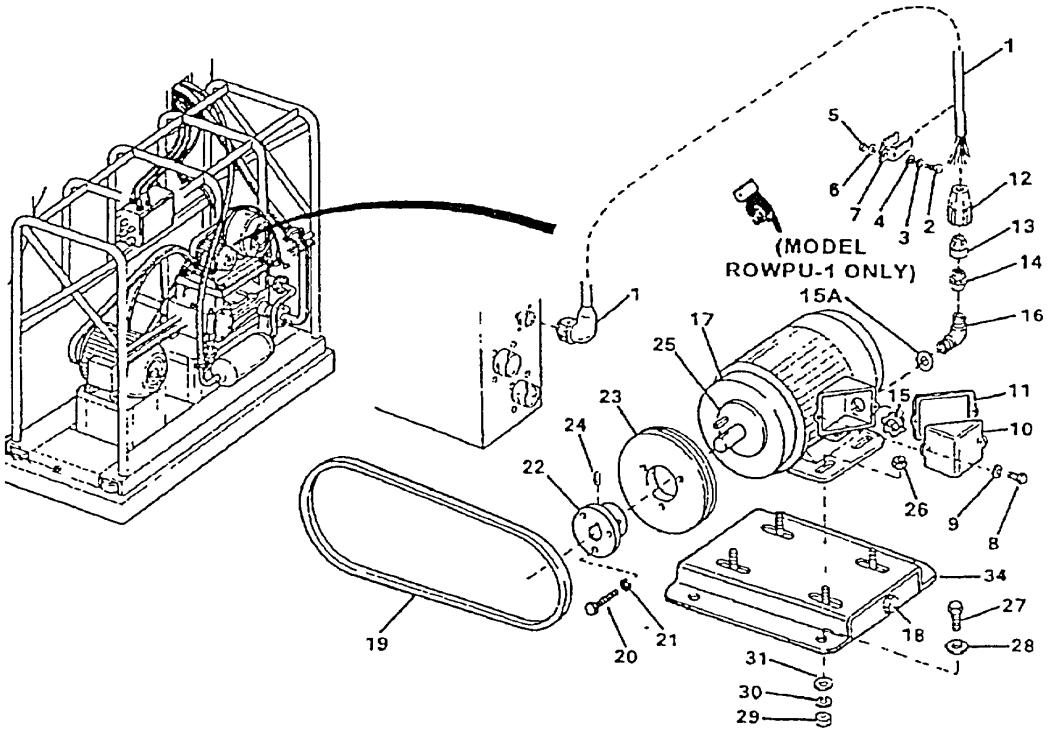


Figure 4-93. Air Compressor Motor (sheet 1 of 2) Components

b Remove four capscrews (2), lockwashers (3), washers (4), nuts (5), washers (6) and clamps (7)

c. Remove two screws (8), washers (9), cover (10) and gasket (11).

d. Refer to Figure 4-93, sheet 2, and disconnect and tag all cable leads (1T0, 1T1, 1T2 and 1T3) at the motor and remove grounding screw (32) and washers (33).

e. (Model WA-060 only) Loosen nut (12, sheet 1) and slide nut (12), retainer (13), and bushing (14) back on cable (1). Pull cable (1) out of the motor (17) box and slide bushing (14), retainer (13) and nut (12) off the cable. Remove elbow (16) and conduit nut (15) from conduit box.

f. (Model ROWPU-1 only) Loosen nut (12, sheet 1) and slide nut (12), retainer (13), and bushing (14) back on cable (1). Pull cable (1) out of the motor (17) box and slide bushing (14), retainer (13) and nut (12) off the cable. Remove sealing washer (15A), elbow (16) and conduit nut (15) from conduit box.

g. Loosen nuts (26) and turn jackscrew (18) counterclockwise to relieve the tension in belt (19). Remove belt (19)

h. Remove hub (22) and sheave (23) as follows:

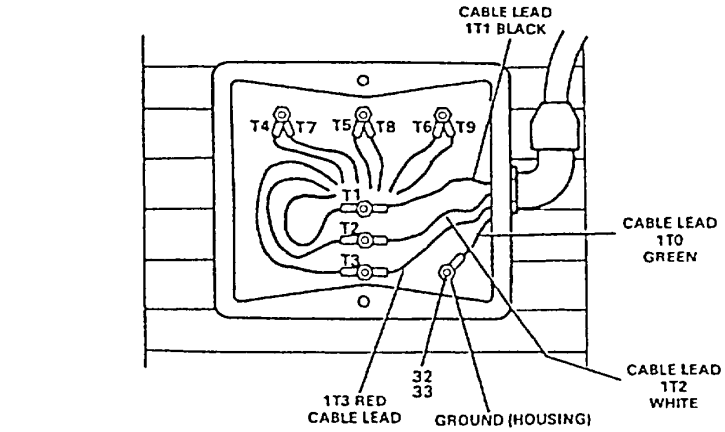
(1) Scribe the motor shaft to indicate the position of hub (22) on the shaft. If the motor is being replaced, measure and record the position of hub (22) on the motor shaft (measure from end of shaft away from motor) so as to be able to return the hub to the correct position on the new motor.

(2) Mark sheave (23) to show which side faces the motor.

(3) Remove capscrews (20) and lockwashers (21)

(4) Remove setscrew (24) which secures hub (22) to motor (17) shaft.

(5) Reinstall capscrews (20) in the threaded holes of hub (22)



HARN. NO	WIRE CHART	
	FROM	TO
W67	1T0	GRD
	1T1	T1
	1T2	T2
	1T3	T3
	T4	T7
	T5	T8
	T6	T9

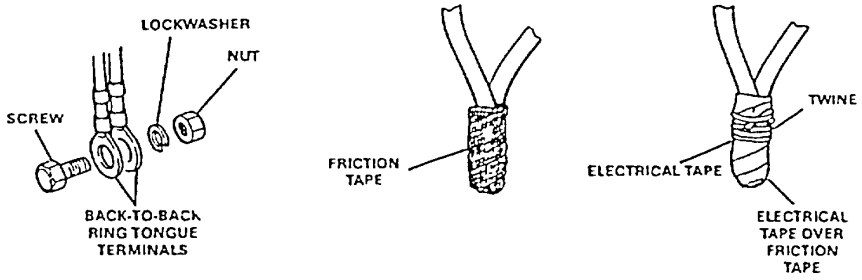


Figure 4-93. Air Compressor Motor (sheet 2 of 2) Connections

(6) Tighten the capscrews (20) evenly and alternately to move sheave (23) off hub (22).

NOTE
The hub will split if the wedge is tapped too hard.

(7) Tap a screwdriver or a chisel into the split line of hub(22)just far enough to allow removal of hub(22) from the motor shaft. Remove sheave (23).

(8) Remove motor shaft key (25).

h. Remove four capscrews (27), washers (28), nuts (29), lockwashers (30), washers (31) and remove motor base (34)

i. Remove four nuts (26) and remove motor (17).

REPAIR

a. Repair loose or damaged ring tongue connectors (para 4-10).

b. Replace wire markers (para 4-10).

c. Replace cracked or damaged sheave (23).

d Replace cracked, worn or frayed belt (1 9).

e. Replace motor (17) if defective.

f. Replace damaged or missing nameplates (para. 4-10).

g. Check motor shaft key (25) for burrs or nicks. File them smooth if necessary. Replace if damaged beyond repair.

NOTE
Do not lubricate hub or sheave.

h. Check inner bore and outer tapered face of hub (22) for rust, corrosion or dirt. Use fine emery cloth to remove it.

i. Check inner bore of sheave (23) for rust, corrosion or dirt. Use fine emery cloth to remove it.

j. Check the motor shah for corrosion and dirt and clean with fine emery cloth.

INSTALLATION

a. Install motor base (34) and secure with capscrews (27), washers (28), nuts (29), lockwashers (30) and washers (31).

b. Tap motor sheave key (25) into shaft of motor (17).

c. Slide sheave (23) onto the motor shaft making sure the side marked faces the motor.

d. Remove capscrews (20) from the threaded holes of hub (22).

NOTE
Do not tap the screwdriver or chisel too hard or the hub will break.

e. Tap a screwdriver or chisel Into the spilt line of hub (22) just far enough to allow It to slide onto the motor (17) shaft Slide the hub to the position marked by scribe marks during disassembly.

f. Tighten setscrew (24). Slide sheave (23) onto hub (22) as far as it will go and align threaded holes in sheave (23) with non-threaded hole in hub (22).

g. Install capscrews (20) with lockwashers (21) through hub (22) into sheave (23). Tighten the capscrews (20) hand tight h. Evenly and alternately tighten capscrews (20) to pull sheave (23) onto hub (22) Torque to 108 inch pounds using a torque wrench.

i. Pack the threaded holes in hub (22) with grease to prevent corrosion.

j. Place motor (17) on motor base (32) and secure with nuts (26). Do not tighten nuts (26) at this time.

k. Install belt (19) over motor sheave (23) and air compressor drive sheave (not shown) with the tapered part of the belt in the sheave grooves.

l. Refer to para. 4-78 and adjust drive belt tension and sheave alignment.

m. (Model WTA-060 only) Install elbow (16) and secure with conduit nut (15).

n. (Model ROWPU-1 only) Install sealing washer (15A) and elbow (16) and secure with conduit nut (15).

o. Slide nut (12), retainer (13) and bushing (14) on cable (1).

p. Push cable (1) through into the electrical box on motor (17).

q. Refer to Figure 4-93, sheet 2, and connect all wires as tagged during removal. Spray all connections with varnish and tape and twine connections as shown.

r. Refer to Figure 4-93, sheet 1, and tighten nut (12).

s. Install cover (10) and gasket (11) and secure with screws (8) and washers (9).

t. Install four clamps (7) and secure with screws (2), lockwashers (3), washers (4), nuts (5) and washers (6)

u. Connect cable (1) at junction box.

WARNING

Do not attempt to change electrical connections as described below with power applied to the motor. Serious injury or death could occur.

v. Check motor rotation when started. It must be counterclockwise when viewing the sheave end of the motor. If it is not correct, shut down the motor and check for correct connections. To reverse rotation, interchange the T1 and T2 connections in the electrical box on the motor.

4-80. AIR COMPRESSOR. This task covers.

a Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Lubricating Oil (Appx E, Sec II, Item 52)
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Generator shutdown. Air compressor shroud, filter and belt guard removed (para 4-78).

General Safety Instructions:

WARNING

Observe specific Warnings in text.

WARNING

Make sure the generator is shut down before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts

WARNING

Relieve air compressor pressure by opening the drain valve at the air pressure relief valve (Figure 4-94) before attempting to do any work on air system Failure to do so could result in serious injury.

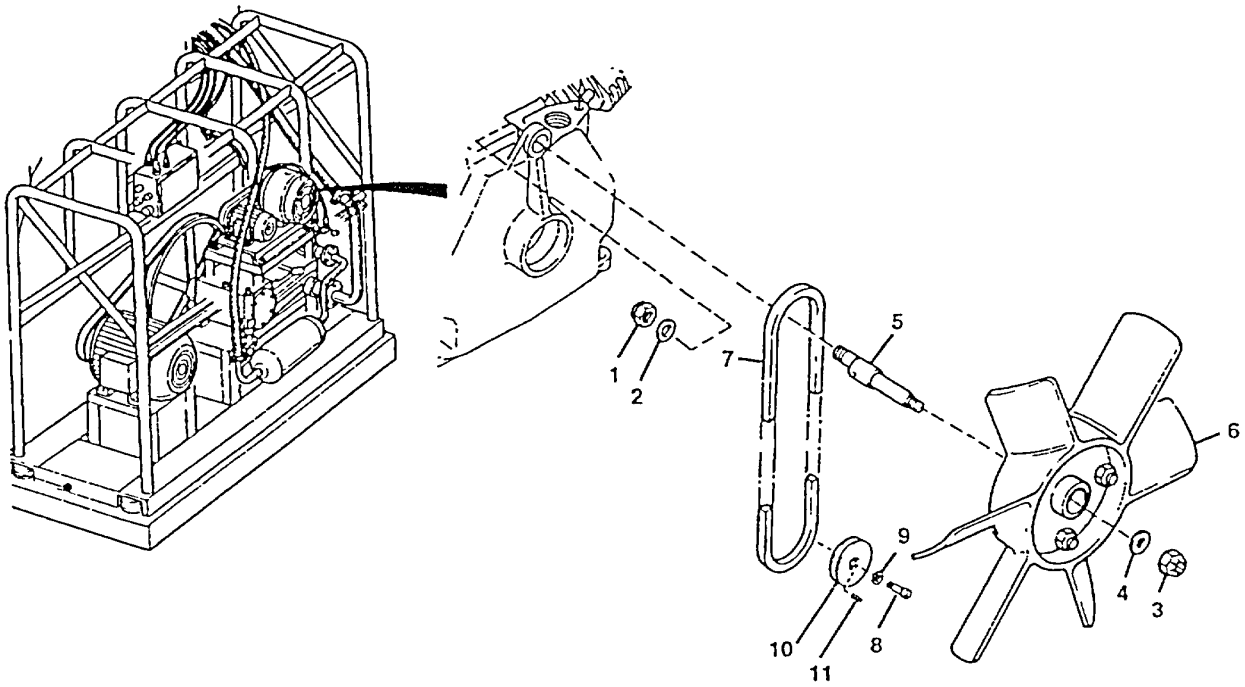


Figure 4-94. Air Compressor, Removal and Installation

DISASSEMBLY.

a. Make sure electrical power is shutoff.

b. Remove nut (1) and washer (2) and remove items (3 thru 10) as an assembly. Belt (7) will now be free.

c. Remove nut (3) and washer (4) and slide eccentric shaft (5) out of fan (6).

d. Remove socket head screw (8) and washer (9) and pull sheave (10) out of compressor housing. Key (11) may now be removed, if necessary.

REPAIR.

a. Repair by replacement of damaged or missing hardware.

b. Replace worn or frayed belt (7).

REASSEMBLY.

a. Place key (11) in the key slot in the crankshaft and slide sheave (10) on the shaft. Secure with washer (9) and socket head screws (8).

b. Install shaft (5) in fan (6) and install washer (4) and nut (3). Do not tighten nut (3) more than hand tight at this time.

c. Insert shaft (5) into belt (7) and place belt (7) over sheave (10), Install shaft (5) through the bore in compressor housing and secure with washer (2) and nut (1). Now, tighten nut (3) securely.

4-81. HIGH PRESSURE PUMP ASSEMBLY. This task covers:

a. Inspection. b. Service. c. Adjust.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Funnel (4)
Gage, Belt Tension (13)
Bucket, Five Gallon

Materials/Parts:
Lubricating Oil (Appx E, Sec II, Item 52)

Equipment Condition: ROWPU shutdown. High pressure pump circuit breaker CB6 (63, Figure 2-4) turned OFF. High pressure pump belt guard removed (para, 4-82).

General Safety Instructions:

WARNING

- **Observe specific Warning in text.**
- **Do not wear jewelry or loose clothing while working on unit.**

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

INSPECTION.

NOTE
Oil level should be at middle of sight gage.

Check oil level by means of sight gage (3, Figure 4-95).

SERVICE.

a. If oil level is low, remove fill plug (2) and add oil as required to bring oil level to the middle of sight gage (3).

b. Oil must be replaced at the intervals specified in the PMCS. Proceed as follows:

(1) Place a container large enough to hold 3 gallons (11.4 liters) of oil beneath oil drain plug (1). Obtain a funnel.

(2) Remove oil drain plug (1), fill plug (2) and use the funnel to drain the crankcase oil into the container.

(3) Observe the appearance of the oil drained from the crankcase. If it has a "milky" appearance, this indicates that water is leaking past plunger rod seals into the pump. Notify direct support maintenance if this condition is noted.

(4) Check magnetic drain plug (1) for metal particles. If large quantities of metal particles are observed, notify direct support maintenance. This is an indication of abnormal wear in moving pump parts.

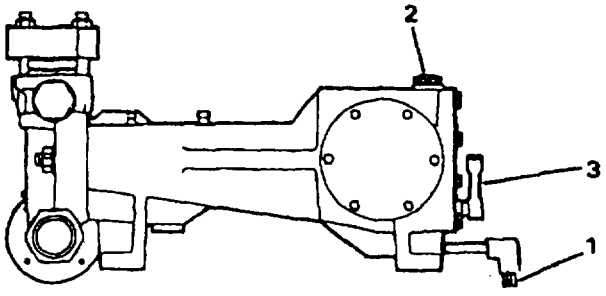


Figure 4-95. Service High Pressure Pump

(5) Clean and reinstall drain plug (1).

(6) Fill the crankcase with the correct type of lubricating oil (refer to Lubrication Chart, LO 10-4610-232-12). This crankcase holds 3 gallons (11.4 liters) of lubricating oil.

(7) Reinstall fill plug (2).

ADJUST.

a. Remove straightedge (7, Figure 4-97) from left side of belt guard and place it between sheaves (1 and 2, Figure 4-96) as shown.

b. Reset upper sliding rubber marker on belt tension gage (3) to handle. Set lower marker on deflection scale at 5/16 (0.79 cm).

c. Place gage (3) at middle of belt and press until belt is deflected 5/16. Use the straightedge to determine proper deflection when rubber marker comes even with bottom.

d. Remove gage and read scale under top sliding rubber marker. That number is the force in pounds required to deflect the belt 5/16, The force required should be between 8 and 13 pounds.

e. If drive belt tension is not between 8 and 13 pounds, loosen four nuts (4) to allow the motor (5) to be moved.

f. Turn jackscrews (6) clockwise to tighten the drive belt (7). Turn counterclockwise to loosen the drive belt.

g. Check the alignment of sheaves (1 and 2) by placing the straightedge across the faces of the sheaves. If the sheaves are not aligned, move motor (5) to bring the sheaves into proper alignment.

h. Recheck belt tension as described above. Then tighten four nuts (4).

i. Install high pressure pump belt guard (para. 4-82).

j. Return the straightedge to the high pressure pump belt guard.

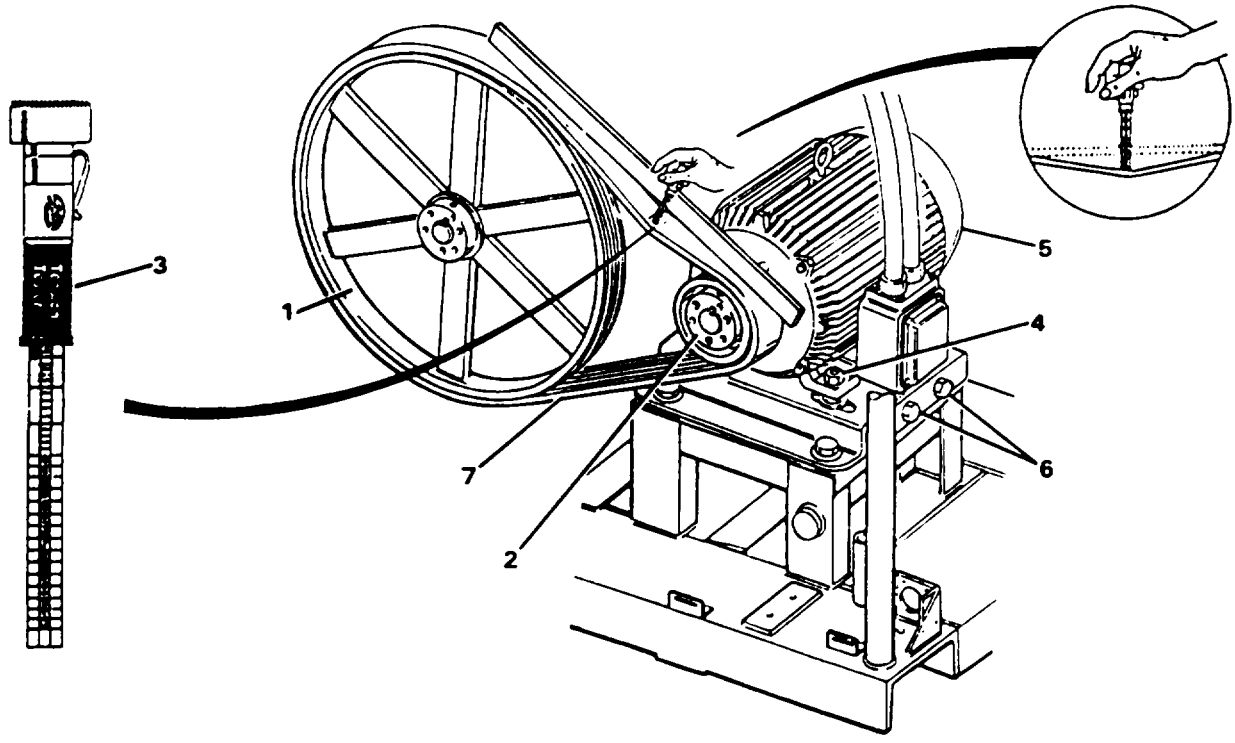


Figure 4-96. High Pressure Pump Belt Adjustment

4-82. HIGH PRESSURE PUMP BELT GUARD. This task covers:

a. Removal. b. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown. High pressure pump circuit breaker CB6 (63, Figure 2-4) turned OFF.

Material/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

General Safety Instructions:

WARNING

- Observe specific Warning in text.
- Do not wear jewelry or loose clothing while working on unit.

WARNING

Disconnect high pressure pump motor cables from junction box before attempting to work on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

REMOVAL.

NOTE

Note the position of the screen and spring nuts before removal.

Remove the twelve capscrews (1, Figure 4-97), lockwashers (2), washers (3), square washers (4) and remove screens (5) and (6). Do not remove straight edge (7) unless necessary. Remove neoprene trim (8 and 9) if necessary.

INSTALLATION.

Install neoprene trim (8 and 9). Install screens (5) and (6) using capscrews (1), lockwashers (2), washers (3) and square washers (4). Install straightedge (7).

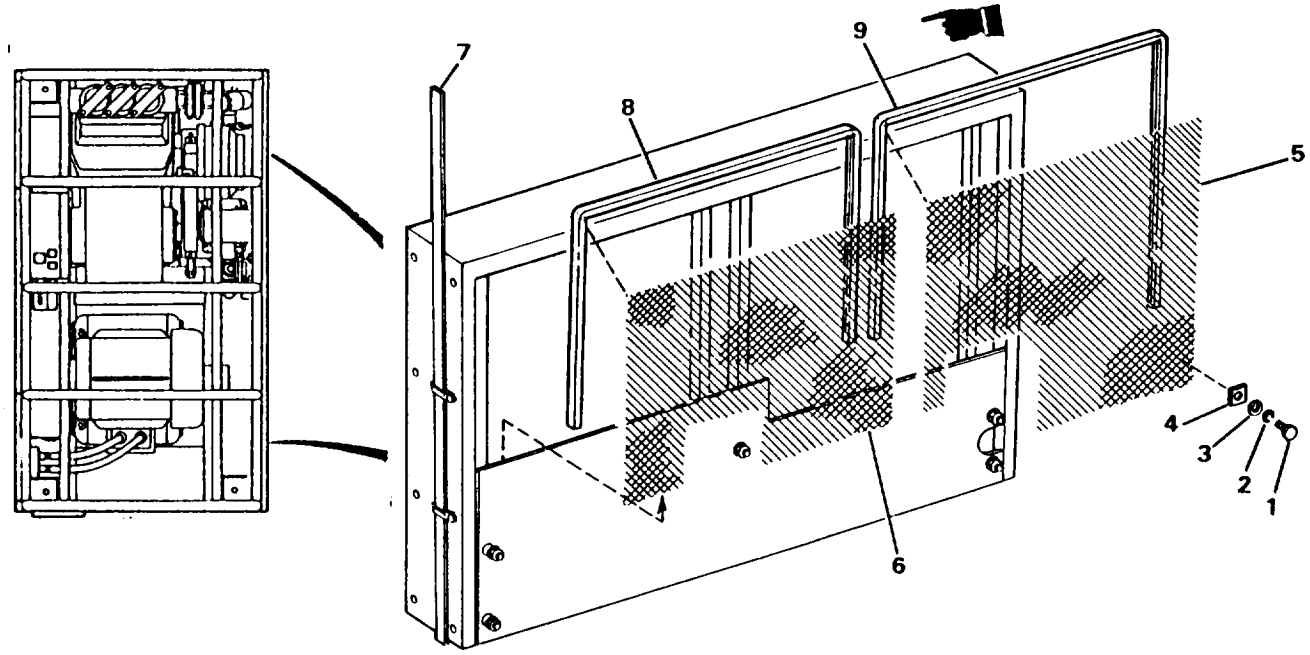


Figure 4-97. High Pressure Pump Belt Guard

4-83. HIGH PRESSURE PUMP V-BELT, This task covers:

a. Inspection. b. Removal. c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No,):
Tool Kit, General Mechanics Automotive (1)

Equipment Condition:
ROWPU shutdown, High pressure pump circuit breaker CB6 (63, Figure 2-4) turned OFF.
High pressure pump belt guard outer screens removed (para. 4-82).

General Safety Instructions:

WARNING

- Observe specific Warning in text.
- Do not wear jewelry or loose clothing while working on unit.

WARNING

Make certain cables are disconnected from junction box before attempting to work on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

INSPECTION.

Inspect V-belt for cracks, tears, heat hardening, or missing pieces of belt material. Replace damaged V-belt as described below.

REMOVAL.

a. Refer to Figure 4-98 and loosen four nuts (1).

b. Turn jackscrews (2) equally and evenly until V-belt (3) is loose enough to be removed

c. Remove V-belt (3) from sheaves (4 and 5).

INSTALLATION.

a. Install belt, with smooth side out, over sheaves (4 and 5).

b. Check alinement and adjust belt tension (para. 4-81).

c. Tighten nuts (1).

d. Install belt guard (para. 4-82).

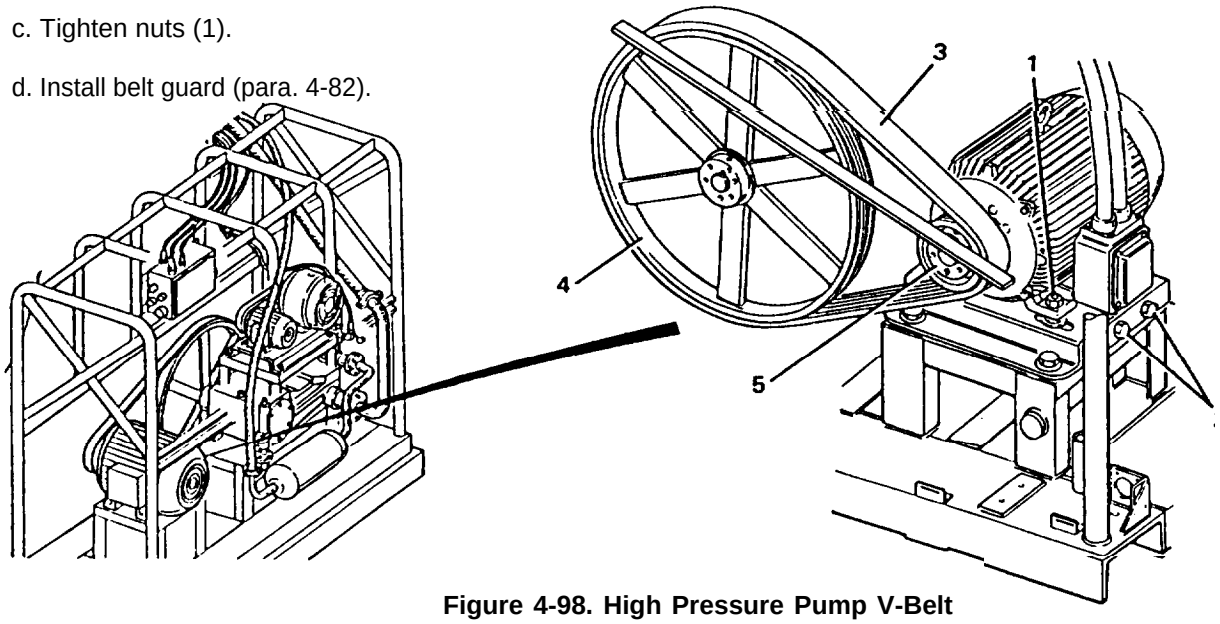


Figure 4-98. High Pressure Pump V-Belt

4-84. HIGH PRESSURE PUMP MOTOR ASSEMBLY. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Torque Wrench (2)
Electrical Repair Kit (16)

Materials/Parts:
Emery Cloth (Appx E, Sec II, Item 28)
Grease (Appx E, Sec II, Item 42)
Tape, Electrical (Appx E, Sec II, Item 68)
Twine (Appx E, Sec II, Item 72)
Varnish (Appx E, Sec II, Item 73)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown. Generator shutdown.
Belts removed (para. 4-83).
Belt guard removed (para. 4-82).
High pressure pump CB6 turned OFF.

General Safety Instructions:

WARNING

Observe specific Warning in text

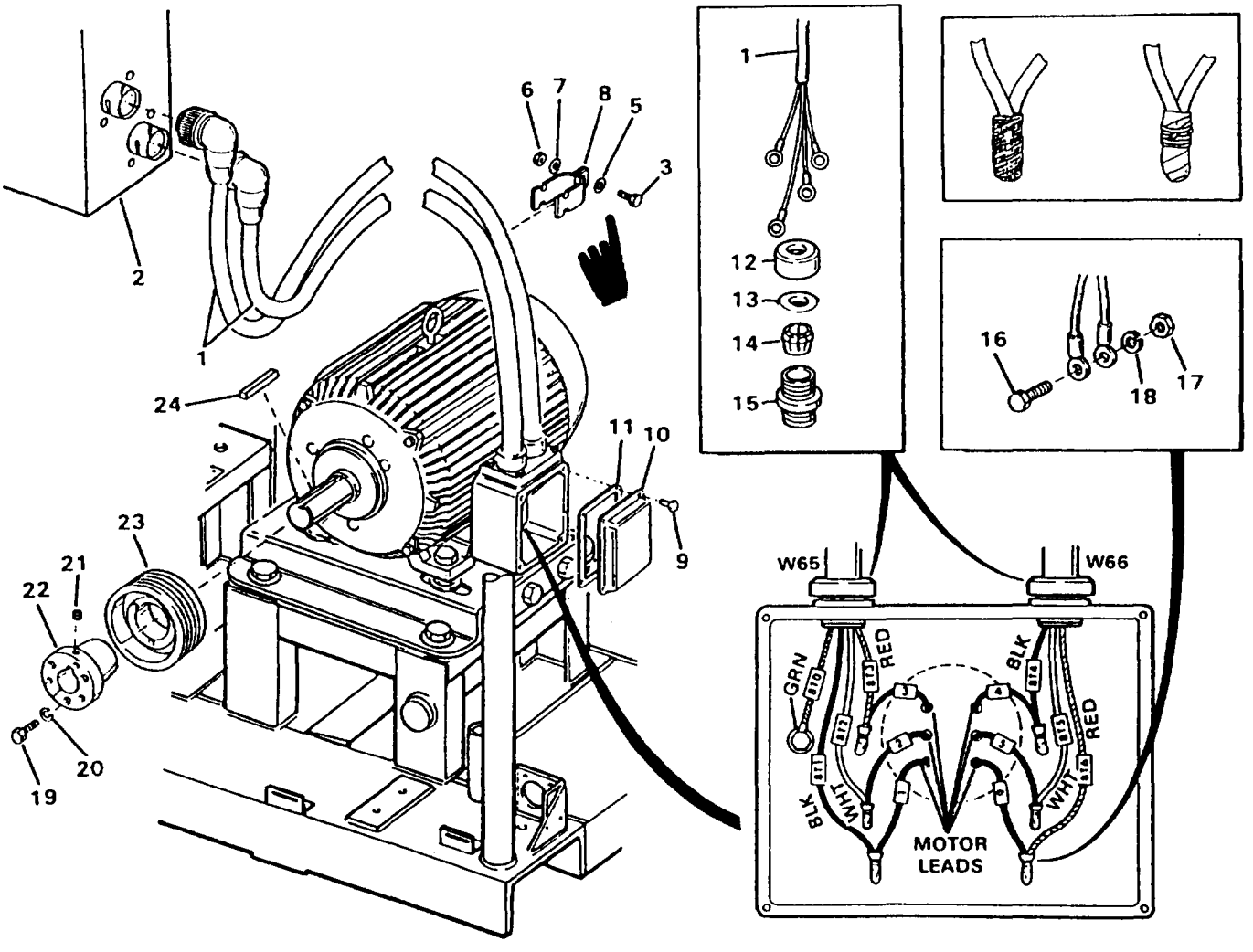


Figure 4-99. High Pressure Pump Motor Assembly

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting to make installation easier.

DISASSEMBLY.

NOTE

Note that the belt guard has been omitted from Figure 4-99 for clarity.

a. Refer to Figure 4-99 and disconnect two cables (1) from junction box (2).

b. Remove capscrews (3), (4) DELETED, washers (5), locknuts (6), washers (7) and clamps (8).

c. Remove screws (9), cover (10) and gasket (11).

d. Unscrew nuts (12) and slide nuts (12), washer (13) and bushing (14) back on cables (1). Remove fitting (15) from conduit box.

e. Cut the twine and tape which cover cable/motor connections and tag and disconnect cables (1) from the motor leads by removing screw (16), nuts (17) and washers (18). Remove ground lead.

f. Pull cables (1) out of the motor conduit box and, if necessary, slip bushing (14), washer (13) and nut (12) off the cables.

g. Remove hub (22) and sheave (23) as follows:

(1) Scribe the motor shaft to indicate the position of hub (22) on the shaft.

(2) Mark, sheave (23) to show which side faces the motor.

(3) Remove capscrews (19) and Iockwashers (20).

(4) Install capscrews (19) in the threaded holes of hub (22).

(5) Tighten the capscrews evenly and alternately to move sheave (23) off hub (22). If they stick together tightly, it may be necessary to tap the sheave gently to break the parts loose.

(6) Remove setscrew (21) which secures hub (22) to the motor shaft.

CAUTION

The hub will split if the screwdriver or chisel is tapped too hard.

(7) Tap a screwdriver or chisel into the split line of hub (22) just far enough to allow removal of hub (22) from the motor shaft.

(8) Remove motor shaft key (24).

REPAIR.

a. Replace loose or damaged ring tongue connectors (para, 4-10).

b. Replace wire markers (para. 4-10).

c. Replace cracked or damaged sheave (23).

d. Check motor shaft key (24) for burrs or nicks. File them smooth if necessary. Replace if damaged beyond repair

NOTE

Do not lubricate hub or sheave.

e. Check inner bore and outer tapered face of hub (22) for rust, corrosion or dirt. Use fine emery cloth to remove it.

f. Check the motor shaft for corrosion and dirt and clean with fine emery cloth.

REASSEMBLY.

a. Tap motor shaft key (24) into the groove provided on the motor shaft.

b. Slide sheave (23) onto the motor shaft making sure the side marked, faces the motor.

c. Remove capscrews (19) from the threaded holes of hub (22).

CAUTION

Do not tap the screwdriver or chisel too hard or the hub will break.

d. Tap a screwdriver or chisel into the split line of hub (22) just far enough to allow it to slide onto the motor shaft. Slide the hub to the position marked by scribe marks during disassembly.

e. Install and tighten setscrew (21). Slide sheave (23) onto hub (22) as far as it will go and align threaded holes in sheave (23) with non-threaded hole in hub (22).

f. Install capscrews (19) and Iockwashers (20) through hub (22) into sheave (23). Tighten the capscrews hand tight.

g. Evenly and alternately tighten capscrews (19) to pull sheave (23) onto hub (22). Torque to 720 inch pounds using a torque wrench.

h. Pack the threaded holes in hub (22) with grease to prevent corrosion.

i. Slide nut (12), washer (13), and bushing (14) on cables (1).

j. Screw fitting (15) into the motor conduit box.

k. Insert cables (1) (one at a time) through fittings (15) and into the motor conduit box. Tighten nuts (12).

l. Connect the cable leads to motor leads as shown and secure with capscrews (16), Iockwashers (18) and nuts (17),

m. Varnish all connections and tape the connections with friction tape, electrical tape and tie with twine as shown.

n. Connect two cables (1) to junction box (2) and secure with clamps (8). Secure clamps with screws (3), (4) DELETED, washers (5), washers (7) and locknuts (6).

WARNING

Do not attempt to change electrical connections as described below with power applied to the motor. Serious injury or death could occur.

o. Check motor rotation when started. It must be counterclockwise when viewing the sheave end of the motor. If it IS not correct, shut down the motor and check for correct connections.

p. To reverse rotation, interchange the T1 and T2 connections in the motor electrical box.

4-85. ADAPTER WITH PRODUCT SHUT-OFF VALVE. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Pipe (2)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown.

DISASSEMBLY.

a. Refer to Figure 4-100. Disconnect hose assembly (1) from connector (2).

b. Disconnect connector (3) and dust plug (4) from van outlet. Remove dust plug (4) from connector

c. Remove gaskets (5 and 6).

d. Remove connector (2) with attached dust cap (7) and connector (3) with attached plug (4).

e. Remove nipple (8) and elbow (9) from product shut-off valve (10).

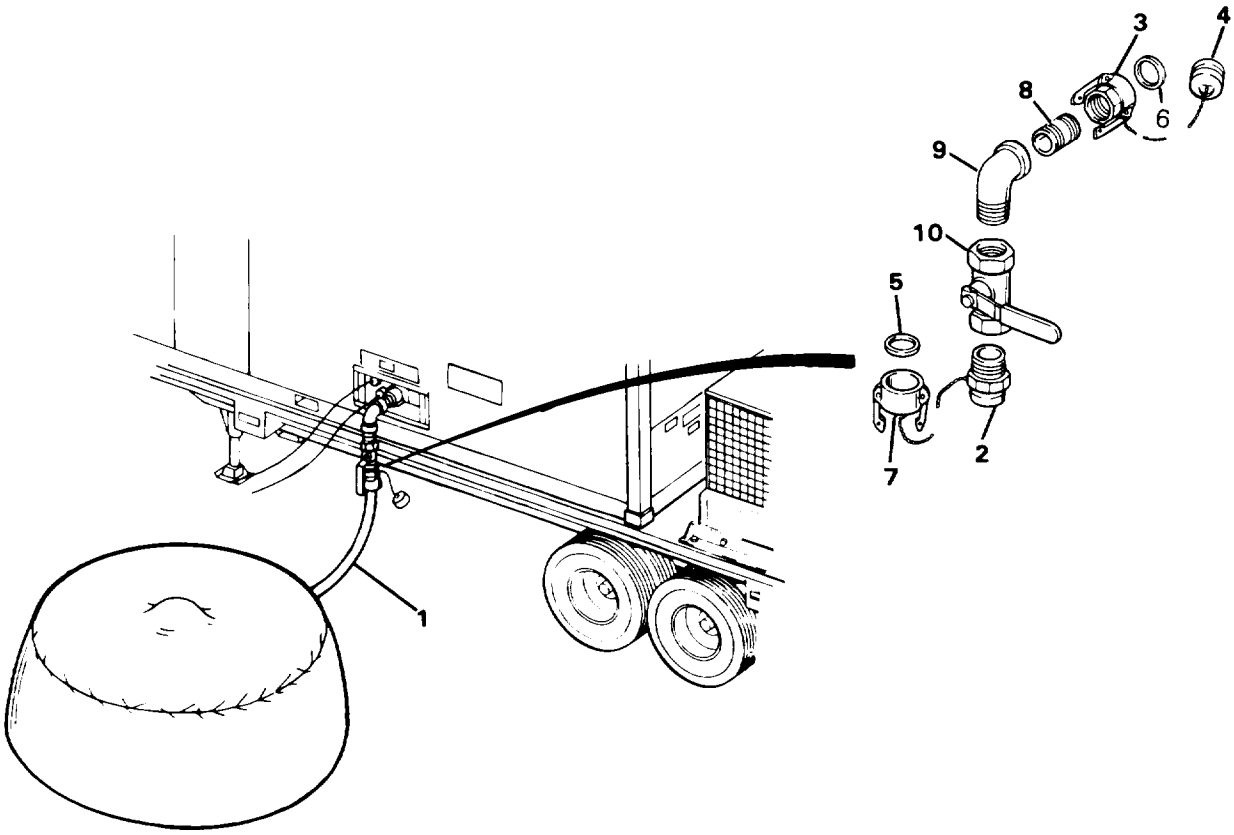


Figure 4-100. Adapter with Product Shut-Off Valve

REPAIR.

a. Install antiseize tape on leaking fittings.

b. Replace damaged gaskets (5 and 6).

c. Replace any damaged or leaking parts.

d. Repair damaged dust cap or plug by replacing them (para. 4-11).

REASSEMBLY.

a. Install nipple (8) on elbow (9) and turn elbow into valve (10).

b. Install connector (3) with gasket (6) and dust plug (4) on nipple (8).

c. Install connector (2) with gasket (5) and dust cap (7) on valve (10).

d. Connect connector (3) to outlet on van and hose assembly (1) to connector (2).

4-86. DISTRIBUTION PIPING, HOSES AND DISPENSING NOZZLES. This task covers:

a. Removal. b. Repair. c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Wrench, Pipe (2)

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Gaskets (TM 10-4610-232-24P)

Equipment Condition:
ROWPU shutdown to standby (para. 2-18).

REMOVAL.

WARNING

To prevent contamination of product water, do not allow nozzle assembly to touch the ground

a. Refer to Figure 4-101 and remove hose assembly (1) by opening cam locks. Remove gaskets (2 and 3).

b. If necessary, remove valve (4), elbow (5) and connector (6). Remove gasket (7).

c. Remove hose assemblies (8 and 9) by opening cam locks, Remove gaskets (10, 11, 12 and 13).

d. Remove hose assembly (14) and gaskets (15 and 16), Tee (17) is now free, Remove gaskets (18 and 19),

e. Remove hose assembly (20) and gaskets (21 and 22).

f. Remove hose assembly (23) and gasket (24),

g. Unscrew nozzle assembly (25).

h. Remove hose assembly (26) and gaskets (27 and 28).

REPAIR.

a. Install antiseize tape on leaking fittings (para. 4-11),

b. Replace damaged gaskets (para. 4-11).

c. Replace any other damaged components,

d. Replace nozzle (25) if leaking.

INSTALLATION.

a. Install hose assembly (26) with gaskets (27 and 28) in place,

b. Install nozzle (25) on hose assembly (23) and install hose assembly (23) with gasket (24) in place on the product water dispenser pump assembly.

c. Install hose (20) with gaskets (21 and 22) in place on the pump assembly,

d. Install tee (17) with gaskets (18 and 19) in place on hose assembly (14), making sure gasket (16) is in place on hose (14).

e. Install hose assembly (9) with gaskets (12 and 13) and hose assembly (8) with gaskets (10 and 11) on tee (17).

f. Install connector (6), elbow (5) and valve (4) and secure hose assembly (1) to valve (4), making sure gaskets (2 and 3) are installed.

g. Connect hose assembly (1) to the storage tank.

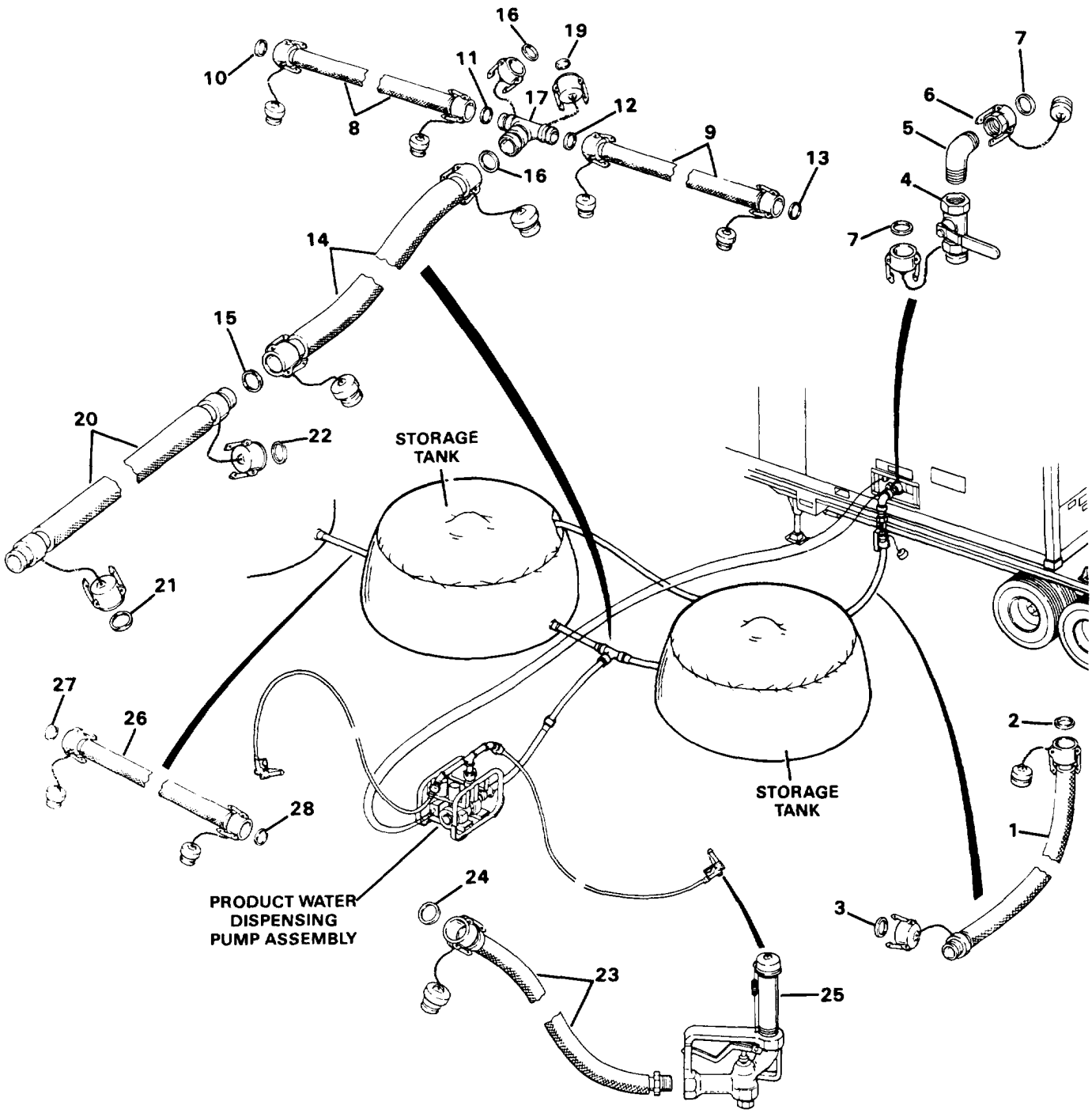


Figure 4-101. Distribution Piping, Hoses and Dispensing Nozzles

4-87. DISTRIBUTION PUMP AND MOTOR ASSEMBLY. This task covers:

a. Service b. Removal c. Disassembly d. Repair e. Reassembly.

INITIAL SETUP:

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)
Crimper, hand Terminal (2)
Wrench, Pipe (5)
Rivnut Repair Kit (15)

Personnel Required: 2
Equipment Condition:
ROWPU shutdown.
Pump cables disconnected from van.
Hoses disconnected from pump (para. 4-86).

Materials/Parts:
Tape, Antiseize (Appx E, Sec II, Item 67)
Tape, Electrical (Appx E, Sec II, Item 68)
Twine (Appx E, Sec II, Item 72)
Varnish (Appx E, Sec II, Item 73)
Suitable Tags
Gaskets (TM 10-4610-232-24P)
Lockwashers (TM 10-4610-:232-24P)
Washers (TM 10-4610-232-24P)

General Safety Instructions:

WARNING
Observe specific Warning in the text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury from electrical shock or moving parts.

DISASSEMBLY.

a. Disassembly of Piping. (Refer to Figure 4-102, sheet 1 for Model WTA-060 or Figure 4-102, sheet 1.1 for Model ROWPU-1).

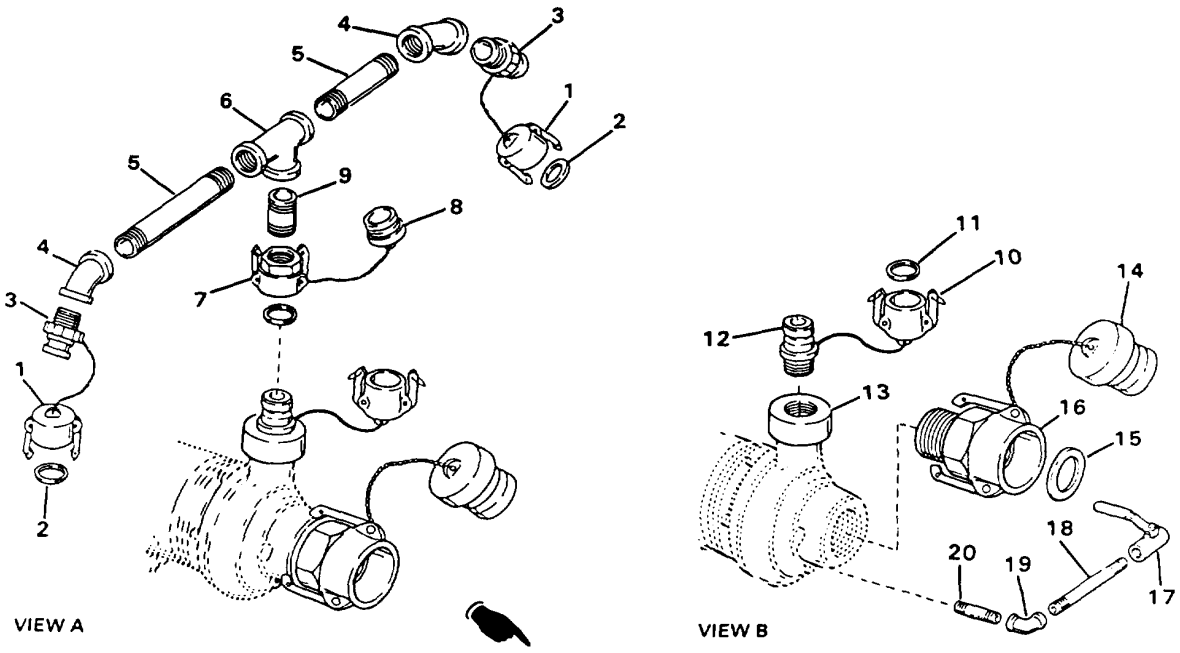


Figure 4-102. Distribution Pump and Motor Assembly (sheet 1 of 5)
(MODEL WTA-060 ONLY)

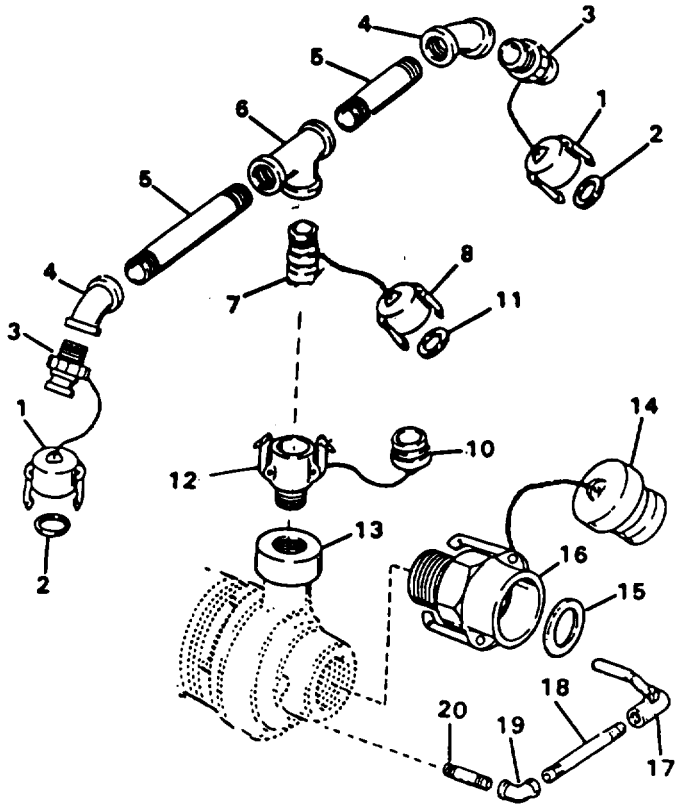


Figure 4-102. Distribution Pump and Motor Assembly (Sheet 1.1 of 5)
(MODEL ROWPU-1 ONLY)

(1) Remove two dust caps (1), gaskets (2) and connectors (3).
(2) Remove two elbows (4) and nipples (5) from tee (6).
(3) On Model WTA-060, remove _ connector (7) and plug (8) from nipple (9). On Model ROWPU-1, remove connector (7) and cap (8).
(4) Remove nipple (9) from tee (6). (MODEL WTA060 ONLY)
(5) On Model WTA-060, Remove dust cap (10), gasket (11) and connector (12) from pump(13). On Model ROWPU-1, remove plug (10) and connector (1) from pump (13).
(6) Remove dust plug (14), gasket (15) and connector (16) from pump (13).
(7) Raise and remove valve (17), nipple (18), elbow (19) and nipple (20) from pump (13).

b. Disassembly of Motor Cable (Figure 4-102, sheet 2).
(1) Remove two screws (21), nuts (22), lockwashers (23), washers (24) and clips (25).
(2) Remove four screws (26), cover (27) and gasket (28) from conduit box (29).

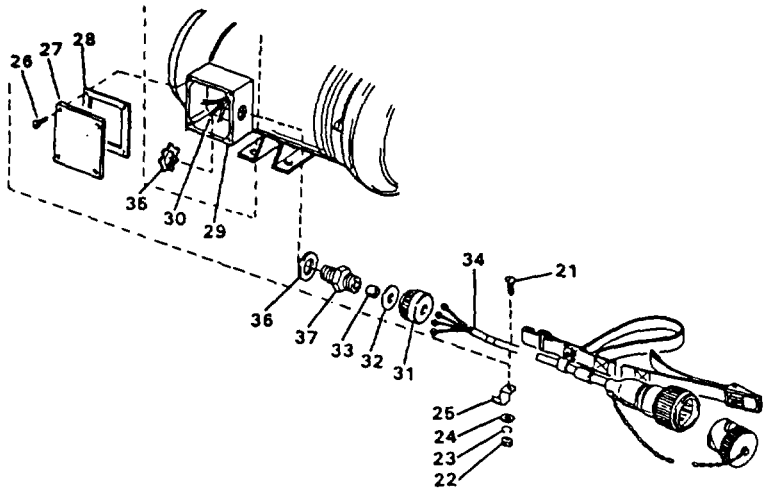


Figure 4-102. Distribution Pump and Motor Assembly **(sheet 2 of 5)**

(3) Pull five sets of wires from conduit box (29). Tag and disconnect as shown in illustration (Figure 4-102, sheet 3)
(4) Remove one screw (30, sheet 2) holding ground cable to conduit box (29).
(5) Loosen nut (31) and slide nut (31), washer (32) and rubber bushing (33) back on cable (34).
(6) Remove conduit nut (35) and pull cable (34) through conduit box (29).
(7) Slide nut (31), washer (32) and bushing (33) from cable (34).

c. Disassembly of Power Box (Figure 4-102, sheet 4).
(1) Remove four screws (38), cover (39) and gaskets (40) from power box (57).
(2) Unscrew and remove switch knob (41), lock ring (42) and data plate (43) from cover. Switch (44) is now free
(3) Tag and disconnect three wires (45).
(4) Remove conduit nut (46) and remove cable (51) and adapter (47) from power box (57).
(5) Loosen nut (48) and slide nut (48), washer (49) and bushing (50) up the cable (51)

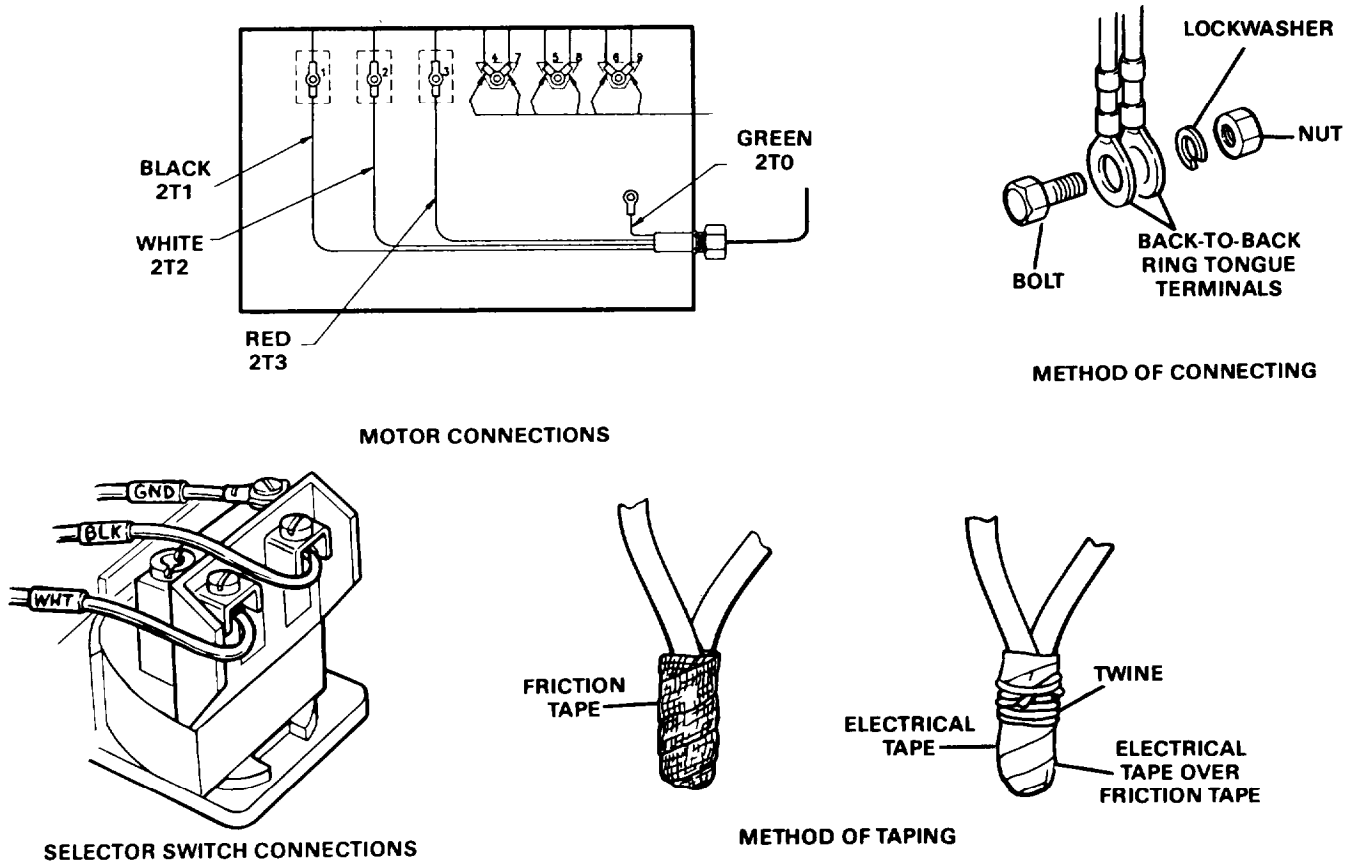


Figure 4-102. Distribution Pump and Motor Assembly (sheet 3 of 5)

(6) Pull cable (51) through nut (48), washer (49), bushing (50) and adapter (47).

(7) Remove two screws (52), washers (53), nuts (54), lockwashers (55) and washers (56) and remove power box (57).

(8) Remove two screws (58), washers (59), nuts (60), lockwashers (61) and washers (62). Remove bracket (63).

d. Disassembly of Pump and Motor (Figure 4-102, sheet 5).

(1) Remove four screws (64), washers (65), nuts (66), lockwashers (67) and washers (68).

(2) Lift pump and motor assembly (69) from frame (70).

(3) Remove nut (71), lockwasher (72) and eyebolt (73).

REPAIR.

a. Replace damaged components.

b. Repair leaks using antiseize tape.

c. Replace damaged carrying strap by removing rivets (para. 4-10

REASSEMBLY.

a. Reassembly of Pump and Motor (Figure 4-102, sheet 5).

(1) Install eyebolt (73) with nut (71) and lockwasher (72).

(2) Position pump and motor assembly (69) on frame (70).

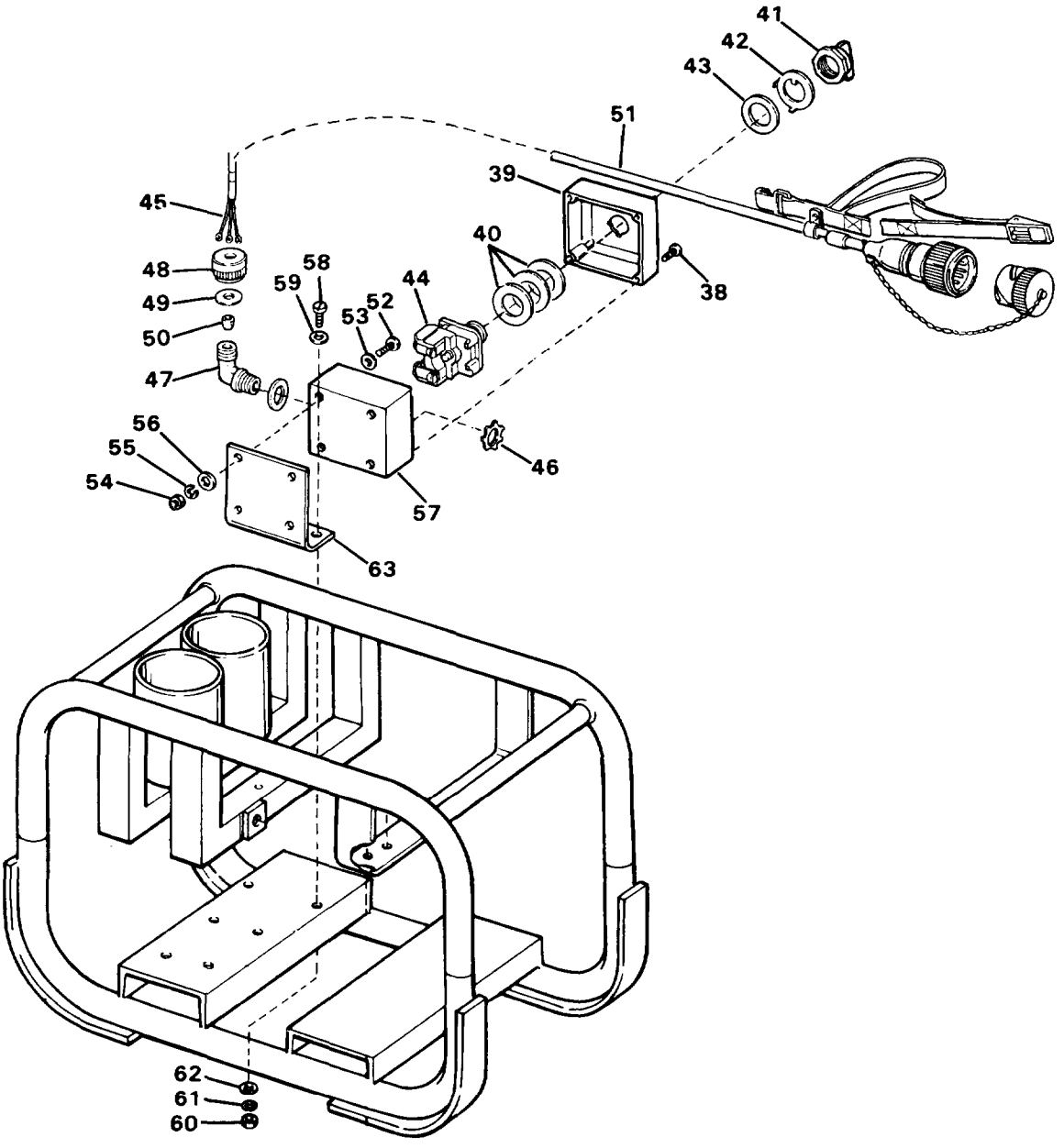


Figure 4-102. Distribution Pump and Motor Assembly (sheet 4 of 5)

(3) Install four screws (64), washers (65), nuts (66), lockwashers (67) and washers (68).

b. Reassembly of Power Box (Figure 4-102, sheet 4).

(1) Install bracket (63) with screws (58), washers (59), nuts (60), lockwashers (61) and washers (62),

(2) Install power box (57) with screws (52), washers (53), nuts (54), lockwashers (55) and washers (56).

(3) Slide cable (51) through adapter (47), bushing (50), washer (49) and nut (48).

(4) Tighten nut (48).

(5) Install adapter (47) and cable (51) in body (57) and secure adapter (47) with conduit nut (46).

(6) Connect three wires (45) as tagged.

(7) Install switch (44), data plate (43), lock ring (42) and screw on switch knob (41).

(8) Install gaskets (40) and cover (39) and secure with four screws (38).

(1) Remove two dust caps (1), gaskets (2) and connectors (3).
(2) Remove two elbows (4) and nipples (5) from tee (6).
(3) On Model WTA-060, remove _ connector (7) and plug (8) from nipple (9). On Model ROWPU-1, remove connector (7) and cap (8).
(4) Remove nipple (9) from tee (6). (MODEL WTA060 ONLY)
(5) On Model WTA-060, Remove dust cap (10), gasket (11) and connector (12) from pump(13). On Model ROWPU-1, remove plug (10) and connector (1) from pump (13).
(6) Remove dust plug (14), gasket (15) and connector (16) from pump (13).
(7) Raise and remove valve (17), nipple (18), elbow (19) and nipple (20) from pump (13).

b. Disassembly of Motor Cable (Figure 4-102, sheet 2).
(1) Remove two screws (21), nuts (22), lockwashers (23), washers (24) and clips (25).
(2) Remove four screws (26), cover (27) and gasket (28) from conduit box (29).

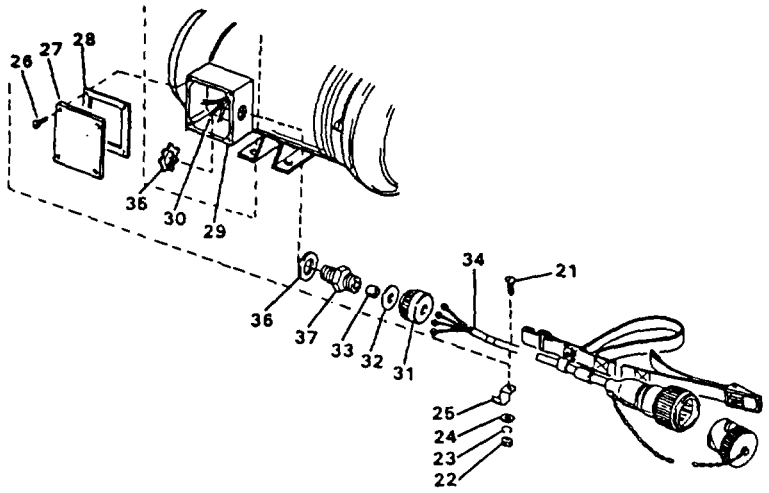


Figure 4-102. Distribution Pump and Motor Assembly **(sheet 5 of 5)**

(3) Pull five sets of wires from conduit box (29). Tag and disconnect as shown in illustration (Figure 4-102, sheet 3)
(4) Remove one screw (30, sheet 2) holding ground cable to conduit box (29).
(5) Loosen nut (31) and slide nut (31), washer (32) and rubber bushing (33) back on cable (34).
(6) Remove conduit nut (35) and pull cable (34) through conduit box (29).
(7) Slide nut (31), washer (32) and bushing (33) from cable (34).

c. Disassembly of Power Box (Figure 4-102, sheet 4).
(1) Remove four screws (38), cover (39) and gaskets (40) from power box (57).
(2) Unscrew and remove switch knob (41), lock ring (42) and data plate (43) from cover. Switch (44) is now free
(3) Tag and disconnect three wires (45).
(4) Remove conduit nut (46) and remove cable (51) and adapter (47) from power box (57).
(5) Loosen nut (48) and slide nut (48), washer (49) and bushing (50) up the cable (51)

4-88. PUMP COVERS. The raw water pump cover and distribution pump cover are part of the winter kit. Replace if damaged. Replace ripped, torn or otherwise unserviceable covers. Forward covers to direct support maintenance for repair.

4-89. HEAT LAMPS. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics (1)

Materials/Parts:
Lamp, Heat 500 Watt (Appx E, Sec II, Item 47)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

General Safety Instructions:

WARNING

Observe specific Warning in text.

WARNING

Make sure electrical power is disconnected before working on unit. Failure to do so could result in serious injury or death from electrical shock.

NOTE

Tag all wires before disconnecting.

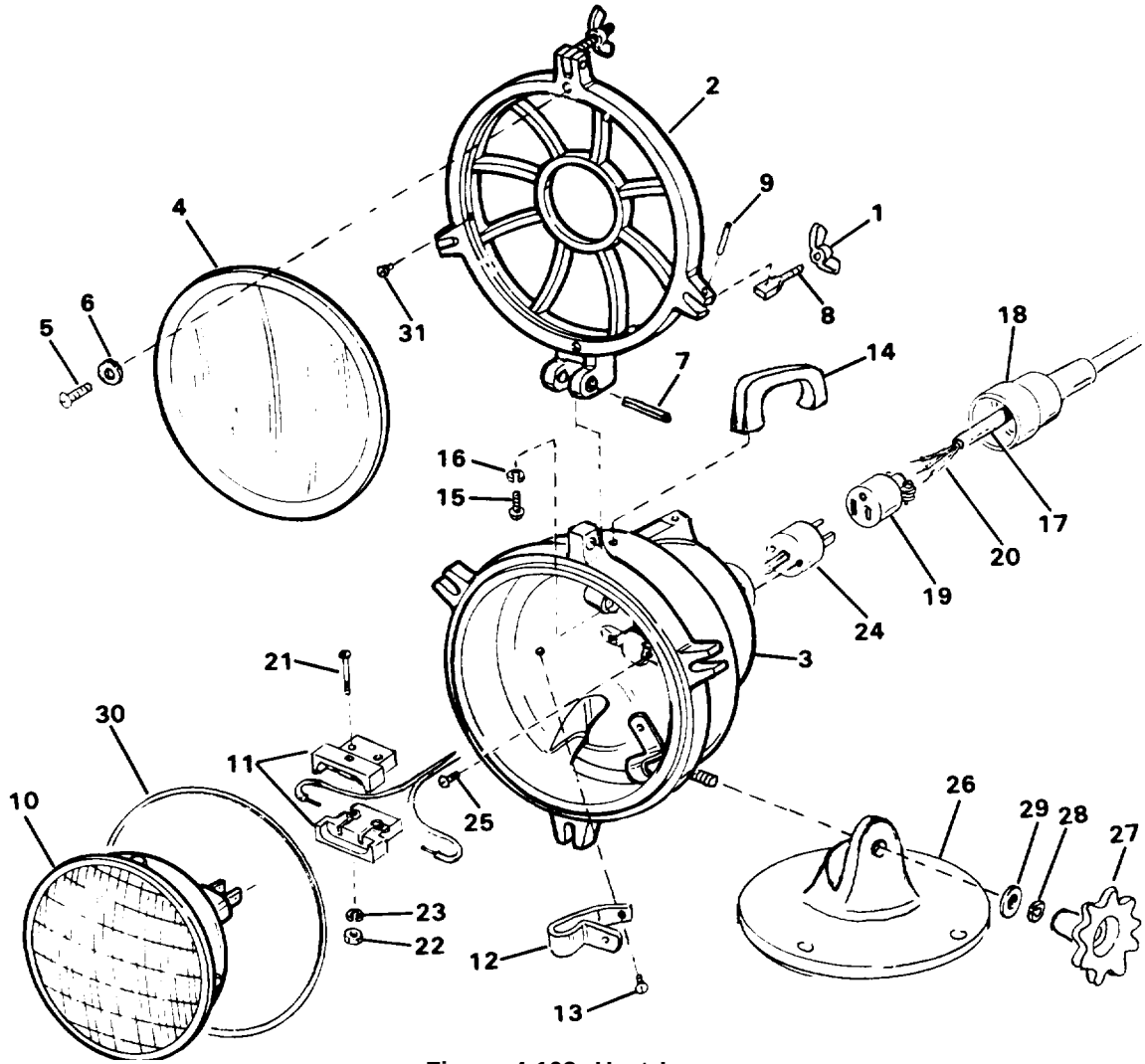


Figure 4-103. Heat Lamps

DISASSEMBLY.

a. Loosen thumbscrews (1, Figure 4-103) and swing lens guard (2) away from heat lamp body (3).

b. Remove lens (4) by removing screws (5) and washers (6).

c. Remove lens guard (2) by tapping out pivot pin (7).

d. Remove thumbscrew bolts (8) from lens guard (2) by tapping out pivot pins (9).

e. Remove bulb (10) by pulling straight out and disconnecting it from bulb socket (11).

f. Remove bulb retaining clips (12) by removing screws (13).

g. Remove handle (14) by removing screws (15) and Iockwashers (16).

h. Remove cable (17) from heat lamp by cutting off boot (18) and removing socket (19) with three wires (20).

i. Remove three wires (20) from socket (19).

j. Remove bulb socket (11) by removing screws (21), nuts (22) and washers (23).

k. Remove cable socket (24) by removing screws (25).

l. Remove heat lamp body (3) from base (26) by removing angle adjustment knob (27), Iockwasher (28) and washer (29).

REPAIR.

Replace any damaged components.

REASSEMBLY.

a. Install heat lamp body (3) on base (26) with flat washer (29), Iockwasher (28) and angle adjustment knob (27).

b. Install cable socket (24) with screws (25).

c. Install bulb socket (11) with washers (23), nuts (22) and screws (21).

d. Connect cable (17) to heat lamp by inserting three wires (20) through new boot (18) into socket (19) and heat shrinking boot onto heat lamp body.

e. Install handle (14) with Iockwashers (16) and screws (15).

f. Install bulb retaining clips (12) with screws (13).

g. Install bulb (10) on bulb socket (11) and press into position.

h. Install thumbscrew bolts (8) with pivot pins (9).

i. Install lens guard (2) with pivot pin (7).

j. Install lens (4) with washers (6) and screws (5).

k. Swing lens guard (2) into position and secure with thumbscrews (1).

4-90. GENERATOR JUMPER CABLE. This task covers:
a. Removal. b. Repair. c. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec III, Ref Code (No.):
Tool Kit, General Mechanics (1)
Wire Stripper (16)
Crimper, Hand Terminal (16)

Equipment Condition:
Generator shutdown.

General Safety Instructions:

WARNING

Observe specific Warning and Caution in text.

WARNING

As with any DC battery, make certain positive (+) and negative (-) battery terminals and cable terminals are connected to + to + and - to -. Connect + to + first then - to -. Failure to do so could result in battery explosion and serious injury.

NOTE

This generator jumper cable is used during cold weather to connect one of the diesel heaters inside the van to the generator battery when the ROWPU is shutdown.

REMOVAL.

a. Disconnect leads (1 and 2, Figure 4-104) from generator battery.
b. Disconnect cable connector (3) from 24 VDC connector (4) on van.

REPAIR.

a. Repair loose or damaged ring tongue terminals (para. 4-10).
b. Replace wire markers (para. 4-10).
c. Repair cable by replacement only.
d. Repair damaged or missing dust cap (para. 4-13).

INSTALLATION.

a. Connect cable connector (3) to connector (4).

CAUTION

White wire (#428) goes to positive battery terminal. Black wire (#429) goes to negative battery terminal.

b. Connect battery terminals (1 and 2) to generator battery.

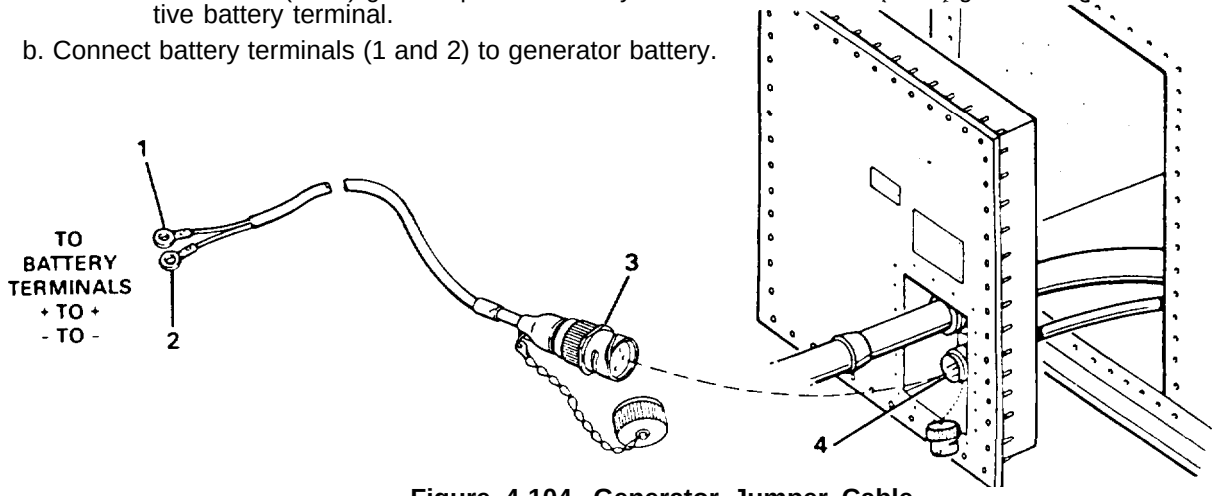


Figure 4-104. Generator Jumper Cable

4-91. PORTABLE FLOW RATE INDICATOR. This task covers:

a. Disassembly. b. Repair. c. Reassembly.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics (1)

Equipment Condition:
ROWPU in normal operation.
Portable flow rate indicator disconnected from product to storage hose (para. 2-35b).

DISASSEMBLY.

a. Loosen the clamping screw (1, Figure 4-105) on each of the two strap damps (2) and remove the strap damps (2).

b. Pull the flow rate gage (3) straight out of the plastic pipe assembly (4).

c. Do not disassemble the plastic pipe assembly (4).

REPAIR.

a. Replace cracked or unserviceable pipe assembly (4).

b. Replace damaged or inoperative flow rate gage (3).

c. Replace worn or broken strap damps (2).

REASSEMBLY.

NOTE

Arrow on flow rate gage must be positioned on pipe assembly in direction of flow.

a. Position flow rate gage (3) on pipe assembly (4) as shown in Figure 4-105.

b. Wrap strap damps around the pipe assembly and over the flanges at each side of the flow rate gage (3).

c. Tighten the screws (1) on the strap damps (2).

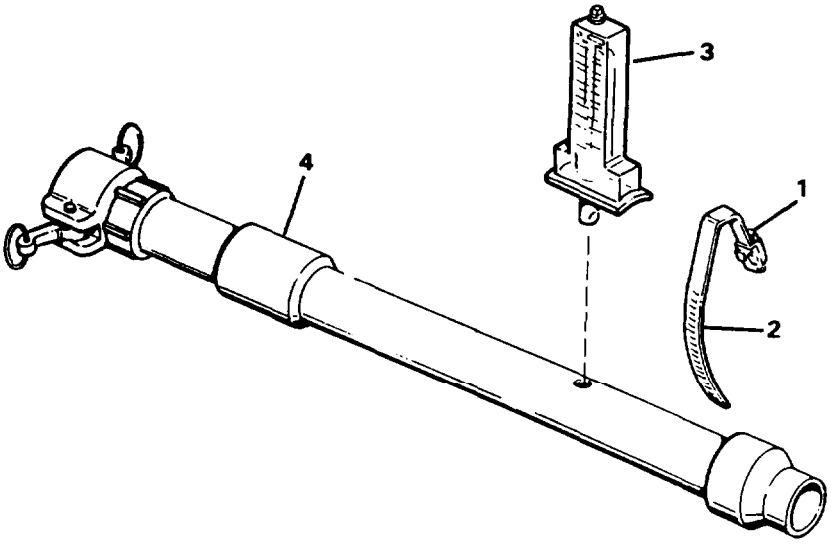


Figure 4-105. Portable Flow Rate Indicator

4-92. PORTABLE TURBIDITY METER. This task covers:

a. Disassembly. b. Repair. c. Reassembly. d. Adjust.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics (1)

Materials/Parts:
Battery, Turbidity Meter (Appx E, Sec II, Item 4)
Lamp, Turbidity Meter (Appx E, Sec II, Item 50)
Suitable Tags
Lockwashers (TM 10-4610-232-24P)

Equipment Condition:
ROWPU in normal operation.
Portable turbidity meter disconnected from battery charger (para. 2-6).

General Safety Instructions:

CAUTION

Observe specific Caution in text.

DISASSEMBLY.

NOTE

Make certain the RANGE switch is in the OFF position before working on the portable turbidity meter.

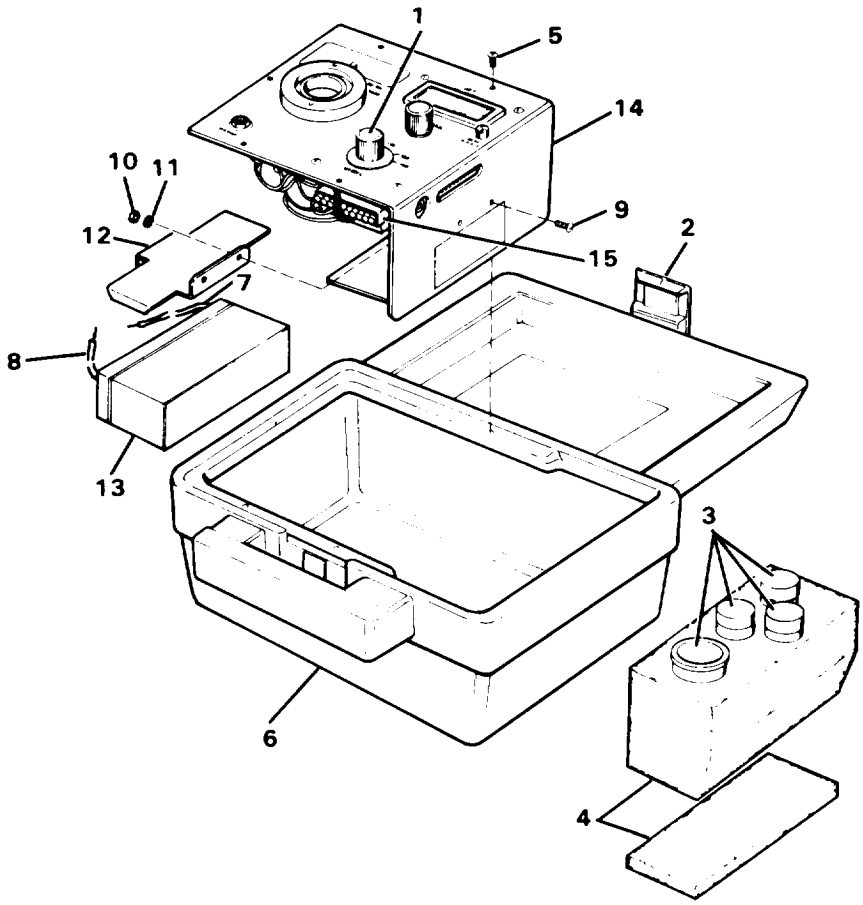


Figure 4-106. Portable Turbidity Meter (sheet 1 of 2)

a. Check to ensure range switch (1, sheet 1) is in the OFF position.

b. Remove a defective battery as follows:

(1) Open the latch (2) on the case (6) and open the case.

(2) Remove all accessories (3) from the foam holder (4). Free the foam holder from under the case lip and pull up and out. Remove foam base.

(3) Position accessories (3) in foam holder (4) to avoid breaking glass components.

(4) Remove the five drive screws (5) and slide the assembled instrument (14) all the way to the right side of the case (6), toward foam holder (4) as it is shown in Figure 4-106.

(5) Carefully lift assembled instrument (14) out of the case (6).

(6) Disconnect the black wire (7) from the (+) terminal on the battery (13).

(7) Disconnect the red wire (8) from the (-) terminal on the battery (13).

(8) Remove the two capscrews (9), nuts (10), and Iockwashers (11) that hold the battery bracket (12) to the nstrument (14).

(9) Remove the battery bracket (12) and battery (13).

NOTE

The lamp used in this meter has a very long life. Always make certain the battery is charged and not defective before replacing a lamp. Refer to para. 2-6 for operating procedures.

c. Remove a defective lamp (21, sheet 2) as follows:

(1) Repeat steps b (1) thru (5) above.

(2) Tag black wires (18 and 19). Loosen screws (16 and 17) at terminals T9 and T10 in terminal board (15).

(3) Disconnect wires (18 and 19) from terminals T9 and T10.

(4) Loosen the two setscrews (20) and pull the lamp (21) straight out of thev barrel (22).

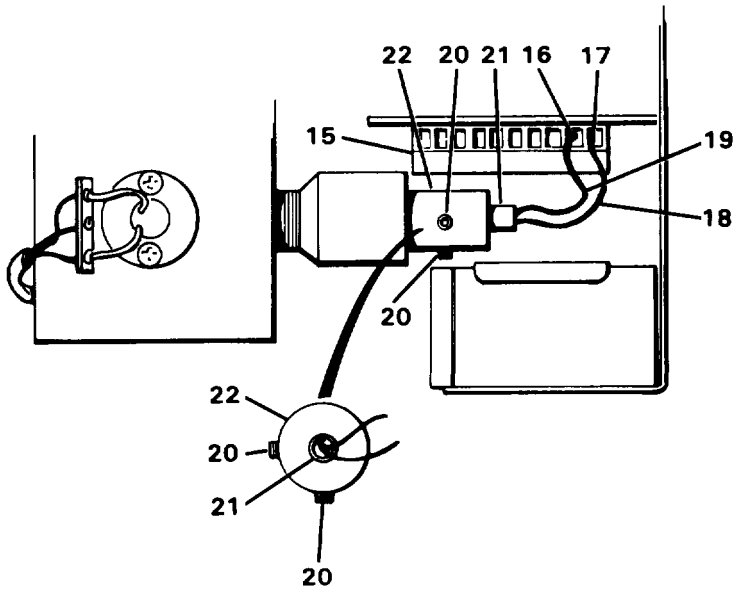


Figure 4-106. Portable Turbidity Meter (sheet 2 of 2)

REPAIR.

a. Replace defective lamp.

b. Replace defective battery.

c. Replace any broken or damaged accessories (para. 2-6).

REASSEMBLY.

a. Install a new lamp as follows:

(1) Install the lamp (21, Figure 4-106, sheet 2) by pushing the lamp (21) straight into the barrel (22). Tighten two setscrews (20).

(2) Connect the wires (18 and 19) to terminals (16 and 17) and tighten terminal screws.

b. Install a new battery as follows:

(1) Install battery (13, Figure 4-106, sheet 1) and bracket (12) and secure with two capscrews (9), nuts (10) and lockwashers (11).

CAUTION

Make certain to connect red battery wire to (-) terminal on battery and black battery wire to (+) terminal on battery. Failure to connect terminals properly will damage battery and other components of the meter.

(2) Connect the red wire (8) to the (-) terminal on the battery (13).

(3) Connect the black wire (7) to the (+) terminal on the battery (13).

(4) Position the assembled instrument (14) on the right side of the case (6), carefully lower the assembled instrument into the case (6) and slide the assembled instrumental (14) all the way to the left as it is shown in Figure 4-106.

(5) Secure the assembled instrument (14) to the case with five capscrews (5).

(6) Remove the accessories (3) from the foam holder (4).

(7) Install the foam holder (4) in the case (6) and install the accessories (3) in the foam holder (6).

(8) Close the cover of the case (6) and close latch (2).

ADJUST.

Whenever the lamp (21, Figure 4-106, sheet 2) is replaced the portable turbidity meter should be adjusted as described in para. 4-6c.

4-93. SLING BRACKET ASSEMBLY. This task covers:

a. Removal. b. Disassembly. c. Repair. d. Reassembly. e. Installation.

INITIAL SETUP.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics (1)

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)

Equipment Condition:
Access panel on top of van removed (para. 4-74).

General Safety Instructions:

WARNING

Observe specific Warning in text.

WARNING

To avoid injury to personnel, hold plate securely prior to removing all fasteners.

REMOVAL.

a. Remove four capscrews (1, Figure 4-107), lockwashers (2) and washers (3).

b. Remove mounting plate (4).

DISASSEMBLY.

Remove four capscrews (5), lockwashers (6), washers (7) and remove straps (8).

REPAIR.

Replace or repair worn or defective straps.

REASSEMBLY.

Fasten straps (8) on plate (4) and secure with capscrews (5), lockwashers (6) and washers (7).

INSTALLATION.

a. Lower and hold plate (4) into position.

b. Secure by installing capscrews (1), lockwashers (2) and washers (3).

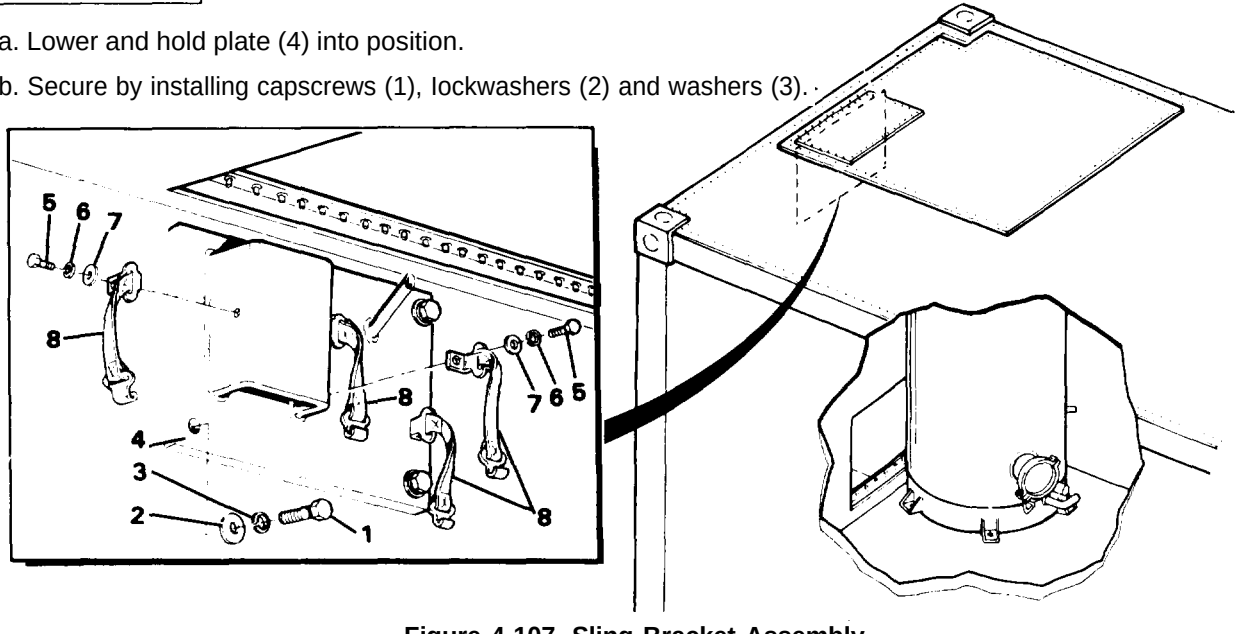


Figure 4-107. Sling Bracket Assembly

4-93.1. SOUND BAFFLING SYSTEM. This task covers:

a. Removal. b. Repair. c. Installation.

Tools, see Appx B, Sec Ill, Ref Code (No.):
Tool Kit, General Mechanics Automotive (1)

Materials/Parts:
Lockwashers (TM 10-4610-232-24P)
Washers (TM 10-4610-232-24P)
Orifice Plates (TM 10-4610-232-24P)

Equipment Condition:
ROWPU off.
Pipe section removed (para. 4-45).

a. Remove nut (1), Iockwasher (2), and washer (3) from shaft (4).

b. Remove larger orifice plate (5).

c. Remove spacer (6).

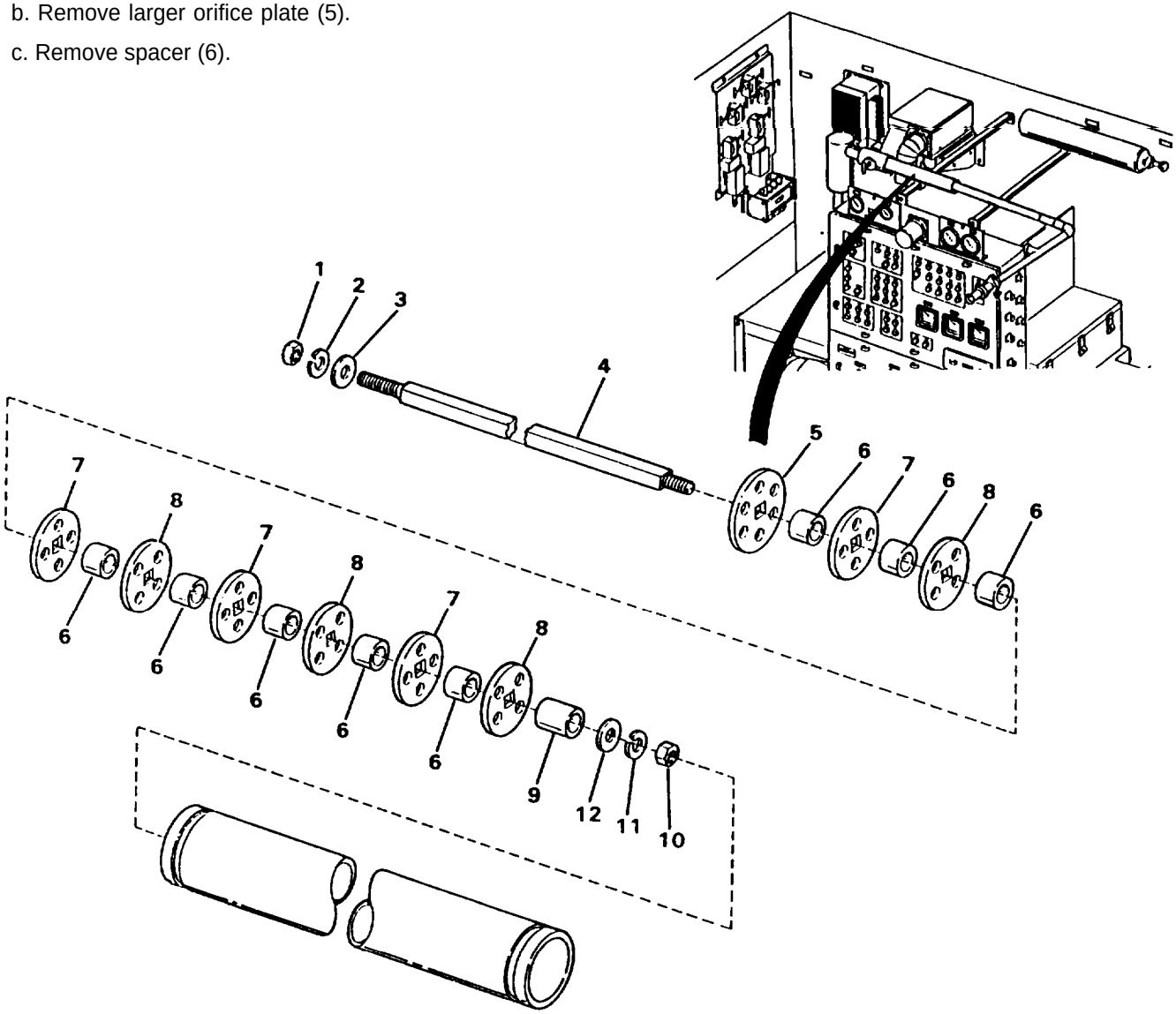


Figure 4-108. Sound Baffling System

NOTE

Keep the orifice plates in the same order as which they were removed.

d. Remove the eight orifice plates (four orifice plates (7) and four orifice plates (8)), and remaining seven spacers (6).

e. Remove longer spacer (9).

f. Remove nut (10), lockwasher (11), and washer (12) from shaft (4).

REPAIR.

a. Repair consists of replacing damaged or worn parts.

(1) Replace orifice plates (7) and (8) if diameter of opening exceeds 0.349 in.

(2) Replace orifice plate (5) if diameter of opening exceeds 0.286 in.

REASSEMBLY.

a. Install washer (12), lockwasher (11), and nut (10) on shaft (4). Torque nut to 6.5 ft/lb.

b. Install longer spacer (9).

NOTE

The two different types of orifice plates must be installed alternately.

c. Install eight orifice plates (four orifice plates (8) and four orifice plates (7)), and eight spacers (6).

d. Install larger orifice plate (5) and secure with washer (3) and nut (1). Torque nut to 6.5 ft/lb.

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

4-94. SECURITY PROCEDURES. Refer to AR 190-11 or 190-13.

4-95. PREPARATION FOR NORMAL MOVEMENT. Refer to para. 2-28 for crew procedures to ready the ROWPU for normal movement.

4-96. PREPARATION FOR EXTENDED ROAD MOVEMENT (OVER 1 HOUR) WITH TEMPERATURE EXTREMES ENROUTE OR AT RECEIVING END.

WARNING

Sensitive items as listed in para. 1-11, equipment data, cannot be subjected to temperatures below 35°F (2°C) or above 110°F (43°C) or damage will occur.

a. Remove RO elements (para. 3-28) and package in accordance with para. 4-97d.

b. Remove listed sensitive items (para. 1-11) and package separately.

c. Ship sensitive items in a temperature controlled environment and store at the receiving end in a temperature controlled environment.

4-97. SHORT TERM (ADMINISTRATIVE) STORAGE.

a. Placement of equipment in administrative storage should be for short periods of time when there is a shortage of maintenance capability. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period, appropriate maintenance records will be kept.

b. Before placing equipment in administrative storage, current preventive check and maintenance services should be completed, shortcomings and deficiencies should be corrected, and all Modification Work Orders (MWOs) should be applied.

c. Before placing equipment in administrative storage, the crew shall perform the flushing, cleaning, and sanitizing procedures given in para. 2-22. Crew personnel will then perform the end-of-mission ROWPU packup (para. 2-28).

d. Before placing equipment in administrative storage, site selection and environmental factors must be considered. When not in use, the ROWPU, with the exception of sensitive items, does not require special siting or shelter. If a temperature controlled shelter is available, storing the ROWPU undercover will minimize routine maintenance. Refer to para. 1-11, for storage temperature requirements of the ROWPU and the temperature sensitive items. Storage of the ROWPU in an environment between 35°F (2°C) and 110°F (43°C) requires no further preparation. Storage beyond these extremes requires the following preparation.

NOTE

Two different procedures (methods 1 and 2) are given. Either may be used at the discretion of the directing authority.

e. Method 1.

(1) Plug an extension cord with a 20 amp capacity into the ROWPU auxiliary power connector on exterior of the van. Voltage must be 110-120 VAC.

NOTE

The ROWPU fuel pumps are not capable of lifting fuel from a ground storage container. Use the generator fuel tank as a supply source. Fuel consumption will be about 1/3 GPH.

(2) Disconnect the generator batteries.

(3) Refer to para. 2-31 and install the generator to ROWPU fuel line. Turn the 24 VDC power supply on and start both heaters per para. 2-31.

(4) Monitor the ROWPU temperature and heater operation daily to ensure above freezing temperatures.

f. Method 2.

(1) Prepare water tight, plastic bags large enough to hold an RO element by using heat sealable plastic sheet and a heat sealer gun.

(2) Move the ROWPU to a heated area and remove the RO elements (para. 3-28).

(3) Prepare a solution of 5 gallons potable water and 1/4 pound of sodium bisulfite.

(4) Place each RO membrane in a bag with about 1/3 gallon of solution.

(5) Seal the bags so they are air tight and store at above freezing temperatures.

(6) Remove the temperature sensitive items (para. 1-11) from the ROWPU and store in above freezing temperatures.

(7) Attach tags to RO pressure vessels that reads "RO elements have been removed. Reinstall before operating unit." (8) Move the ROWPU to selected storage site.

4-98. PREPARATION FOR RAIL MOVEMENT.

WARNING

If, during transport, the ROWPU will be subjected to temperatures below 35°F or above 110°F (20C and 43°C) the temperature sensitive items listed in para. 1-11, equipment data, must be removed from the ROWPU and shipped in a temperature controlled environment. RO element removal is covered in para. 3-28. Storage of RO elements is covered in para. 4-97d.

a. Check that all equipment stowage straps are pulled up tight and all equipment is secure.

b. Check that media filter restraint tumbuckles are secure. Loosen tumbuckles and tighten hand tight Tighten tumbuckle an additional half turn by tightening each turnbuckle a quarter of a turn at a time.

c. Check that items in storage boxes are securely packed.

d. Use 2 x 4 lumber and wedge it between the van lower rail and the high pressure pump assembly frame.

e. Check that high pressure pump assembly mounting straps are pulled up tightly and that there is no slack in the straps.

f. Check that trailer/van bolster locks are secure.

g. Check that generator mounting brackets are torqued to 180-200 ft-lbs.

h. Install tie down cables from the generator lifting eyes to the trailer. Size cables for a generator weight of 5,000 pounds.

i. Use suitable lumber (2 x 4 and 4 x 4) for bracing and wedge it between the high pressure pump assembly frame and the trailer bulkhead panel.

j. Block, brace and tie down the ROWPU trailer assembly on the rail car. Size cables and tie down method for a 40,000 pound assembly.

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4-99. PREPARATION FOR AIR MOVEMENT.

WARNING

If, during transport or subsequent storage, the ROWPU will be subjected to temperatures below 35°F (2°C) or above 110°F (43°C) the temperature sensitive items listed in para. 1-11, equipment data, must be removed from the ROWPU and shipped in a temperature controlled environment. RO element removal is covered in para. 3-28. Storage of RO elements is covered in para. 4-97. Storage at the receiving end must be temperature controlled for the sensitive items.

WARNING

Make sure all air vents, drains and air storage tank valves are open and there is no air pressure left in system.

a. *Assembled Unit.*

(1) Prepare for air movement by following para. 4-98, a, b, c and f.

(2) Disconnect and remove the high pressure pump assembly, (TM 10-4610-232-34, para. 2-67).

(3) Disconnect and remove the generator. (TM 10-4610-232-34, para. 2-86).

(4) Load and secure the ROWPU in the aircraft per the approved loading plan.

4-100. PREPARATION FOR SEA MOVEMENT. Preparation for sea movement is the same as for air movement (para. 4-99).

APPENDIX A. REFERENCES

A-L SCOPE.

This appendix lists all forms, field manuals, and technical manuals, referenced in this manual.

A-2. FORMS.

EquipmentInspection and Maintenance Worksheet . . . . . DA Form 2404
Modification WorkOrder . . . . . DAForm 2408-5
Quality Deficiency Report SF-368
Recommended Changes to Publications and Blank Forms . . . . . DA Form 2028
Recommended Changes to DA Publications . . . . . DA Form 2028-2
Warranty Information . . . . . DA Form 2408-9

A-3. TECHNICAL MANUALS.

Preservation, Packaging, and Packing of Military Supplies and Equipment TM38-230
Painting for Army Materiel..... . . . . TM 43-0139 and TM9-213
The Army Maintenance Management System . . . . . DA PAM 736-750
Operator, Organizational Maintenance Manual, Generator Set; Diesel Engine Driven, Tactical, 60kW ,60 Cycle, AC, 120/208 V, 240/416 V, 3 Phase, Portable; Skid Mounted, NSN 6115-00-116-1243. . . . . TM 5-6115-545-12

Military Trailer . . . . . TM9-2330-358-14&P or TM 9-2330-386-14&P
Storage Tanks . . . . . TM 5-5430-225-12&P

Procedures for Destruction of Equipment to Prevent Enemy Use . . . . . TM 750-244-3
Repair Parts and Special Tool List for 3000 GPH ROWPU . . . . . TM 10-4610-232-24P

A-4. MISCELLANEOUS.

Lubrication 0rder for 3000 GPH ROWPU . . . . . LO 10-4610-232-12
Field Water Supply. . . . . FM 10-52
Oocupational and Environmental Health Sanitary Control and Surveillance of Field Water Supplies . . . . . TB MED 577

First Aid Manual FM21-11
NBC Decontamination Procedures . . . . . FM 3-5
Electrical Procedures . . . . . FM 20-31 and TC 11-6
Security Procedures . . . . . AR 190-11 or 190-13

APPENDIX B. MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION

B-1. GENERAL.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section Ill lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section Il.

d. Section lV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install maybe the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i. e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new conditions.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. *Colurnn 1, Group A/umber.* Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.)

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category, The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

C . . . . . Operator or Crew (Unit)
O . . . . . Organizational Maintenance (Unit)
F . . . . . Direct Support Maintenance (Intermediate)
H . . . . . General Support Maintenance (Intermediate)
D . . . . . Depot Maintenance

e. Colurnn 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column contains remarks or added information pertaining to maintenance functions.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number, if available.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in column 6 of the MAC (Section II), as applicable.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC (Section II).

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Unit C	Unit O	DS F	GS H	Depot D	(5) Tools and Equipment	(6) Remarks
00	WATER PURIFICATION UNIT, REVERSE OSMOSIS 3,000 GPH, Trailer Mounted, Flatbed Cargo 22½ Ton 8 Wheel Tandem, Aqua-Chem Model No. WTA-060	Repair				200.0			
		Rebuild					200.0		
01	RAW WATER SYSTEM (Consists of Items 0101 thru 0114)								
0101	• Anchor and Anchor Rope	Inspect	0.1						
		Replace	0.1						
		Repair	0.1						
0102	• Intake Strainer	Inspect	0.1						
		Service	0.2						
		Replace	0.1						
		Repair	0.1						A
0103	• Raw Water Hoses and Van Adapter	Inspect	0.1						
		Replace	0.1						
		Repair	0.1	0.2				1	A
0104	• Power Cables	Inspect	0.1						
		Service	0.1						
		Replace		0.1					
		Repair		0.2	0.2			1,2,16	B
0105	• Piping and Valves	Inspect	0.1						
		Replace		0.2				1,5	
		Repair	0.1	0.2				1,5	A
0106	• Raw Water Pump and Motor Assembly	Inspect	0.1						
		Replace		0.1				1	
		Repair	0.1	0.4	0.2			1,2,16	A, B
0107	• • Raw water pump	Inspect	0.1	0.1					C
		Repair		0.1	0.5			1	D, E
0108	• • Raw water pump Motor	Inspect	0.1	0.1					
		Test			0.1			1,2	F
		Replace			0.3			1	
		Repair			0.5			1,2	G

SECTION II. MAINTENANCE ALLOCATION CHART
FOB 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment	(6) Remarks
			Unit		DS	GS	Depot		
			C	O	F	H	D		
01	RAW WATER SYSTEM (cont.)								
0109	•• Raw Water Pump Frame	Inspect	0.1						
		Replace		0.1				1	
		Repair		0.1	0.2			1,6	H, I
0110	• Raw Water Prime Assist Pump	Inspect	0.1						
		Replace		0.1				1	
		Repair	0.1	0.1				1	A
0111	• Separator Assembly (Consists of Items 0112 thru 0114)								
0112	•• Separator Piping	Inspect	0.1						
		Replace		0.2				1,5	
		Repair	0.1	0.2				1,5	A
0113	•• Separators	Inspect	0.1						
		Replace		0.1				1,5	
		Repair	0.1	0.1	0.6			1,5	A, J
0114	•• Separator Frame	Inspect	0.1						
		Replace		0.1					
		Repair		0.1	0.2			1,6	H, I
02	WATER PURIFICATION SYSTEM (Consists of Items 0279, 0201, 0294)								
0201	Van Assembly (or ISO Container, Consists of Items 0202 thru 0278)								
0202	• Eyewash Station	Inspect	0.1						
		Service	0.1						
		Replace		0.1					
		Repair		0.2				1	
0203	• Fire Extinguisher and Bracket	Inspect	0.1						
		Replace		0.1			1		
0204	• Tubing Installation (Consists of Items 0205 thru 0209)								
0205	•• Low pressure Air Tubing	Inspect	0.1	0.2				1	C
		Repair		0.2				1	
							1		

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment	(6) Remarks
			Unit		DS	GS	Depot		
			C	O	F	H	D		
02	WATER PURIFICATION SYSTEM (cont.)								
0206	•• High Pressure Air Tubing	Inspect	0.1	0.1				1	C, K
		Repair			0.2			1	
0207	•• Low Pressure Water Tubing and Hoses	Inspect	0.1	0.1					C
		Repair		0.2				1	
0208	•• High Pressure Water Piping, Tubing and Hoses	Inspect	0.1	0.1					C
		Repair	0.2		0.2			1,5	L
0209	•• Chemical Tubing	Inspect	0.1						
		Repair		0.2				1	
0210	• Electrical Installation	Inspect	0.1	0.2				1	C
		Repair	0.1	0.5	0.5			1,2,16	B, M
0211	• Pressure Gage Assemblies	Inspect	0.1	0.1					C
		Test			0.3			1,9	
		Replace			0.3			1	
		Repair			0.3			1	
0212	• Main Control Panel	Inspect			0.5				
		Replace				2.0		1,8	
0213	•• Cable Assemblies, Connectors, and Wiring	Inspect			0.1				
		Replace			0.3			1	
		Repair			1.0			1,2,16	
0214	•• Panel Light	Inspect	0.1						
		Replace		0.1				1	
		Repair	0.1	0.1				1	M
0215	•• Upper Exterior Panel	Inspect	0.1	0.1	0.3				C
		Test			0.3			1,2,7	
		Adjust			0.1			1	
		Repair	0.1		0.4			1	M
0216	•• Upper Interior Panels	Inspect			0.1				
		Repair			0.2			1	

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Unit C	Unit O	DS F	GS H	Depot D	(5) Tools and Equipment	(6) Remarks
02	WATER PURIFICATION SYSTEM (cont.)								
0217	• Lower Exterior Panel	Inspect		0.1					
		Test			0.2				
		Adjust			0.4			1	
		Repair			0.3			1	
0218	• Lower Interior Panels	Inspect			0.2				
		Adjust			0.1			1	
		Repair			0.8			1	
0219	• Main Control Panel Doors, Latches, Gaskets and Housing	Inspect		0.1					
		Adjust		0.2				1	
		Repair		0.3	0.4			1,6	B
0220	• Pressure Switch Panel Assembly (Consists of Items 0221 and 0222)	Inspect	0.1	0.1					C, K
		Replace			0.5			1	
		Repair			0.5			1	
0221	• Junction Box and Cable Assemblies	Inspect	0.1	0.1				1	
		Repair			0.3			1,2,16	
0222	• Pressure Switches	Inspect			0.1			1	
		Test			0.2			1,9	
		Adjust			0.2			1,9	
		Replace			0.1			1,16	
0223	• Switch Panel No. 1	Inspect	0.1	0.1				1	
		Replace		0.1				1	
		Repair	0.1	0.3	0.3			1,2,16	B, M
0224	• Switch Panel No. 2	Inspect	0.1					1	
		Replace		0.1				1,2	
		Repair		0.3	0.3			1,2,16	B
0225	• Junction Box No. 3	Inspect	0.1					1	
		Replace		0.1				1,2	
		Repair		0.3	0.3			1,2,16	B

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment	(6) Remarks
			Unit		DS	GS	Depot		
			C	O	F	H	D		
02	WATER PURIFICATION SYSTEM (cont.)								
0226	• External Electrical Panels (Van Mounted)	Inspect Repair	0.1	 0.5	 0.3			1 1,2,16	 B
0227	• Chemical Injection Pumps	Inspect Replace Repair	0.1	 0.2 0.3	 0.2			 1 1,2,16	 B
0228	• Backwash Hypochlorite Pump Assembly	Inspect Replace Repair	0.1	 0.2 0.2	 0.2			 1,2,16	 B
0229	• Hypochlorite Tank Assembly (Consists of Items 0230 and 0231)	Inspect Repair	0.1	0.1 0.4				 1,2	C
0230	•• Mixer Assembly	Inspect Replace Repair	0.1	 0.2 0.2	 0.2			 1 1,2,16	 B
0231	•• Hypochlorite Tank Components and Covers	Inspect Repair	0.1 0.1	 0.5				 1,2,16	 A
0232	• Hypochlorite Tank Frame	Inspect Replace Repair	0.1	 0.2	 0.2			 1 1,6	
0233	• Booster Pump Cover	Inspect Replace Repair	0.1	 0.5 0.2				 1 1,2	
0234	• Booster Pump Assembly	Inspect Replace Repair	0.2	 2.0 0.2	 0.2			1 1 1,2,16	 B
0235	•• Booster pump	Inspect Repair		0.1	0.2 0.5			1 1	A

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment	(6) Remarks
			Unit		DS	GS	Depot		
			C	O	F	H	D		
02	WATER PURIFICATION SYSTEM (cont)								
0236	•• Booster pump	Inspect		0.1				1	
	Motor	Test			0.1			1,2	F
		Replace			0.3			1	
		Repair			0.5			1,2	G
0237	• Cartridge Filter Assembly	Inspect	0.1						
		Service	0.3						
		Replace		0.3				1	
		Repair	0.1	0.2	0.2			1,6	A, H
0238	• Piping Installation (Consists of Items 0239 thru 0244)								
0239	•• Low Pressure	Inspect	0.1						
	Piping Assemblies and Fill and Drain Hoses)	Replace		0.3				1,5	
		Repair	0.1	0.2				1,5	A
0240	•• Basket strainer	Inspect	0.1						
		Service	0.2						
		Replace		0.2				1	
		Repair	0.1	0.2				1	A
0241	•• Butterfly Valves with Actuators	Inspect	0.1						
		Replace		0.2				1	
		Repair		0.4	0.6			1,2,4,10	N
0242	•• Product Relief Valve	Inspect	0.1	0.1					A
		Test			0.2				
		Adjust			0.1			1	
		Replace			0.2			1	
0243	•• Waste Relief Valve	Inspect	0.1	0.1					A
		Test			0.2				
		Adjust			0.1			1	
		Replace			0.2			1	
0244	•• Safety Valve	Inspect	0.1						
		Replace		0.1					
		Repair		0.1				1	

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Unit C	Unit O	DS F	GS H	Depot D	(5) Tools and Equipment	(6) Remarks
02	WATER PURIFICATION SYSTEM (cont.)								
0245	• Turbidity Flow Panel	Inspect	0.1						
		Replace		0.2				1	
		Repair		0.2				1	
0246	• Turbidity Meter Panel	Inspect	0.1						
		Adjust		0.2				11	
		Replace		0.2				1	
		Repair		0.2	0.2			1,2,16	B
0247	• Low Pressure Solenoid Valves	Inspect	0.1						
		Replace		0.1				1	
		Repair		0.3	0.2			1	
0248	• Media Filter Air Blanket Level Indicator Assembly	Inspect	0.1						
		Test		0.3				1,2	
		Replace		0.2				1	
		Repair		0.2	0.2			1,2	
0249	• Media Filter Assembly (Includes Valves and Tank)	Inspect	0.1						
		Service	0.2	4.0					
		Replace			4.0			1,2,8	M
		Repair		0.2				1	
0250	• Clean/Flush Tank Assembly	Inspect	0.1						
		Replace			3.5			1,2,8	M
		Repair	0.1	0.2	0.2			1,2,16	A
0251	• Polyelectrolyte and Sequestrant Tanks	Inspect	0.1						
		Replace		0.4				1,2	
		Repair	0.1	0.5				1,16	A
0252	• Chemical Tanks Frame	Inspect	0.1						
		Repair		0.2	0.2			1,6	H
0253	• Sample Trough Assembly	Inspect	0.1						
		Replace		0.2				1	
		Repair		0.2				1	
0254	• High Pressure Solenoid Valve	Inspect	0.1	0.1					C, K
		Replace			0.1			1	
		Repair			0.3			1,2,16	

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		DS	GS	Depot	Tools and	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Equipment	Remarks
02	WATER PURIFICATION SYSTEM (cont.)								
0255	• Turbidity Meter Air Dryer	Inspect	0.1						
		Service	0.2						
		Replace		0.2				1	
		Repair		0.1				1	
0256	• TDS Meter	Inspect	0.1						
		Adjust		0.2					
		Replace		0.2				1	
		Repair		0.2	0.2			1,2,16	B
0257	• 24 VDC Power Supply	Inspect	0.1	0.1				1	C
		Replace			0.2			1	
		Repair			0.2			1,2,16	
0258	• Diesel Heaters	Inspect	0.1						
		Test		0.7				1,2	
		Service		0.4					
		Adjust		0.4				1	
		Replace		0.5				1	
		Repair		0.5	0.8			1,2	B
0259	• Heater Fuel Pump and Fuel Lines	Inspect	0.1						
		Service		0.1				1	
		Replace		0.2				1	
		Repair		0.1				1	
0260	• Thermostats	Inspect		0.1					
		Replace		0.1	0.2			1	
		Repair		0.1	0.2				
0261	• Carbon Monoxide Monitor	Inspect	0.1						
		Test	0.1	0.2	0.2			1,17	O, P
		Adjust		0.2	0.2			1,17	Q
		Replace			0.3			1	
		Repair		0.1	0.4			1,2	R, S
0262	• RO Pressure Vessels and Elements	Inspect	0.1	0.1					C
		Repair	2.5		4.0			1,8	L, T
0263	• Storage Rack and Storage Boxes	Inspect	0.1						
		Replace		0.1				1	
		Repair		0.1				1	
0264	• NBC Filter Assembly	Inspect	0.1						
		Service	1.0						
		Replace			3.0			1,8	
		Repair	0.1	0.2	0.2			1,2,6,8	A, H

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment	(6) Remarks
			Unit		DS	GS	Depot		
			C	O	F	H	D		
02	WATER PURIFICATION SYSTEM (cont.)								
0265	• NBC Filter Hoses	Inspect	0.1						
		Replace		0.1					
		Repair	0.1	0.1				1	
0266	• Air Dryer	Inspect	0.1						
		Replace		0.1				1	
0267	• Outlet Air Filter	Inspect	0.1	0.1					K
		Service	0.1						
		Replace			0.3			1	
		Repair			0.2			1	
0268	• Air Manifolds and Air Block Valves	Inspect	0.1						
		Replace		0.2				1	
		Repair		0.2				1	
0269	• Air Tank	Inspect	0.1	0.1	0.1				C, K
		Test			0.5				U
		Replace			0.5			1	
0270	• Air Regulator	Inspect	0.1	0.1				1	C, K
		Replace			0.2			1	
		Repair			0.2			1	
0271	• Vent Fan	Inspect	0.1						
		Replace		0.3				1	
		Repair		0.2	0.2			1,2,16	B
0272	• Sump Heaters	Inspect	0.1						
		Replace		0.2				1	
		Repair			0.2			1,2,16	B
0273	• Waste Water Hoses and Van Adapters	Inspect	0.1						
		Replace		0.1					
		Repair	0.1	0.2				1	A
0274	• Ladders	Inspect	0.1						C
		Replace		0.1					
		Repair		0.1	0.2			1,6	H

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		DS	GS	Depot	Tools and	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Equipment	Remarks
02	WATER PURIFICATION SYSTEM (cont.)								
0275	• ISO Container Assembly (Consists of Items 0276 thru 0278)								
0276	•• Accessory Table	Inspect	0.1						
		Repair		0.2	0.2			1	H
0277	•• Access Panels and Seals (Incl. Container Shell)	Inspect	0.1	0.1					C
		Replace		0.1				1	
		Repair		0.2	0.5	0.5		1,6,8,15	V
0278	•• Doors	Inspect	0.1						
		Service		0.1					
		Adjust		0.1				1	
		Replace		0.4				1	
		Repair		0.4				1	V
0279	High Pressure Pump Assembly and Cover (Includes Air Compressor, Consists of Items 0280 thru 0294)	Inspect	0.1	0.1					C
		Replace			1.0			1,8	
		Repair			0.4				
0280	• Metal Oxide Varistor (MOV) Box	Inspect		0.1					
		Replace		0.3				1	
		Repair		0.3	0.4			1,2,16	B
0281	• Electric Heater	Inspect	0.1	0.1					
		Replace		0.3				1	
		Repair			0.4			1,2,16	
0282	• Air Compressor Relief Valve	Inspect	0.1	0.1					K
		Repair			0.2			1	
0283	Air Compressor Assembly (Consists of Items 0284 and 0285)	Inspect	0.1	0.2				1	C
		Service	0.1	0.1					W, X
		Adjust		0.3				1,13	
0284	• Air Compressor Motor	Inspect	0.1						
		Test			0.1			1,2	
		Replace		0.3				1	
		Repair		0.2	0.5			1,2,16	

SECTION II, MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Unit C	Unit O	DS F	GS H	Depot D	(5) Tools and Equipment	(6) Remarks
02	WATER PURIFICATION SYSTEM (cont.)								
0285	Air Compressor	Inspect	0.1	0.1	0.3				C, K
		Replace			0.3			1	
		Repair		0.5	2.0	5.0		1,2,12	Y
0286	High Pressure Pump Assembly Consists of Items 0287 thru 0294)	Inspect	0.1	0.1					K
		Service	0.1	0.2					X
		Adjust		0.2				1,13	
0287	High Pressure Pump Belt Guard	Inspect	0.1						
		Repair		0.2	0.2			1,6,8	Z
0288	High Pressure Pump V-Belt	Inspect		0.1					
		Replace		0.6				1	
0289	High Pressure Pump Motor Assembly	Inspect	0.1						
		Test			0.1			1,2	
		Replace			0.3			1,8	
		Repair		0.2	0.7	4.0		1,2,16	B, G
0290	High Pressure Assy, Piping, Valves, Radiator, Dampener, and Hoses	Inspect	0.1	0.1					
		Repair			0.2			1	
0291	High Pressure Relief Valve	Inspect	0.1	0.1					C
		Replace			0.2			1	
0292	High Pressure Pump Sheave	Inspect		0.1				1	
		Replace			2.0			1,8	
0293	High Pressure Pump	Inspect			0.1				
		Replace			1.5			1,8	
		Repair			2.0	6.0		1,2	
0294	Mounting Frame	Inspect	0.1	0.1					C
		Replace			0.3			1,8	
		Repair			0.7			1.6	

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Euipment	(6) Remarks
			Unit		DS	GS	Depot		
			C	O	F	H	D		
03	WATER DISTRIBUTION SYSTEM (Consists of terns 0301 thru 0305)								
0301	▪ Adapter with Product Shut-off Valve	Inspect	0.1						
		Replace	0.1						
		Repair	0.1	0.2				1,5	A
0302	▪ Distribution Hoses, (Includes Piping and Dispensing Nozzles)	Inspect	0.2						
		Replace		0.4				1	
		Repair	0.1	0.2				1,5	A
0303	▪ Distribution Pump Assembly (Includes Motor Cable, Switch Cable and Frame)	Inspect	0.1						
		Repair	0.1	0.2	0.2			1,2,16	A, B
0304	▪▪ Distribution Pump	Inspect	0.1	0.1	0.3			1	C
		Repair			0.5			1	
0305	▪▪ Distribution Pump Motor	Inspect	0.1	0.1					
		Test			0.1			1,2	
		Replace			0.3			1	
		Repair			0.5			1	G
0306	▪▪ Tank, Storage, 3000 Gal.	See TM5-5430-225-1215							

SECTION II. MAINTENANCE ALLOCATION CHART FOR 3000 GPH ROWPU (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools And Equipment	(6) Remarks
			Unit		DS	GS	DePot		
			C	O	F	H	D		
04	WINTER KIT (Consists of Items 0401 thru 0404)								
0401	• Pump Covers	Inspect Replace Repair	0.1	0.1	0.2				
0402	• Heat Lamps and Cables	Inspect Replace Repair	0.1	0.1 0.2	0.2			1,2, 16	B
0403	• Generator Jumper Cable	Inspect Replace Repair	0.1	0.1 0.2	0.2			1 1,2, 16	B
0404	• Ice Hole Intake Strainer	Inspect Replace	0.1 0.1						
0405	• Pump Skids	Inspect Replace	0.1 0.1						
05	ACCESSORIES								
0501	• Portable Fbw Rate Indicator	Repair	0.1						
0502	• Portable Turbidity Meter	Adjust Repair		0.1 0.1					
0503	• Sling Bracket Assembly	Replace Repair		0.1 0.1					
06	GENERATOR, Engine 60kw	Replace			1.0				aa
0601	• Generator Brackets	Inspect Replace Repair		0.1	0.3 0.5			1,8	
07	TRAILER, 30 Foot See TM 9-2330-350-14 Or TM 9-2330-386-14P								

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR 3000 GPH ROWPU

Tool or Test Equipment Ref.	Maintenance Category	Nomenclature	National/ NATO Stock Number	Tool Number
1	O	TOOL KIT, GENERAL MECHANIC'S, AUTOMOTIVE	5180-00-177-7033	SC5180-90-N26
2	O	SHOP EQUIPMENT, AUTOMOTIVE	4910-00-754-0654	SC4910-95-CL-A74
3	O	SHOP EQUIPMENT, AUTOMOTIVE, SUPPLY	4910-00-754-0653	SC4910-95-CL-A73-HR
4	O	SHOP EQUIPMENT, AUTOMOTIVE. MAINTENANCE & REPAIR, FIELD MAINTENANCE BASIC, LESS POWER	4910-00-754-0705	SC4910-95-CL-A31
5	O	WRENCH, PIPE	5120-00-270-4309	
6	H	WELDING EQUIPMENT	3431-95-A01	
7	O	FLOW METER, AUXILIARY	120-01929	
8	F	LIFTING EQUIPMENT		
9	F	TESTER, DEAD WEIGHT	TYPE 1305	
10	F	TOOL, VALVE ACTUATOR	120-01799	
11	O	CALIBRATION STANDARD, TURBIDITY METER	120-00783-5	
12	F	TOOL KIT, COMPRESSOR (METRIC)	120-00654-004	
13	O	GAGE, BELT TENSION	120-00823	
14	O	RO ELEMENT PUSHER	120-00510	
15	O	RIVNUT REPAIR KIT	5120-00-017-2849	
16	O	ELECTRICAL CONNECTOR REPAIR KIT	120-02620	
17	C	CALIBRATION KIT, CO MONITOR	120-02499-5	

SECTION IV. REMARKS

Reference Code	Remarks
A	Crew replaces gaskets and/or preformed packings.
B	Unit repairs by replacing component(s).
c	Crew does visual inspection.
D	Unit inspects and repairs flapper by replacement.
E	Direct support replaces mechanical seals, impeller, and internal seals.
F	Direct support does post-repair testing.
G	Repair by replacing bearings only at direct support.
H	Direct support welds and straightens.
I	Unit tightens loose hardware and replaces missing hardware.
J	Direct support replaces separator liners.
K	Unit does soap and water leakage check.
L	Crew replaces high pressure gaskets as part of RO vessel repair.
M	Crew replaces light bulbs only.
N	Top of actuator is repaired at unit level, bottom of actuator repaired at direct support.
O	Crew uses test kit to check accuracy of CO monitor
P	Unit tests alarms and checks DC fuse.
Q	Unit adjusts alarm settings.
R	Unit repairs by replacing DC fuse.
S	Direct support repairs by replacing sensor.
T	60 kw generator set must be removed prior to removing vessels.
U	Hydrostatic pressure test.
V	Prepare water tight patches and rivet patches in place at direct support. Replace helicoils.
W	Crew replaces inlet fitter parts.
X	Crew adds oil.
Y	Unit replaces fan belt; direct support replaces valves.
Z	Unit replaces inner panels, direct support replaces outer panels.
aa	Repair generator in accordance with TM 5-6115-545-12 and TM 5-6115-545-34

APPENDIX C. COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

SECTION I. INTRODUCTION

C.1. SCOPE.

This appendix lists components of end item and basic issue items for the 3000 GPH ROWPU to help you inventory items required for safe and efficient operation.

C.2. GENERAL.

The components of End Item and Basic Issue Items Lists are divided into the following sections:

a. *Section II. Components of End Item.* This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. *Section III. Basic Issue Items (BII).* These are the minimum essential items required to place the ROWPU in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the ROWPU during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C.3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listings:

a. *Column (1) - Illustration Number (Illus. Number).* This column indicates the number of the illustration in which the item is shown.

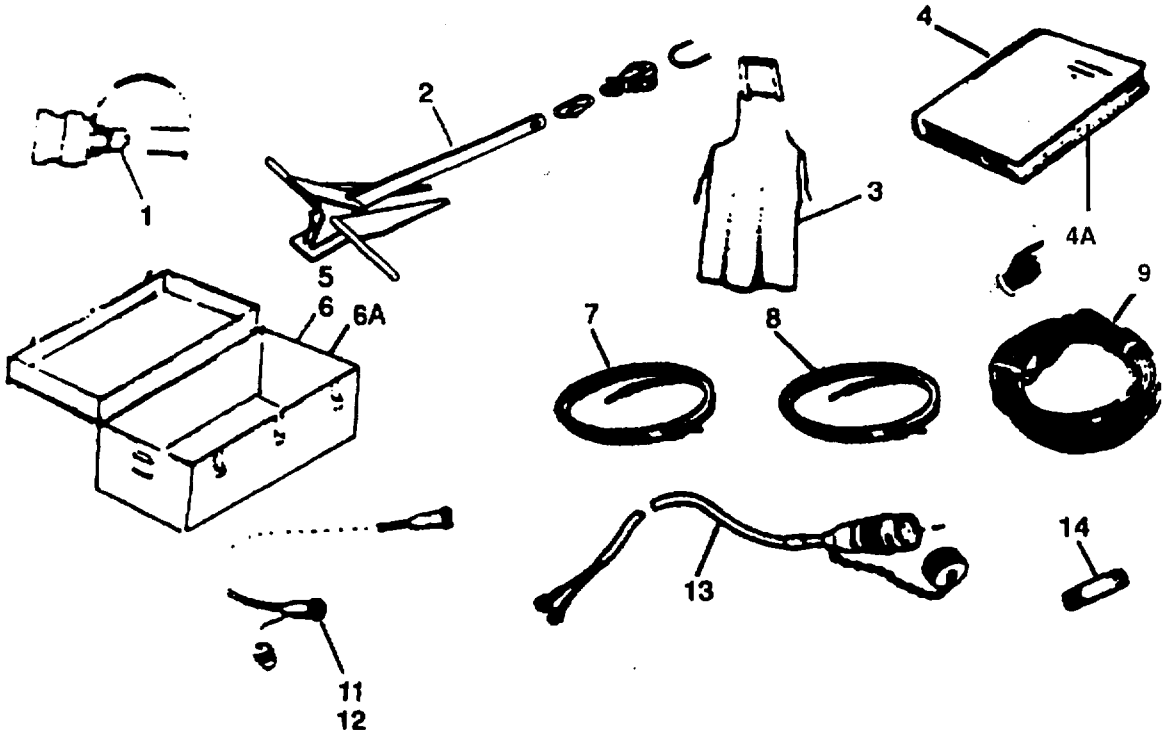
b. *Column (2) - National Stock Number (NSN).* Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. *Column (3) - Description.* Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parenthesis) followed by the part number.

d. *Column (4) - Unit of Measure (U/M).* Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., EA, RL).

e. *Column (5) - Quantity Required (Qty. rqr).* Indicates the quantity of the item authorized to be used with/on the equipment.

SECTION II. COMPONENTS OF END ITEM

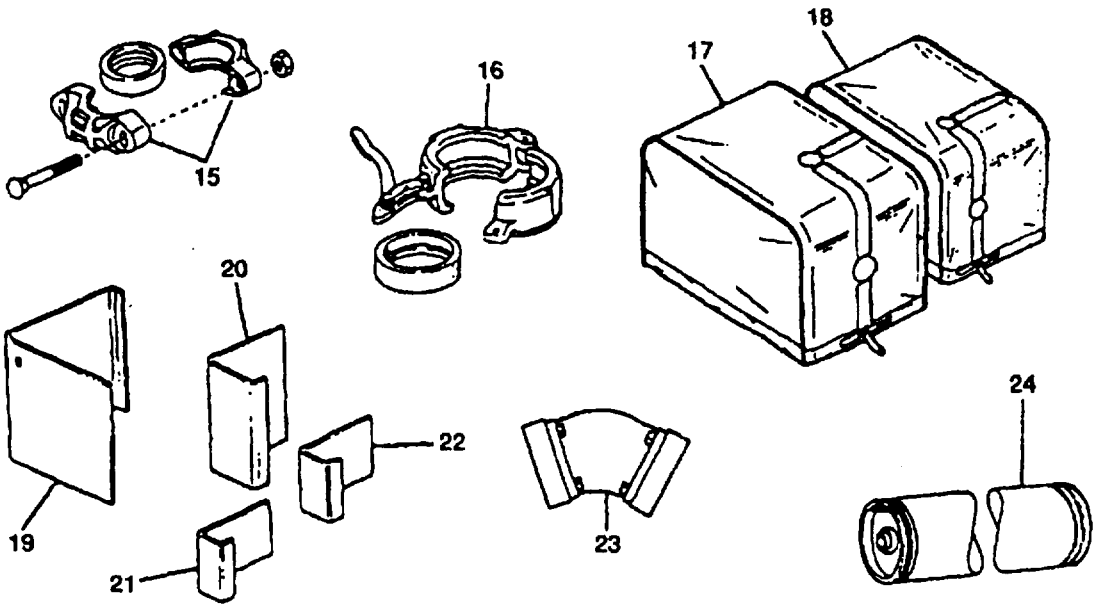


(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
1		ADAPTER, Water Flush (97403) 13229E0481		EA	1
2	2040-01-349-0496	ANCHOR ASSEMBLY (97403) 13229E0167		EA	1
3	8415-00-634-5023	APRON, Chemical (15481) 021-758		EA	1
4	7510-00-187-6488	BINDER, Looseleaf (58536) A-A-2549		EA	1
4A		BINDER PAPER, Looseleaf (97403) 13229E1055		EA	1
5		BOX, Storage (97403) 13229E0234-3		EA	1
6		BOX, Storage (97403) 13229E0234-4		EA	1
6A		BOX, Storage (97403) 13229E0234-1		EA	1
7		CABLE, Ground, Generator (15 ft) (97403) 13229E0860-4		EA	1
8		CABLE, Ground, Van (20 ft) (97403) 13229E0860-5		EA	1
9	6150-01-350-1387	CABLE, Heat Lamp, Raw Water Pump W61 (97403) 13229E1262-7		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)

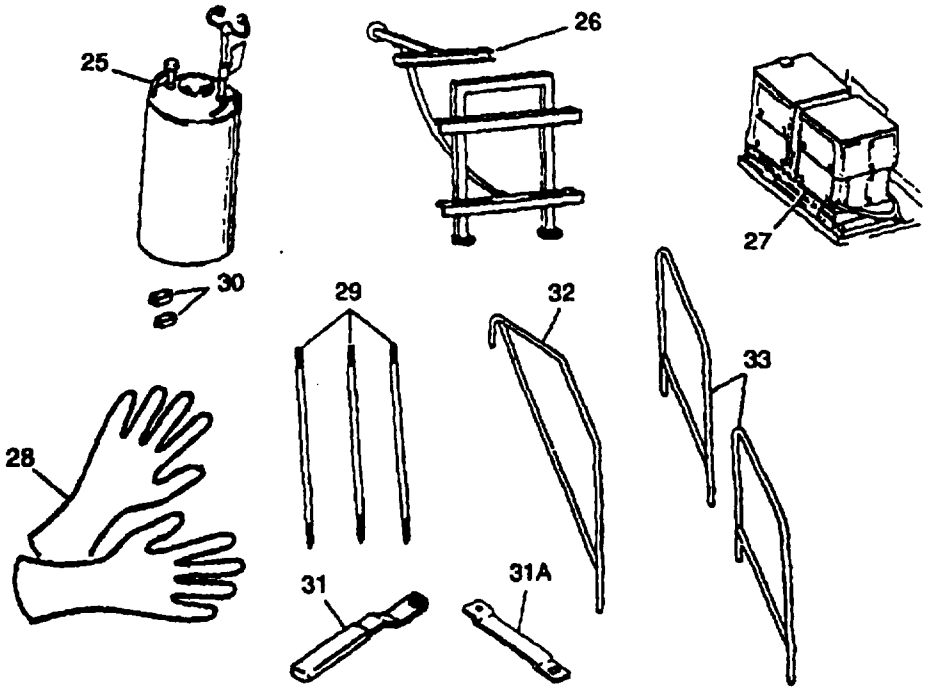
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
10		DELETED			
11	6150-01-345-5613	CABLE, Power, Raw Water Pump W57 (97403) 13229E1262-4		EA	1
12	6150-01-345-5614	CABLE, Power, Raw Water Pump W58 (97403) 13229E1262-5		EA	1
13	6150-01-351-9930	CABLE, 24VDC, Generator to Van W2 (97403) 13229E1260-6		EA	1
14	4730-01-351-8102	CONNECTOR, RO Element (63624) 81282		EA	8

SECTION II. COMPONENTS OF END ITEM (Continued)



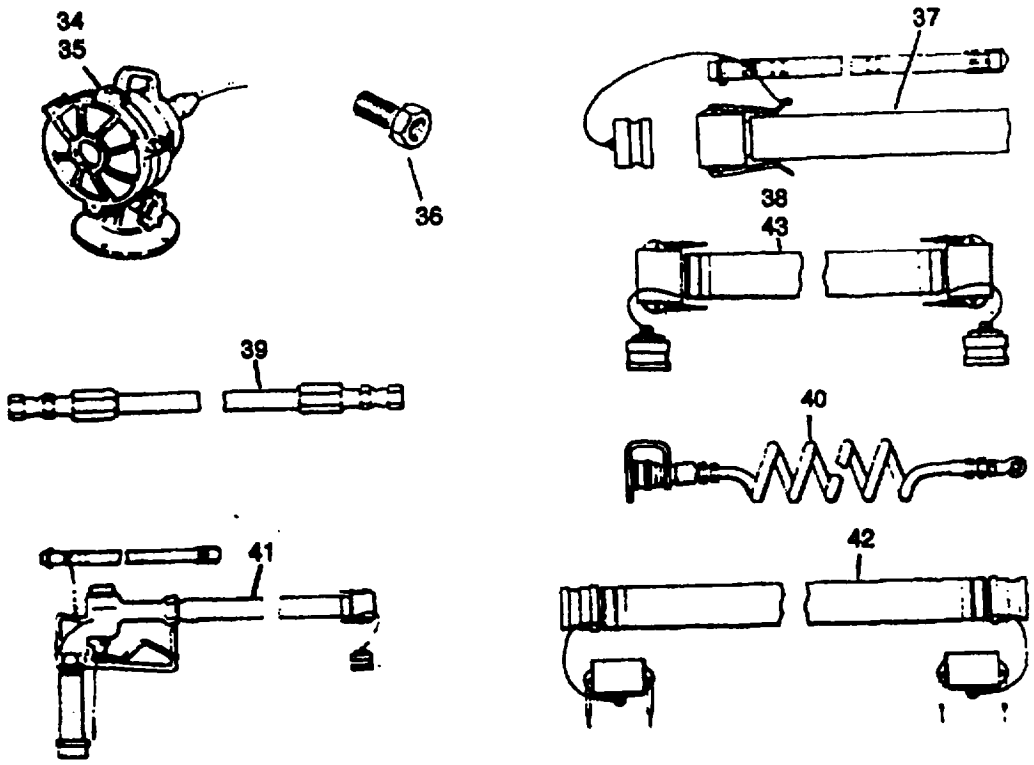
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
15	5340-01-346-7265	COUPLING, Clamp, 1-1/2 in. pipe (97403) 13229E0156-2		EA	1
16	4370-00-947-0364	COUPLING, Sump Drain (97403) 13229E1122		EA	4
17	5340-01-466-2753	COVER, Distribution Pump (97403) 13229E0031-2		EA	1
18	5340-01-466-2699	COVER, Raw Water Pump (97403) 13229E0031-1		EA	1
19		DIVIDER, Box (97403) 13229E1140-1		EA	4
20		DIVIDER, Box (97403) 13229E1140-2		EA	4
21		DIVIDER, Box (97403) 13229E1140-3		EA	4
22		DIVIDER, Box (97403) 13229E1140-4		EA	4
23	4730-01-468-5339	ELBOW, 450, Grooved End (MODEL WTA-060 ONLY) (75039) 7051		EA	2
24	4610-01-253-4294	ELEMENT, RO (97403) 13229E0213		EA	12

SECTION II. COMPONENTS OF END ITEM (Continued)



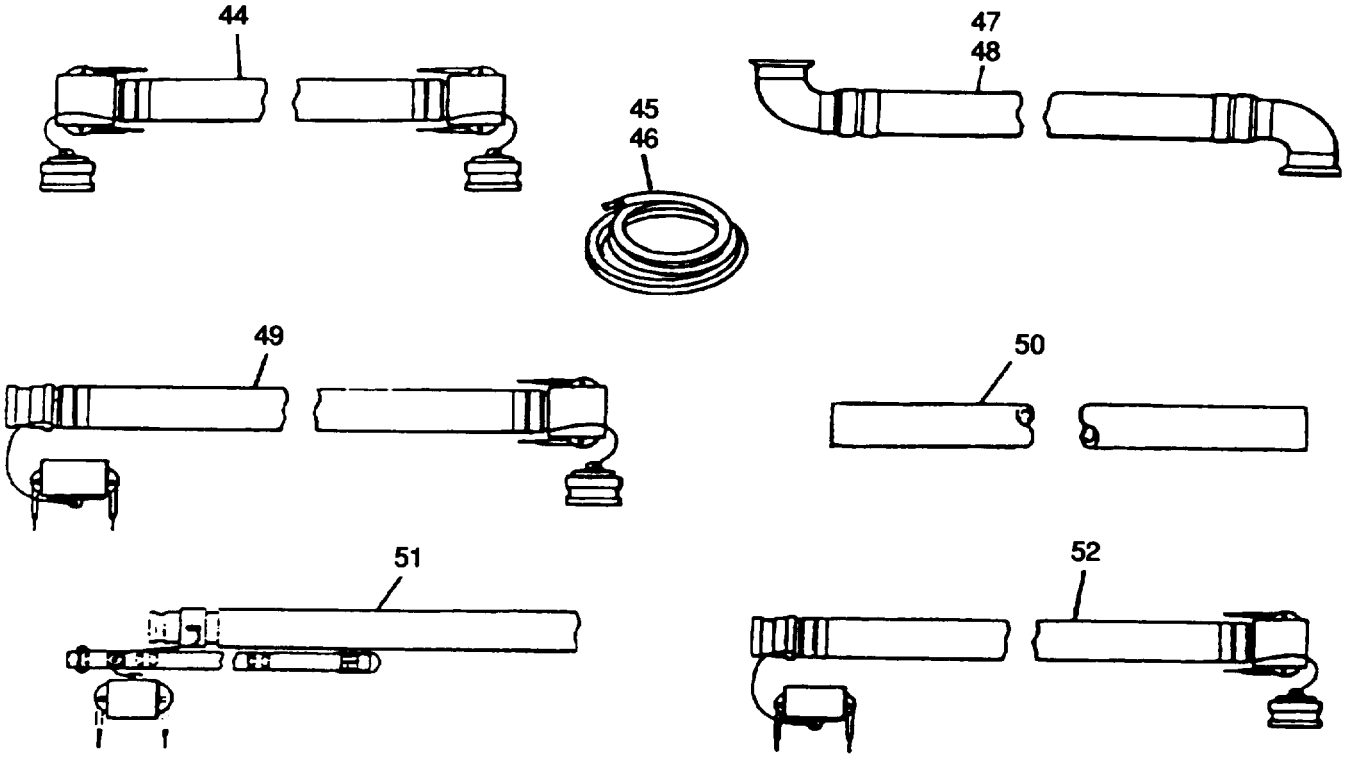
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
25	4720-01-357-4912	EYEWASH STATION (87327) SE-591		EA	1
26		FRAME ASSEMBLY, Separator (MODEL WTA-060 ONLY) (97403) 13229E0075		EA	1
27	6115-00-118-1243	GENERATOR SET, 60 kw		EA	1
28	8415-00-266-8677	GLOVES, Chemical (81348) ZZ-G-381		EA	1
29	5975-00-878-3791	GROUND ROD ASSEMBLY (82370) A104		EA	1
30	5999-00-186-3912	GROUND ROD CLAMP, 5/8 in. Rod x #6 (04655) 70-801074		EA	2
31	5430-01-430-4205	HANDLE, Butterfly Valve (MODEL WTA-060 ONLY) (32033) BVP-86-10		EA	1
31A		HANDLE, Butterfly Valve (MODEL ROWPU-1 ONLY) (97403) 13229E0231-2		EA	1
32		HAND RAIL, Ladder (97403) 13229E0539		EA	2
33		HAND RAIL, Ladder (97403) 13229E0538		EA	4

SECTION II. COMPONENTS OF END ITEM (Continued)



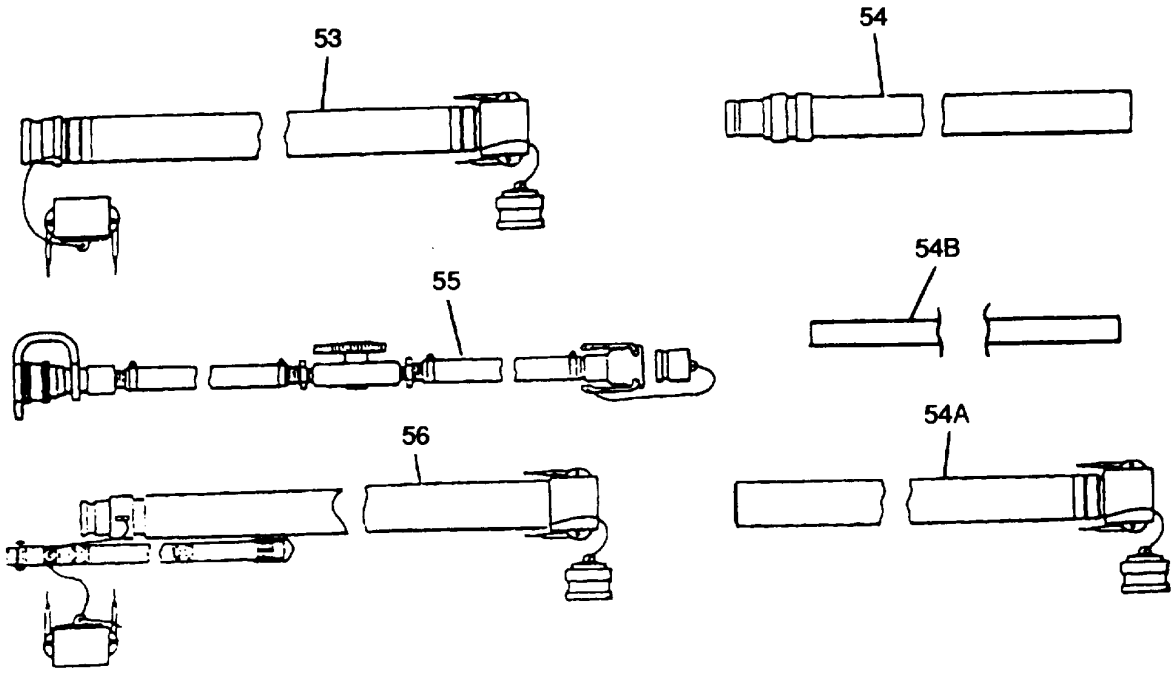
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
34		HEAT LAMP ASSEMBLY, Raw Water Pump (97403) 13229E1271-1		EA	1
35		HEAT LAMP ASSEMBLY, Distribution Pump (97403) 13229E1271-2		EA	1
36	4730-00-684-7555	HOSE ADAPTER, Hex, Male 1/2-20TRD (88044) AN815-5S		EA	1
37	4210-01-349-7779	HOSE ASSEMBLY Auxiliary (97403) 13229E1155		EA	1
38	4210-01-349-7780	HOSE ASSEMBLY, Cleaning Heat-Up (97403) 13229E0524		EA	1
39		HOSE ASSEMBLY Diesel Fuel (97403) 13229E0908		EA	1
40		HOSE ASSEMBLY, Eyewash Air Pressure (97403) 13229E0856		EA	1
41		HOSE ASSEMBLY Dispensing with Nozzle (97403) 13229E1156		EA	2
42	4720-01-349-3637	HOSE ASSEMBLY, Distribution Pump Suction (97403) 13229E0201		EA	1
43	4720-01-351-4011	HOSE ASSEMBLY, Distribution Pump Suction (97403) 13229E0202		EA	2

SECTION II. COMPONENTS OF END ITEM (Continued)



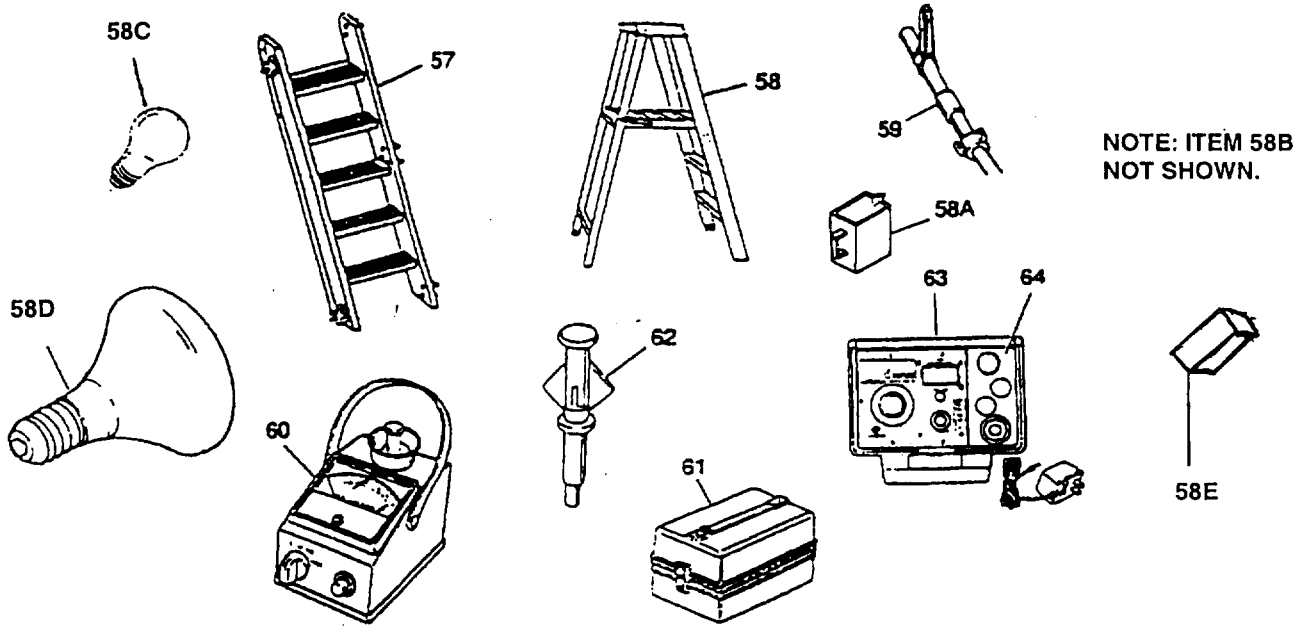
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
44	4720-01-350-3787	HOSE ASSEMBLY, Distribution System (97403)13229E0203		EA	1
45		HOSE ASSEMBLY, Distribution Drain (97403) 13229E0403		EA	1
46		HOSE ASSEMBLY, Raw Water Pump Drain (97403)1 3229E404		EA	1
47		HOSE ASSEMBLY, NBC Operation, 41.5 in. lg (97403) 13229EO624-1		EA	1
48		HOSE ASSEMBLY, NBC Operation, 71.5 in. lg (97403) 13229E0624-2		EA	1
49	4720-01-351-5891	HOSE ASSEMBLY, Product Outlet (97403) 13229E01 94		EA	5
50		HOSE ASSEMBLY, NBC Drain (97403) 13229E1 378-27		EA	1
51	4720-01-347-5480	HOSE ASSEMBLY, Raw Water Distribution (97403) 13229E1154		EA	4
52	4720-01-345-5640	HOSE ASSEMBLY, Raw Water Suction (97403) 13229E1125		EA	2

SECTION II. COMPONENTS OF END ITEM (Continued)



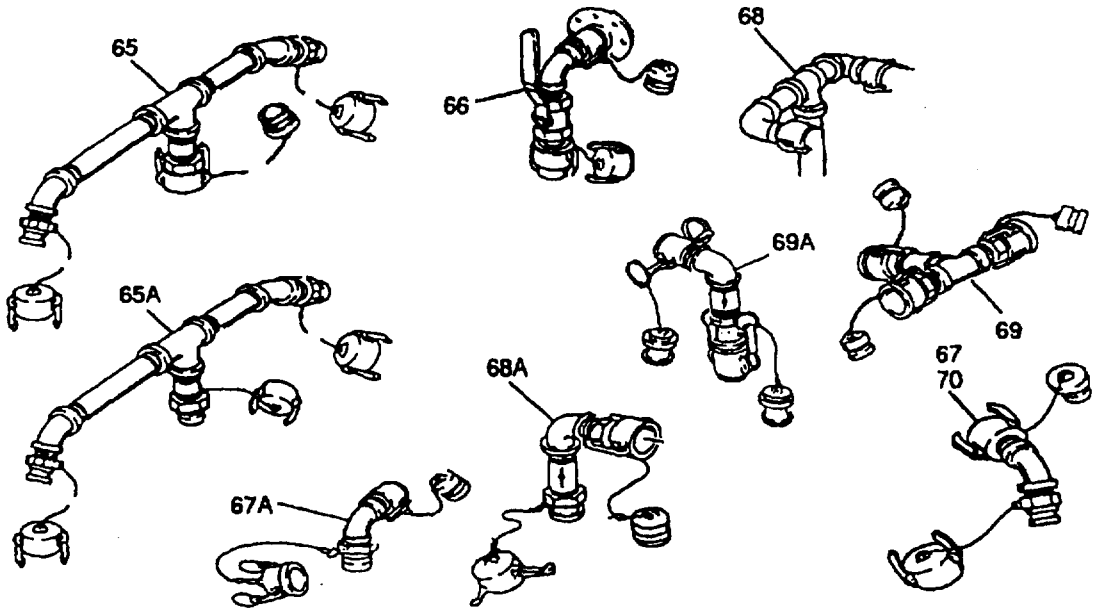
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
53	4720-01-345-5641	HOSE ASSEMBLY, Raw Water Pump Suction (97403)1 3229E0168		EA	10
54	4720-01-353-7429	HOSE ASSEMBLY, Sump Drain (MODEL WTA-60 ONLY) (97403)1 3229E01 27		EA	2
54A		HOSE, Sump Drain (With Fitting) (MODEL ROWPU-1 ONLY) (97403) 13229E0188		EA	2
54B		HOSE, Sump Drain (Without Fitting) (MODEL ROWPU-1 ONLY) (97403)1 3229E0302-1		EA	2
55		HOSE ASSEMBLY, Utility (97403) 13229E0511		EA	1
56	4720-01-352-8999	HOSE ASSEMBLY, Waste Out (97403)1 3229E1157		EA	6

SECTION II. COMPONENTS OF END ITEM (Continued)



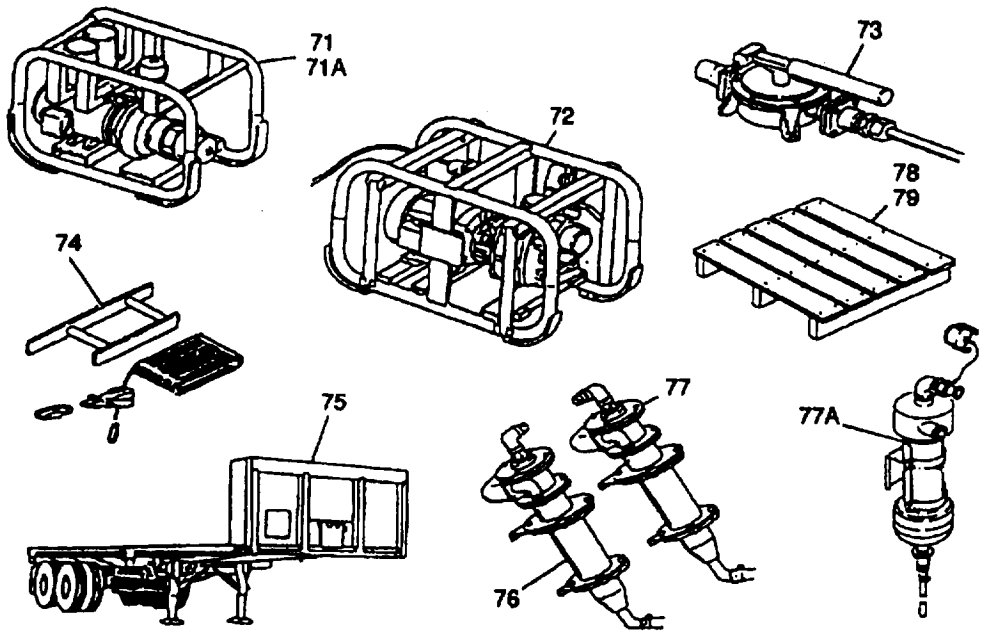
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
57		LADDER, Access (97403) 13229E0030		EA	2
58	5440-01-353-3135	LADDER, Step (97403) 13229E0242		EA	1
58A		CUP, Measuring (MODEL ROWPU-1 ONLY) (81343) MIL-M-43530, Size 1		EA	1
58B		LAMP, Incandescent, T-3-1/4 (81349) A50588-1		EA	3
58C		LAMP, Incandescent, 100 watt (81348) W-L-101/77A		EA	4
58D	6240-00-843-0692	LAMP, Incandescent, Heat Lamp Assembly (08805) 2500PAR56MFL120V		EA	1
58E	9150-01-260-2534	LUBRICANT, Solid Film (81349) MIL-L-23398, Type II		EA	1
59	6680-01-473-8286	METER ASSEMBLY, Flow Rate Indicating (97403) 13229E0889		EA	1
60	6630-00-127-4774	METER, Total Dissolved Solids, TDS (30053) 532T1		EA	1
61		METER CASE, TDS (30053) PORTA-PAK		EA	1
62	6630-01-103-9007	METER RANGE EXTENDER, TDS (30053) RE-10		EA	1
63	6630-01-350-0250	METER, Turbidity (58177) DRT-15C		EA	1
64	4610-01-350-1450	MONITOR ACCESSORY KIT, Turbidity (97403) 13229E0280-4		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



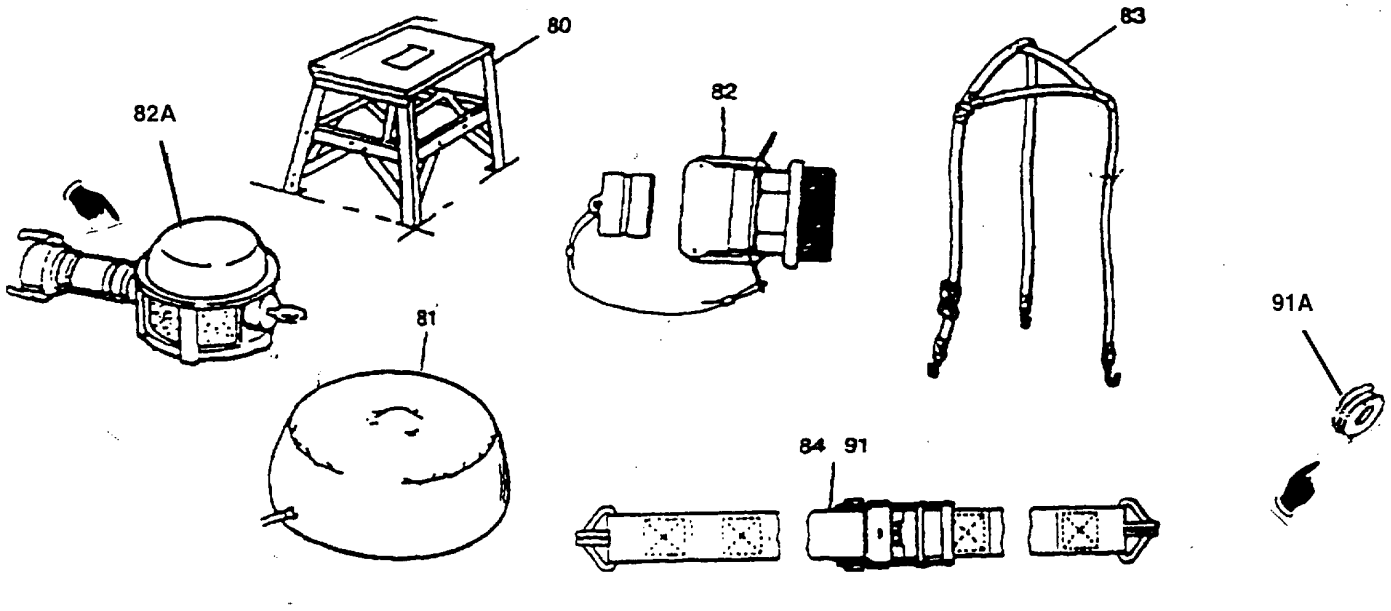
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
65	4730-01-469-6943	PIPE SECTION, Distribution Pump Discharge (97403) 13229E0036 (MODEL WTA-060 ONLY)		EA	1
65A	4730-01-469-6943	PIPE SECTION, Distribution Pump Discharge (97403) 13229E0191 (MODEL ROWPU-1 ONLY)		EA	1
66	4730-01-466-5290	PIPE SECTION, Product to Storage (97403) 13229E0630		EA	1
67	4730-00-249-3878	PIPE SECTION, Raw Water Feed (97403) 13229E0142 (MODEL WTA-060 ONLY)		EA	1
67A		PIPE SECTION, Raw Water Feed (97403) 13229E0721 (MODEL ROWPU-1 ONLY)		EA	1
68		PIPE SECTION, Raw Water System (97403) 13229E1124 (MODEL WTA-060 ONLY)		EA	1
68A		PIPE SECTION, Raw Water System (97403) 13229E0143 (MODEL ROWPU-1 ONLY)		EA	1
69	4730-01-349-3866	PIPE SECTION, Separator Out (97403) 13229E0501 (MODEL WTA-060 ONLY)		EA	1
69A		PIPE SECTION, Separator Out (97403) 13229E0141 (MODEL ROWPU-1 ONLY)		EA	1
70		PIPE SECTION, Waste Out (97403) 13229E0140		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



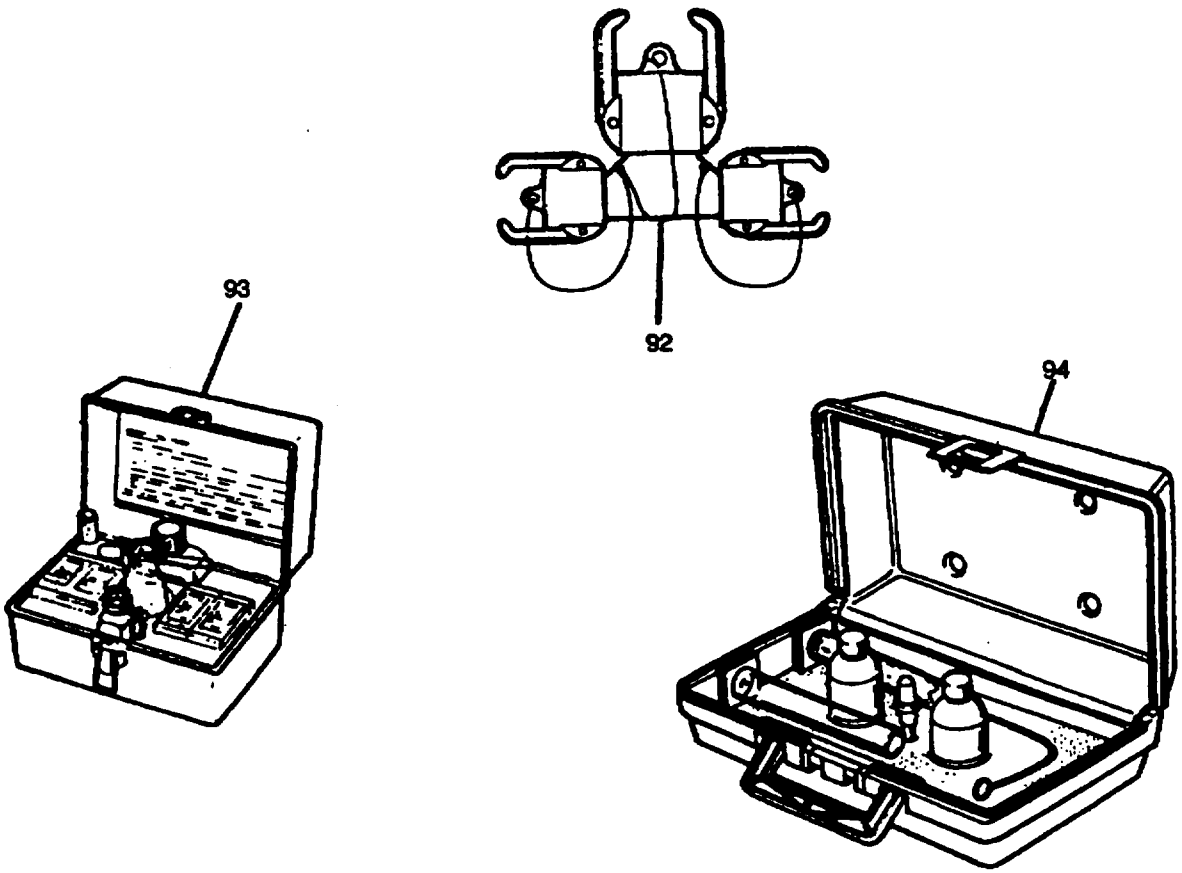
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr	
71	4320-01-348-4386	PUMP AND MOTOR ASSEMBLY, Distribution (MODEL WTA-060 ONLY) (97403) 13229E0043		EA	1	
71A		PUMP AND MOTOR ASSEMBLY, Distribution (MODEL ROWPU-1 ONLY) (97403) 13229E0190		EA	1	
72	4320-01-353-8422	PUMP AND MOTOR ASSEMBLY, Raw Water (97403) 13229E0045		EA	1	
73		PUMP ASSEMBLY, Raw Water Prime Assist (97403) 13229E0484				
74		ROPE ASSEMBLY, Anchor (97403) 13229E1161		EA	1	
75	2330-01-294-3367	SEMI-TRAILER, 22.5 Ton M871 AI		EA	1	
76	4610-01-345-6671	SEPARATOR ASSEMBLY, Left Hand (MODEL WTA-060 ONLY) (97403) 13229E0499		EA	1	
77	4610-01-345-6672	SEPARATOR ASSEMBLY, Right Hand (MODEL WTA-060 ONLY) (97403) 13229E0497		EA	1	■
77A	4610-01-472-4529	SEPARATOR ASSEMBLY (MODEL ROWPU-1 ONLY) (97403) 13229E0176		EA	1	■
78		SKID, Distribution Pump Assembly (97403) 13229E0016-1		EA	1	
79		SKID, Raw Water Pump Assembly (97403) 13229E0016-2		EA	1	

SECTION II. COMPONENTS OF END ITEM (Continued)



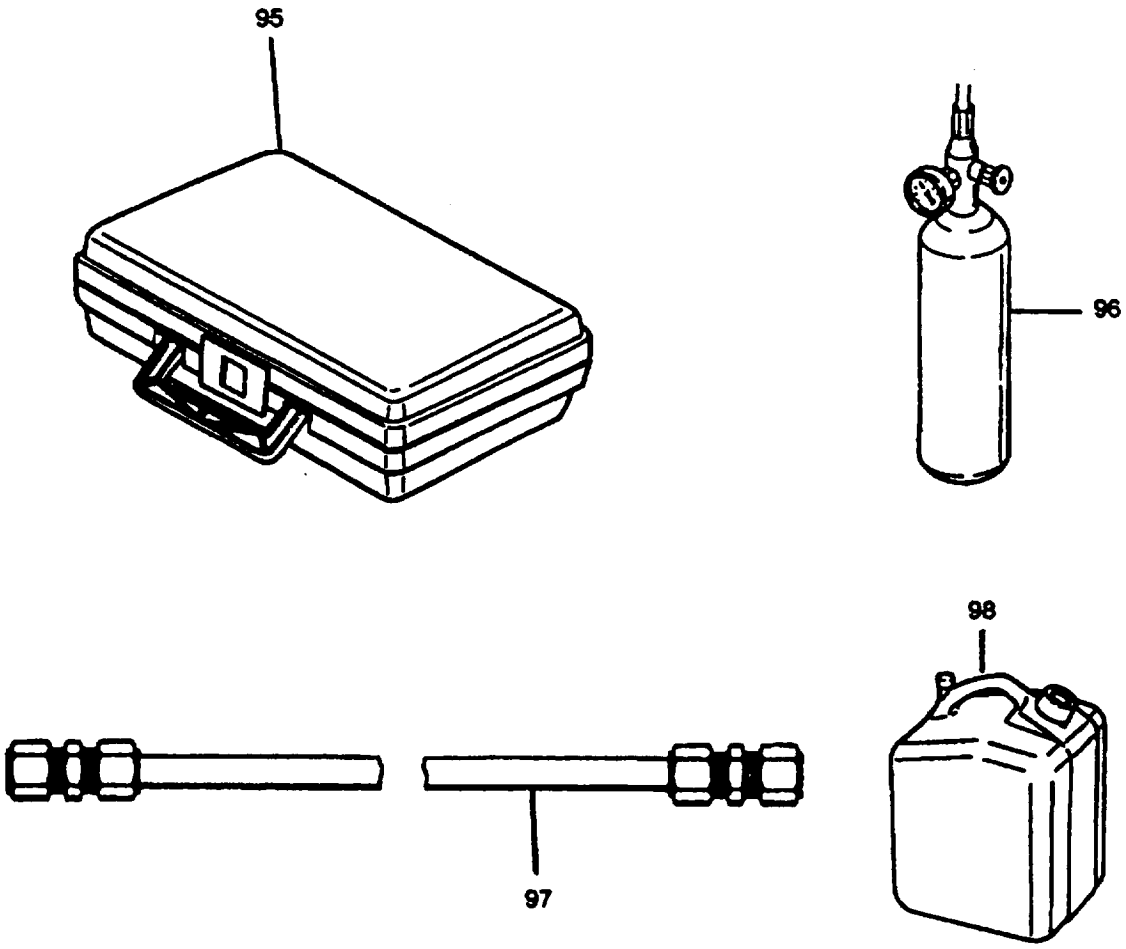
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
80		STOOL, Step (97403) 13229E0241		EA	1
81	5430-01-318-9434	STORAGE TANK (81349) 91038		EA	3
82		STRAINER, Intake, Ice Hole (97403) 13229E1069		EA	1
82A	4730-01-345-5781	STRAINER, Suction (Dolphin) (97403) 13229E1139		EA	1
83	5340-01-352-8190	STRAP, Eyewash Station (97403) 13229E1139		EA	1
84	5430-01-353-1961	STRAP, Access Ladder Tie Down, Padded (97403) 13229E1160-1		EA	2
85	5340-01-353-3579	STRAP, Tie Down, 95 in. (97403) 13229E1001-1		EA	1
86	5340-01-353-8241	STRAP, Tie Down, 72 in. (97403) 13229E1001-2		EA	1
87	5340-01-352-2840	STRAP, Tie Down, 80 in. (97403) 13229E1001-6		EA	2
88	5340-01-353-1308	STRAP, Tie Down, 83 in. (97403) 13229E1001-4		EA	1
89	5340-01-352-6427	STRAP, Tie Down, 104 in. (97403) 13229E1001-5		EA	1
90	5340-01-353-9483	STRAP, Tie Down, 120 in. (97403) 13229E1001-3		EA	4
91	5340-01-352-6428	STRAP, Tie Down, 38 in. (97403) 13229E1001-7		EA	2
91A	8030-00-889-3535	TAPE, Antiseizing, Size II (58536) A-A-58092-2-2		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



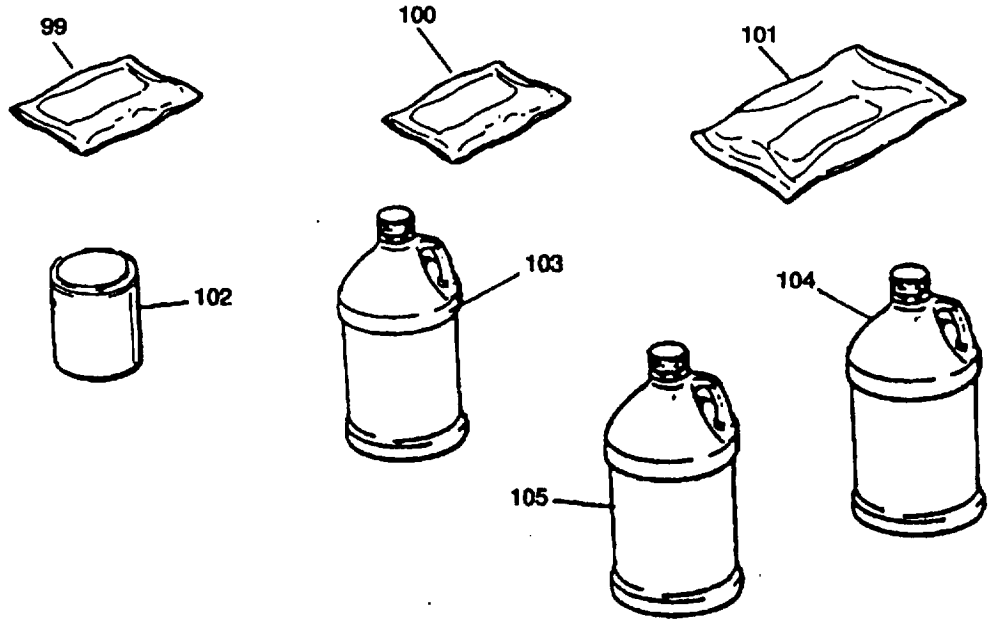
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
92		TEE, special, 2 in. x 2 in. x 3 in., Storage Tank (97403) 13229E1133		EA	1
93	6640-01-358-5340	TEST KIT, Available Chlorine (91224) 2254-01		EA	1
94	4610-01-349-8731	TEST KIT, Color (53390) 8946		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



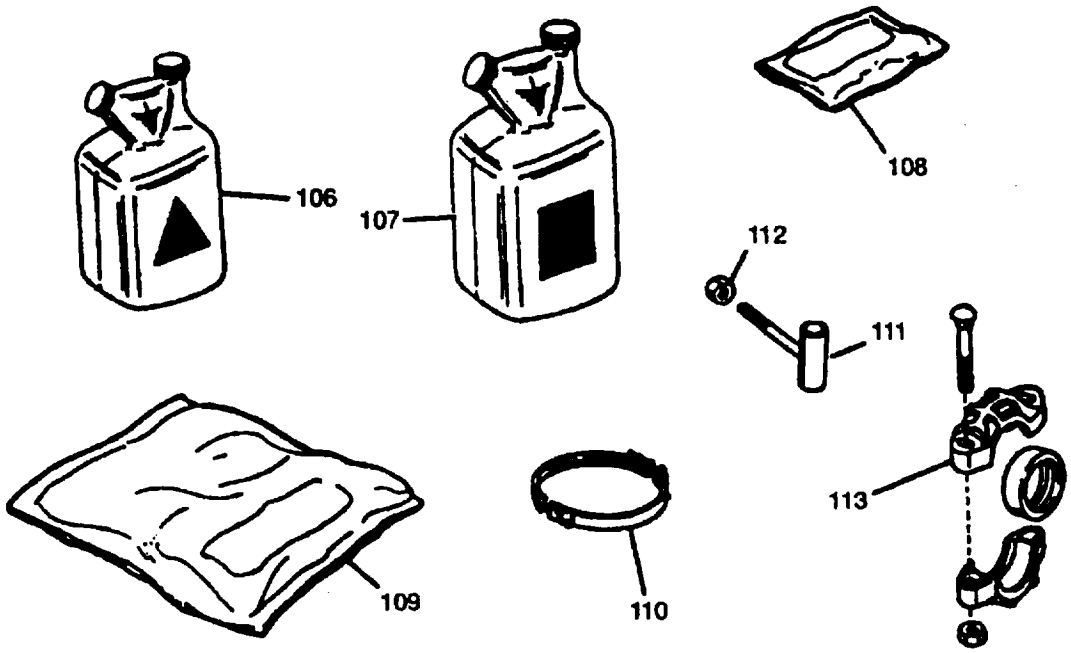
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
■ 95	6625-01-473-3742	TEST KIT, CO Monitor (97403) 13229E1334-5		EA	1
96		TEST KIT CYLINDER, CO Monitor (97403) 13229E1334-6		CYL	1
■ 97	4720-01-469-6933	TUBING, Jumper, Solenoid Valve (97403) 13229E1052		EA	1
98	7240-01-359-0910	WATER JUG, 5 Gal. (97403) 13229E1037		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



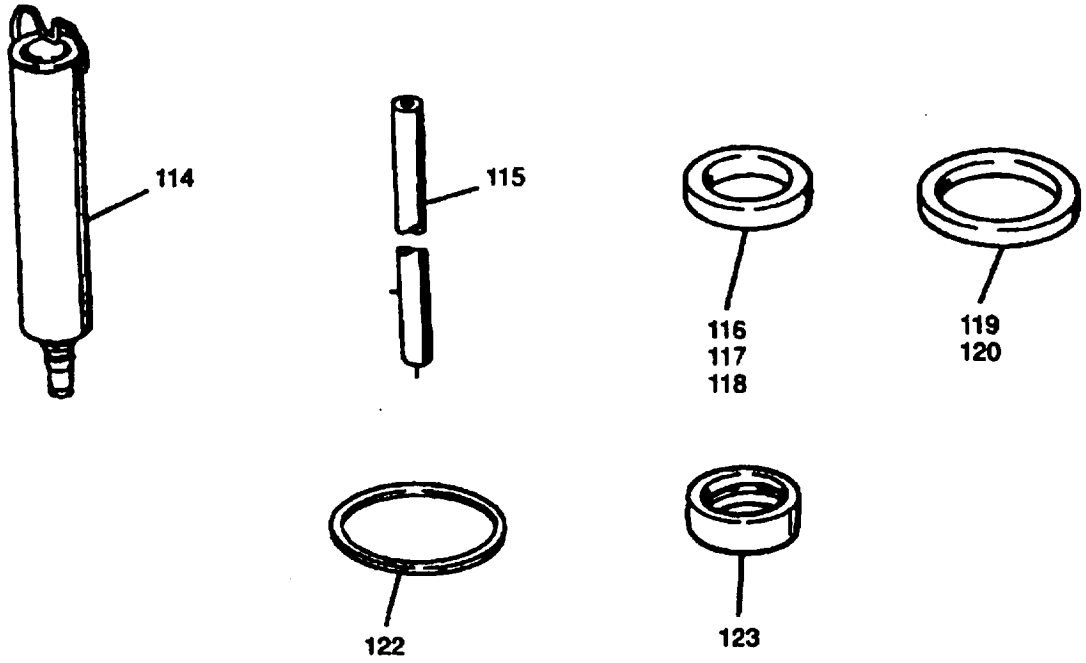
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
		CHEMICALS:			
99	6810-01-359-5011	ACID, Citric (97403) 13229E0956		PK	2
100	6840-01-267-4346	FUNGICIDE, Eyewash 4 oz Package (6M644) C2128		BOX	2
101	6810-01-358-4336	CALCIUM HYPOCHLORITE, lib (97403) 13229E0923		PK	50
102	6850-01-384-5083	DESICCANT, Indicator Type (MODEL WTA-060 ONLY) (97403) 13229E1351-2		CAN	1
103	6850-01-370-4209	DETERGENT, RO Element Cleaning (97403) 13229E0957		PK	1
104	6810-01-359-4919	GLYCERIN, 250 cc (97403) 13229E0172		BTL	1
105	6850-01-362-0945	NTP-A, RO Element Cleaner (97403) 13229E1228		PK	8

SECTION II. COMPONENTS OF END ITEM (Continued)



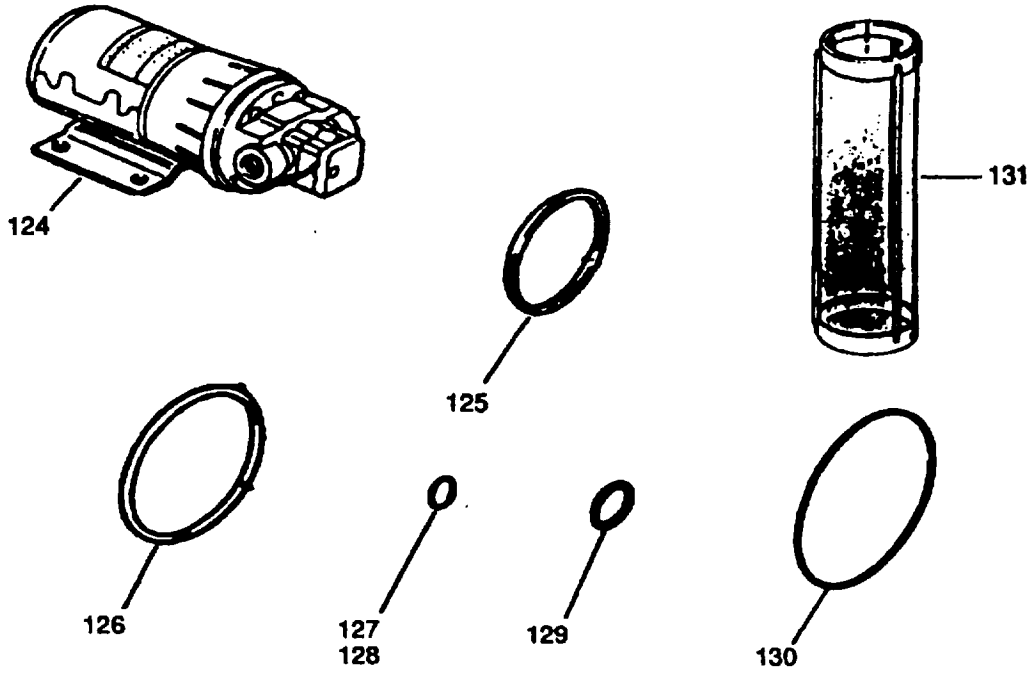
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
106	6850-01-369-7897	POLYELECTROLYTE, 625 cc (09647) 120-00707		BTL	5
107	6850-01-362-2182	SEQUESTRANT, 128 oz. (97403) 13229E0924		BTL	1
108	6810-01-359-4918	SODIUM BISULFITE, 32 oz. (97403) 13229E0922		PK	12
109	6810-01-408-6336	SODIUM BISULFITE, 2 oz. (97403) 13229E0958		PK	30
		ON BOARD SPARES:			
110		CLAMP, T-Bolt, Cartridge Filter (00624) MV86144-KJ-1316C		EA	2
111	5306-01-351-7744	COUPLING, T-Bolt, Cartridge Filter (00624) 56555AW125-500		EA	2
112	5310-01-353-2582	COUPLING NUT T-Bolt (00624) 56541A6C-C		EA	2
113	5340-01-346-7265	COUPLING, Pipe, Grooved, 1 1/2 in. (97403) 13229E0156-2		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



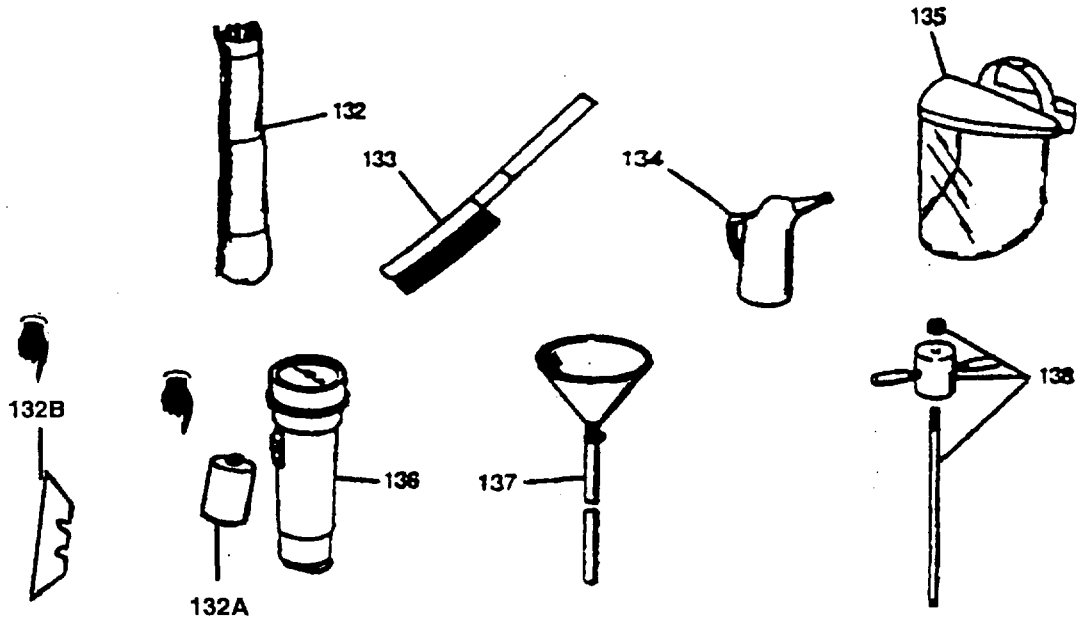
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
114	4330-01-350-9101	ELEMENT, Air Compressor, Air Filter, Supply Line (57328) 059183		EA	3
115	4330-01-350-9102	ELEMENT, Cartridge Filter (97403) 13229E0181		EA	140
116	5330-01-349-8922	GASKET, Cam and Groove, 112 in. (97403) 13229E0857-1		EA	2
117	5330-01-351-7666	GASKET, Cam and Groove, 1 in. (97403) 13229E0857-2		EA	2
118	5330-01-349-6190	GASKET, Cam and Groove, 3 in. (97403) 13229E0857-3		EA	4
119	5330-01-349-8921	GASKET, Coupling, 2 in. (97403) 13229E0857-4		EA	4
120	5330-01-349-6191	GASKET, Coupling, 2-1/2 in. (97403) 13229E0857-5		EA	4
121	Deleted				
122	5330-01-351-7679	GASKET, Flat, Basket Strainer 3.38 OD x 2.94 ID x .12 (OJR79) 3274-EO		EA	2
123	5330-01-349-8928	GASKET Victaulic, 1.5 in. (97403) 13229E0855-2	IPS	EA	4

SECTION II. COMPONENTS OF END ITEM (Continued)



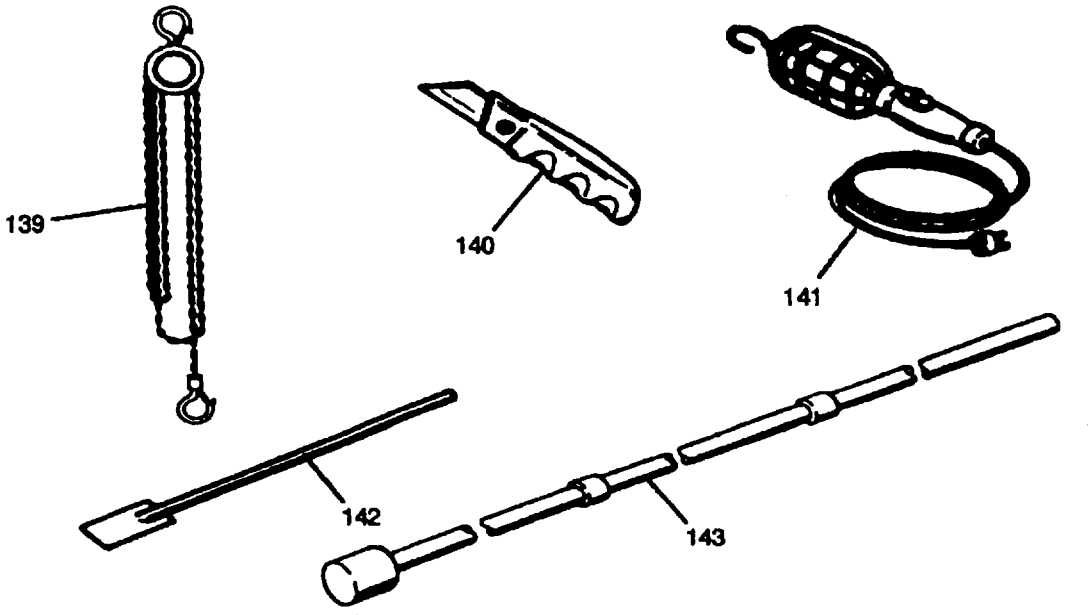
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
124		HYPOCHLORITE PUMP, Backwash (97403) 13229E1267		EA	1
125	5331-01-351-7615	PACKING, Preformed, Basket Strainer (OJR79) 3176-EO		EA	1
126	5331-01-352-1160	PACKING, Preformed, Cartridge Fitter (97403) 13229E0117		EA	1
127	5331-01-353-9383	PACKING, Preformed, RO Center Connector (63624) 80478		EA	10
128	5331-01-352-7478	PACKING, Preformed, RO End Adapter (64382) 6ER001-221		EA	8
129	5330-01-424-3761	PACKING, Preformed, RO End Adapter (64382) 6ER001-225		EA	16
130	5330-01-352-1980	PACKING, Preformed, RO End Cap (64382) 6ER002-442		EA	8
131	4730-01-351-3031	STRAINER OVERSCREEN (OJR79) 4135-8D		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



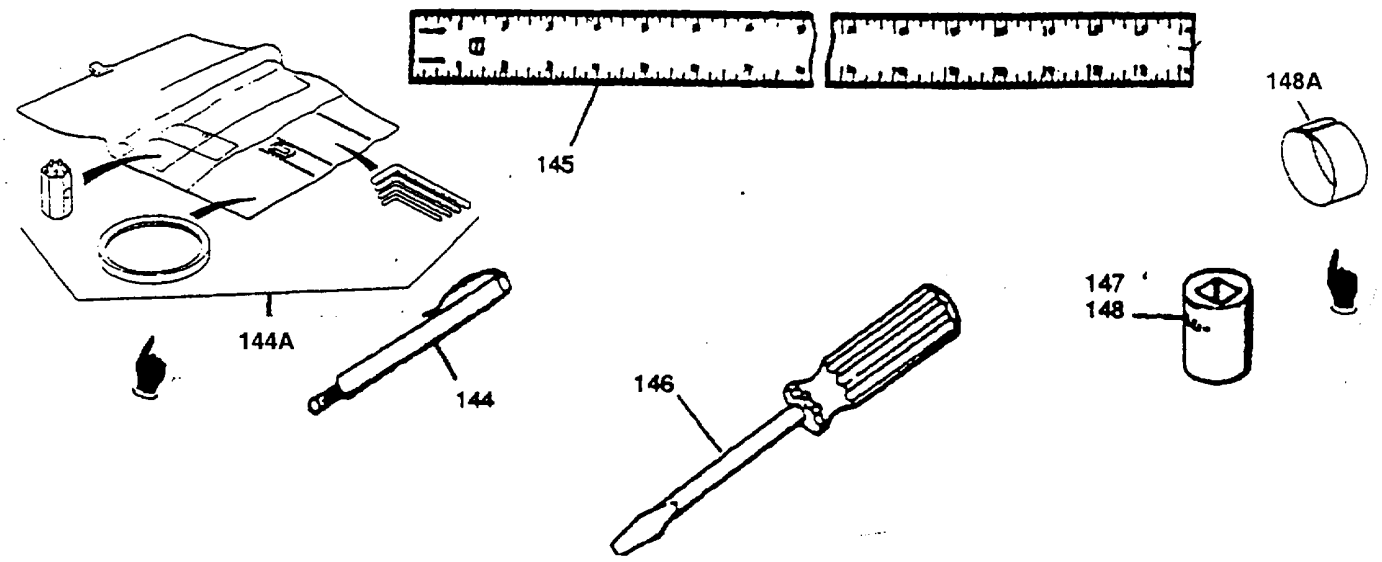
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
		TOOLS:			
132	4610-01-466-5268	BAG, Chain Hoist (97403) 13229E1345		EA	1
132A		BATTERY, Dry Alkaline (97403) 13229E1378-102		EA	2
132B	5110-00-293-2865	BLADE, Knife, 5 blades (19987) 11-5-HD		PK	1
133	7920-00-244-7431	BRUSH, Platers (97403) 13229E1009		EA	1
134	7240-01-359-0893	CAN, Priming Pitcher, 3 quart (97403) 13229E1036		EA	1
135	4240-01-239-2349	FACE SHIELD (77852) 38110		EA	1
136	6230-00-264-8261	FLASHLIGHT (21108) MX-991/U		EA	1
137		FUNNEL ASSEMBLY (97403) 13229E1049		EA	1
138	5120-01-013-1676	GROUND ROD HAMMER (45225) P74-144		EA	1

SECTION II. COMPONENTS OF END ITEM (Continued)



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
139	3950-01-354-1194	HOIST, Chain (97403) 13229E1377		EA	1
140	5110-00-892-5071	KNIFE, Utility with Spare Blades (80244) PD5110-00-892-5071		EA	1
141	6230-00-901-9755	LIGHT, Trouble, 50 ft. cable (88193) A23ROUGHSERVICE		EA	1
142	7330-00-782-3247	PADDLE, Stirring (15398) FOODPADDLE		EA	1
143		ELEMENT PUSHER (97403) 13229E0120		EA	1

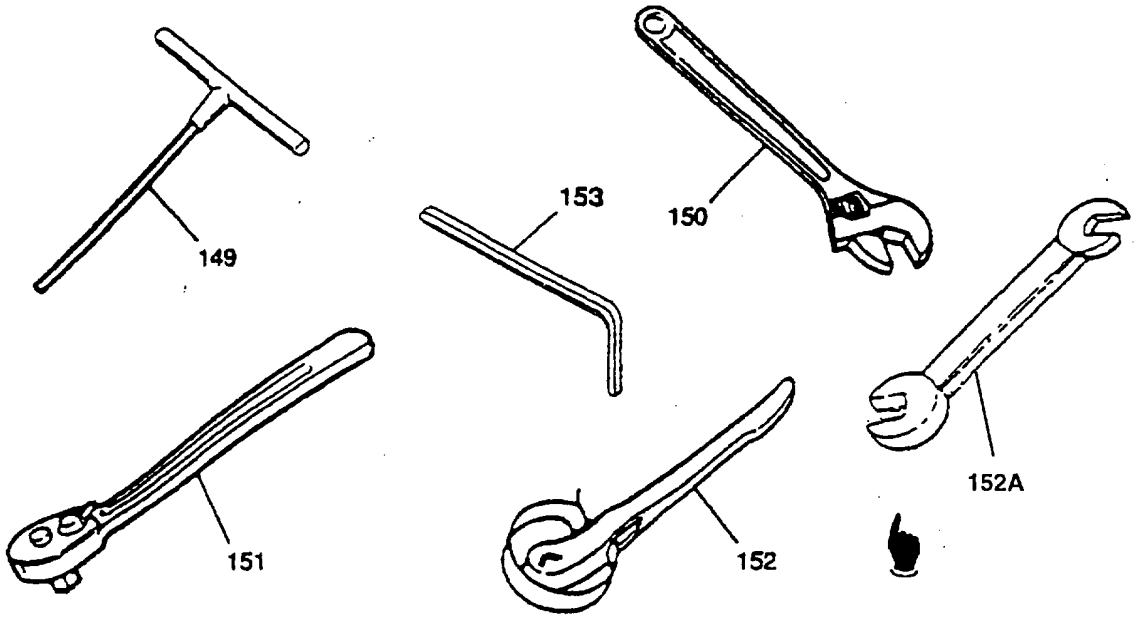
SECTION II. COMPONENTS OF END ITEM (Continued)



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
144	4910-01-353-3123	GAGE, Pressure, Pencil 20-120 psig (97403) 13229E1383		EA	1
144A	4310-01-355-6344	REPAIR KIT, Compressor (57328) PURUS-TOOL KIT Consisting of: 4 mm Wrench, 5 mm Wrench, 6 mm Wrench, 8 mm Wrench, Belt, List and Pouch		EA	1
145	5410-01-352-6612	RULE, 24" (97403) 13229E1048		EA	1
146	5120-01-367-3745	SCREWDRIVER, 6 in. Blade (55719) SDD6		EA	1
147	5120-01-335-0883	SOCKET, 3/8 Square Drive x 9/16 Hex (55719) SFS181		EA	1
148	5120-00-235-5809	SOCKET, 3/8 Square Drive x 7/8 Hex (58536) A-A-1403		EA	1
148A	4730-01-351-2985	SPACER, RO Vessel (64382) 407052-1		EA	4

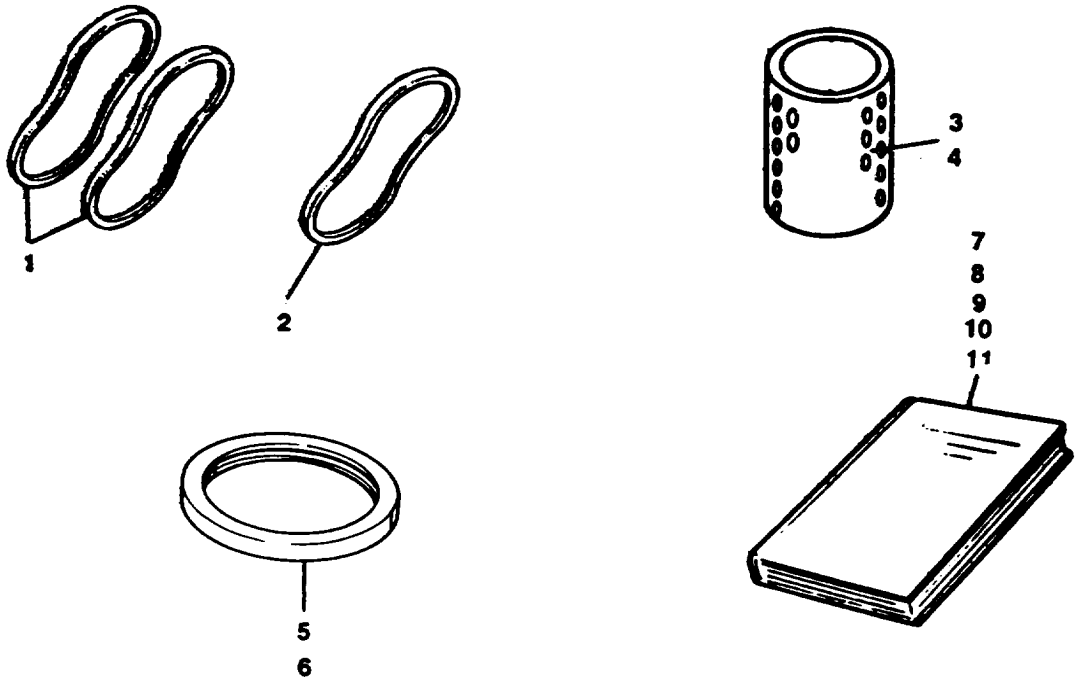
SECTION II. COMPONENTS OF END ITEM (Continued)

NOTE:
ITEM 148B
NOT SHOWN



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
148B		WIPES, Hand (97403) 13229E1135		EA	1
149	5120-00-798-2133	WRENCH, Hex Key 1/4 in. (80244) PD5120-00-798-2133		EA	1
150	5120-00-449-8083	WRENCH, Open End Adjustable (58536) A-A-2344		EA	1
151	5120-00-240-5364	WRENCH, Ratchet 3/8 in. (55719) F730		EA	1
152	5120-00-262-8491	WRENCH, Strap (95683) 41 W1853		EA	1
152A	5120-00-187-7126	WRENCH, Tool, Open End, 5/8 in. x 9/16 in. (80204) B107.6		EA	1
153	5120-00-224-2504	KEY, Socket Head Screw, 5/64 in. (MODEL ROWPU-1 ONLY) (88379) ARX 132-20		EA	1

SECTION III. BASIC ISSUE ITEMS



(1) Illus. Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code	(4) U/M	(5) Qty. Req.
1	3030-00-257-0727	BELTS, Generator Water Pump and Fan (Matched set)		EA	1
2	3030-00-630-0092	BELT, Generator Alternator		EA	1
3	2910-00-287-1912	ELEMENT, Generator Fuel Fitter		EA	2
4	2910-00-580-6283	ELEMENT, Generator Oil Filter (MS35802-3)		EA	1
5	5330-00-663-4773	GASKET, Generator Fuel Filter		EA	2
6	5330-00-740-6097	GASKET Generator Oil Filter		EA	1
		PUBLICATIONS:			
7		LO 10-4610-232-12 Water Purification Unit Reverse Osmosis, 3,000 GPH		EA	1
8		TM5-6115-5450-12 Genarator Set, Diesel Engine Driven, Tactical		EA	1
9		TM 5-5430-225-12&P Tank, Fabric, Collapsible, Air		EA	1
10		TM 9-2330-358-14&P Semitrailer, Tactical		EA	1
11		TM 10-4610-232-12 Water Purification Unit Reverse Osmosis, 3,000 GPH		EA	1

* U.S. GOVERNMENT PRINTING OFFICE: 1995-655-121/20192

APPENDIX D. ADDITIONAL AUTHORIZATION LIST

(NOT APPLICABLE)

APPENDIX E. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the ROWPU.

This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

E-2. EXPLANATION OF COLUMNS.

a. *Column (7) — Itern Number.* This number is assigned to the entry In the listing and is referened in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 14, App. E").

b. *Column 2 — Level.* This column identifies the lowest level of maintenance that requires the listed item

(Enter as applicable)

C — Operator/Crew
O — Organizational Maintenance
F — Direct Support Maintenance
H — General Support Maintenance

c. Column(3)— Nationa/Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. *Column (4) — Description.* Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parenthesis followed by the part number.

e. Column(5) — Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

SECTION II. EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	F		ADHESIVE, Neoprene (09647) P/N 120-02086	RL
2	F		ADHESIVE, Separator liner ( ) P/N 62-4939-4930-9(IPA)	RL
3	C	8415-00-222-8074	APRON, Chemical Protective, (97403) P/N 13229E0927	EA
4	C		BATTERY, Turbidity Meter, (97403) P/N 13229E0928	EA
5	C		BATTERY, TDS Meter (09647) P/N 120-00790-4	EA
6	C		BATTERY, Flashlight, D Size, 6A 3030/V (09647) P/N 120-01647	EA
7	C		BLADE, Utility Knife, 1 Pack, 5 ea. (09647) P/N 120-02056-002	PK
8	C		BOTTLE, Color Comparator (09647) P/N 120-00706	EA
9	C		CAULK (09647) P/N 120-01962	PK
			CHEMICALS, Operation	
10	C		ACID, Citric, 2 Packets, 2.5 Lbs. ea. (97403) P/N 13229E0956 (Shelf life 5 yrs.)	PK
11	C		BACTERIOSTATIC ADDITIVE, Eyewash, 2 Pk, 2 oz. ea. (97403) P/N 13229E1127	PK
12	C		CALCIUM HYPOCHLORITE, 50 Packets, 1 Lb. ea. (97403) P/N 13229E0923 (Shelf life indefinite)	PK
13	C		CARBON, Activated, 35 Lb. (97403) P/N 13229E0245	PK
14	C		CARBON MONOXIDE, (97403) P/N 13229E1334	BL
15	C		DETERGENT, RO Element Cleaning, 12 Lb. Pack (97403) P/N 13229E0952 (Shelf life indefinite)	LB
16	C		GLYCERIN, 250 CC Bottle, (97403) P/N 13229E0172 (Shelf life indefinite)	BL
17	C		METHYL PARAHYDROXYBENZOATE (97403) P/N 13229E2127 (Shelf life 2 yrs)	PK
18	C		NTP-A RO Element Cleaner, (97403) P/N 13229E1228 (Shelf life 5 yrs.)	PK
19	C		POLYELECTROLYTE, Type 1, 625 CC Bottle, Pack of 10, (Catfloc TL), (97403) P/N 13229E0921 (Shelf life 1 yr.)	PK
20	C		RESIN, Ion Exchange, 35 Lb. (Order to Govt. Spec. 0l12-79) (97403) (Shelf life 2 yrs.)	PK
21	C		SEQUESTRANT, 300 CC Bottle, Pack of 10, (AC-1000), (97403) P/N 13229E0924 (Shelf life 1 yr.)	PK
22	C		SODIUM BISULFITE (97403) P/N 13229E0922 (Shelf life indefinite)	PK
			CHEMICALS, Operation Test Kit (97403) P/N 13229E1328	
23	C		COLOR REAGENT, Color Test Kit (09647) P/N 120-02336 (Shelf life 1 yr.)	EA
24	C		SULFAMIC ACID REAGENT, Chlorine Test Kit (30053) P/N 2203 (Shelf life 1 yr.)	PK
25	C		SULFITE REAGENT, Chlorine Test Kit (30053) P/N 1055 (Shelf life 1 yr.)	PK
26	C		SODIUM THIOSULFATE, Chlorine Test Kit (30053) P/N 24085-37 (Shelf life 1 yr.)	BL
27	O	6850-00-941-5054	CLEANING COMPOUND, Solvent Fed. Spec. O-C-1889 (30053)	GL
28	O	5350-00-161-9066	CLOTH, Emery, Fine	PK
29	C		COLOR COLUMN, Color Test Kit (97403) P/N 13229E0231	EA
30	C		CUVETTE, Meter (09647) P/N 120-00783-004	PK
31	C		DESICCANT, Indicator Type, (97403) P/N 13229E1351	CN
32	C	6850-00-664-5685	DRY CLEANING SOLVENT, AA711, Types I and II	GL

SECTION II. EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST (Continued)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
33	C	6515-00-139-0483	EAR PLUG, Disposable, Box of 10	BX
34	C		ELEMENT, Air Compressor Filter, (97403) P/N 13229E0157	EA
35	C		ELEMENT, Cartridge Filter, (97403) P/N 13229E0181	PK
36	C		ELEMENT, Reverse Osmosis, (97403) P/N 13229E0213	EA
37	C		EYE DROPPER ( ) P/N 0219-01-5	EA
38	C		FLASK, Color Comparator ( ) P/N 6319-01-7	EA
39	O		FILTER, Compressor Inlet (09647) P/N 120-00719	EA
40	C		FILTER, Compressor Outlet, (97403) P/N 13229E0926	EA
41	O		FUSE, CO Monitor, 5 Amp (09647) P/N 120-01065-012	EA
42	C	9150-00-190-0904	GAA GREASE, Auto/Artillery, (81349) MIL-G-23827	LB
43	C		GLOVES, Chemical, (97403) P/N 13229E0925	EA
44	O		GRAVEL (09647) P/N 120-03006	
			Coarse, 35 Lb.	PK
			Fine, 35 Lb.	PK
45	O		INHIBITOR, Corrosion (09647) P/N 120-02051	GL
46	C	6230-00-264-8261	LAMP, Flashlight	EA
47	C		LAMP, Heat 500 watt, (97403) P/N 13229E1314	EA
48	C		LAMP, Incandescent, 100 Watt, (97403) P/N 13229E0209	EA
49	C		LAMP, Incandescent Indicator Light (09647) P/N 120-01635	EA
50	O		LAMP, Turbidity Meter (58177) P/N 51004	EA
51	C		LUBRICATING OIL, MIL-L-23398	GL
52	C	9150-00-181-9858	LUBRICATING OIL, Engine 0E30, (81349) MIL-L-2104	GL
53	O		MARKERS, Tubing (09647) P/N 120-02456	PK
54	O		MARKERS, Wire (09647) P/N 120-02433	PK
55	O		MEDIA, Coarse, 35 Lb. (09647) P/N 120-03003	PK
56	C		MEDIA, Fine, 35 Lb. (09647) P/N 120-03004	PK
57	C		PAPER, Looseleaf, 9-1/2 x 6 (09647) P/N 120-02050	PK
58	C	7920-00-205-1711	RAG, Wiping	LB
59	O		RIVETS (09647) P/N 120-01185	PK
60	C		SAND, Garnet, 35 Lb. (09647) P/N 120-03205	PK
61	C	5350-CO-61 9-9166	SANDPAPER, OD	PK
62	C		SEALANT, Pipe Thread, 0.25 in. wide (09647) P/N 120-01360	PK
63	O		SEALANT, Silicone (09647) P/N 120-01361	PK
64	O		SLEEVES, Tubing (09647) P/N 120-02456-40	RL
65	C	7930-00-282-9699	SOAP, GP, Liquid, A (81349) MIL-D-16791	GL
66	C		SILICONE LUBRICANT (09647) P/N 120-02508	PK
67	C	8030-00-889-3534	TAPE, Antiseize, (81349) MIL-T-27730	RL
68	C	5970-00-147-5674	TAPE, Electrical	RL
69	O		TAPE, Friction (09647) P/N 120-02439	RL
70	O		TERMINALS (96906) MS25036	PK
71	O		TIES, Wire/Tubing (96906) MS3367	PK
72	O	4020-00-138-7042	TWINE, Ball (81349) MIL-T-713	RL
73	O		VARNISH, Electrical (09647) P/N 120-01970	CN
74	O		WATER SEAL, Van (09647) P/N 120-01962	PK
75	O		W D 4 0 ( ) 4 2 0 6 0	PK
76	C		WIPES, Hand (09647) P/N 120-02112	BX

APPENDIX F. MANUFACTURED ITEMS LIST

Manufacturers items not applicable.

APPENDIX G. TORQUE LIMITS

Torque Limits for Dry Fasteners

SHANK SIZE		TORQUE					
		SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 8	
INCHES	MILLIMETERS	POUNDS FOOT	NEWTON METERS	POUNDS FOOT	NEWTON METERS	POUNDS FOOT	NEWTON METERS
1/4	6.35	5-6	6.8- 8.13	9-11	12.2- 14.9	12-15	16.3- 20.3
5/16	7.94	10-12	13.6- 16.3	17-20.5	23.1- 27.8	24-29	32.5- 39.3
3/8	9.53	20- 23	27.1- 31.2	35-42	47.5- 57.0	45- 54	61.0- 73.2
7/16	11.11	30- 35	40.7- 47.4	54-64	73.2- 86.8	70-84	94.9- 113.9
1/2	12.70	45- 52	61.0- 70.5	80-96	108.5- 130.2	110-132	149.2- 179.0
9/16	14.29	65- 75	88.1-101.6	110-132	149.2- 179.0	160-192	217.0- 260.4
5/8	15.88	95-105	128.7-142.3	150- 180	203.4- 244.1	220- 264	298.3- 358.0
3/4	19.05	150-185	203.3-250.7	270- 324	366.1- 439.3	380- 456	515.3- 518.3
7/8	22.23	160-200	216.8-271.0	400- 480	542.4- 650.9	600- 720	813.6- 976.3
1	25.40	250-300	338.8-406.5	580- 696	786.5- 943.8	900-1080	1220.4-1464.5
1-1/8	25.58	-	-	800- 880	1084.8-1193.3	1280-1440	1735.7-1952.8
1-1/4	31.75	-	-	1120-1240	1518.7-1681.4	1820-2000	2467.9-2712.0
1-3/8	34.93	-	-	1460-1680	1979.8-2278.1	2380-2720	3227.3-3688.3
1-1/2	38.10	-	-	1940-2200	2630.6-2983.2	3160-3560	4285.0-4827.4

Torque Limits for Wet Fasteners

SHANK SIZE		TORQUE					
		SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 8	
INCHES	MILLI-METERS	POUNDS FOOT	NEWTON METERS	POUNDS FOOT	NEWTON METERS	POUNDS FOOT	NEWTON METERS
1/4	6.35	4.5- 5.5	6.1- 7.5	8 - 10	10.8- 13.6	11 - 13.5	14.9- 18.3
5/16	7.94	9 - 11	12.2- 14.9	15 - 18.5	20.4- 25.1	21.5- 26	29.2- 35.3
3/8	9.53	18 - 20.5	24.4- 27.8	31.5- 38	42.8- 51.6	40.5- 48.5	55 - 65.9
7/16	11.11	27 - 31.5	36.7- 42.8	48.5- 57.5	65.9- 78.2	63 - 75.5	85.6- 102.6
1/2	12.70	40.5- 47	55 - 63.9	72 - 86.5	97.9- 117.6	99 - 119	134.6- 161.8
9/16	14.29	58.5- 67.5	79.5- 91.8	99 - 119.0	134.6- 161.8	144 - 173	195.8- 235.2
5/8	15.88	85.5- 94.5	116.2-128.5	135 - 162	183.6- 220.3	198 - 237.5	269.2- 323
3/4	19.05	135 -166.5	183.6-226.4	243 - 291.5	330.4- 396.4	342 - 410	465.1- 557.6
7/8	22.23	144 -180	195.8-224.8	360 - 432	489.6- 587.5	540 - 648	734.4- 881.2
1	25.40	225 -270	306 -367.2	522 -626	709.9- 851.3	810 - 972	1101.6-1321.9
1-1/8	25.58	-	-	720 - 792	979.2-1077.1	1152 -1296	1566.7-1762.5
1-1/4	31.75	-	-	1008 -1116	1370.8-1517.7	1638 -1800	2227.6-2448
1-3/8	34.93	-	-	1314 -1512	1787 -2056.3	2142 -2448	2430.3-3329.2
1-1/2	38.10	-	-	1746 -1980	2374.5-2692.8	2844 -3204	3867.8-4357.4

APPENDIX H. DATA LOG

H-1 . DATA LOG FORMS.

Three Data Log forms are included in the appendix. Forms should be kept in this manual and locally reproduced when more forms are needed.

DATA LOG, 3000 ROWPU

Serial No. _____ **Location:** _____

_____

		Meter Hours			RO Element Pressures						Vessel TDS				
Date	Time	HP Pump	Comp.	Prod Flow	In	Out	Water Temp.	Cart.Fltr NTU	Raw TDS	Comb. TDS	Top Isle	Top Wall	Bot. Isle	Bot. Wall	Comments

POLYELECTROLYTE

OPTIMIZATION LOG

Date: _____

Location: _____

Raw Water Turbidity _____

Speed Setting _____

Time	Stroke	Turbidity
	10	
	15	
	20	
	25	
	30	
	35	
	40	
	45	
	50	
	55	
	60	
	65	
	70	
	75	
	80	
	85	
	90	
	95	
	100	

MEDIA FILTER LOG
3000 ROWPU

Serial No. _____

Location: _____

Date	Time	TURBIDITIES		Backwash Note	PUMP SETTINGS	
		Raw	Filter		Stroke	Speed

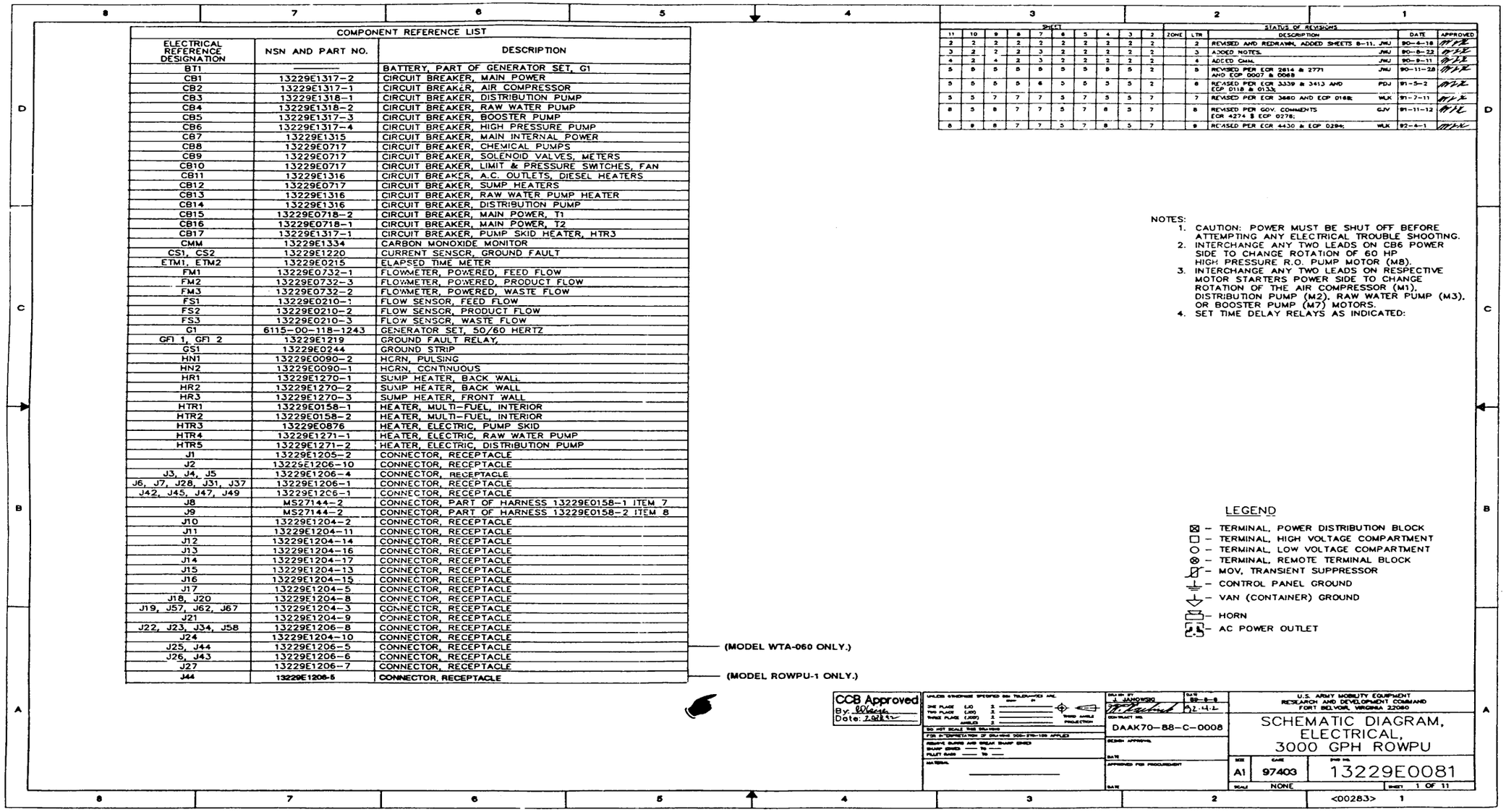
APPENDIX I. SCHEMATICS AND INTERCONNECTING DIAGRAMS

I-1. SCHEMATIC DIAGRAMS.

Pages FP-1 thru FP-22 are reproductions of schematic diagrams packed with the ROWPU.

I-2. INTERCONNECTION DIAGRAMS.

Pages FP-23 thru FP-52 are reproductions of interconnecting diagrams packed with the ROWPU.



COMPONENT REFERENCE LIST

ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION
BT1	———	BATTERY, PART OF GENERATOR SET, G1
CB1	13229E1317-2	CIRCUIT BREAKER, MAIN POWER
CB2	13229E1317-1	CIRCUIT BREAKER, AIR COMPRESSOR
CB3	13229E1318-1	CIRCUIT BREAKER, DISTRIBUTION PUMP
CB4	13229E1318-2	CIRCUIT BREAKER, RAW WATER PUMP
CB5	13229E1317-3	CIRCUIT BREAKER, BOOSTER PUMP
CB6	13229E1317-4	CIRCUIT BREAKER, HIGH PRESSURE PUMP
CB7	13229E1315	CIRCUIT BREAKER, MAIN INTERNAL POWER
CB8	13229E0717	CIRCUIT BREAKER, CHEMICAL PUMPS
CB9	13229E0717	CIRCUIT BREAKER, SOLENOID VALVES, METERS
CB10	13229E0717	CIRCUIT BREAKER, LIMIT & PRESSURE SWITCHES, FAN
CB11	13229E1316	CIRCUIT BREAKER, A.C. OUTLETS, DIESEL HEATERS
CB12	13229E0717	CIRCUIT BREAKER, SUMP HEATERS
CB13	13229E1316	CIRCUIT BREAKER, RAW WATER PUMP HEATER
CB14	13229E1316	CIRCUIT BREAKER, DISTRIBUTION PUMP
CB15	13229E0718-2	CIRCUIT BREAKER, MAIN POWER, T1
CB16	13229E0718-1	CIRCUIT BREAKER, MAIN POWER, T2
CB17	13229E1317-1	CIRCUIT BREAKER, PUMP SKID HEATER, HTR3
CMM	13229E1334	CARBON MONOXIDE MONITOR
CS1, CS2	13229E1220	CURRENT SENSOR, GROUND FAULT
ETM1, ETM2	13229E0215	ELAPSED TIME METER
FM1	13229E0732-1	FLOWMETER, POWERED, FEED FLOW
FM2	13229E0732-3	FLOWMETER, POWERED, PRODUCT FLOW
FM3	13229E0732-2	FLOWMETER, POWERED, WASTE FLOW
FS1	13229E0210-1	FLOW SENSOR, FEED FLOW
FS2	13229E0210-2	FLOW SENSOR, PRODUCT FLOW
FS3	13229E0210-3	FLOW SENSOR, WASTE FLOW
G1	6115-00-118-1243	GENERATOR SET, 50/60 HERTZ
GFI 1, GFI 2	13229E1219	GROUND FAULT RELAY,
GS1	13229E0244	GROUND STRIP
HN1	13229E0090-2	HORN, PULSING
HN2	13229E0090-1	HORN, CONTINUOUS
HR1	13229E1270-1	SUMP HEATER, BACK WALL
HR2	13229E1270-2	SUMP HEATER, BACK WALL
HR3	13229E1270-3	SUMP HEATER, FRONT WALL
HTR1	13229E0158-1	HEATER, MULTI-FUEL, INTERIOR
HTR2	13229E0158-2	HEATER, MULTI-FUEL, INTERIOR
HTR3	13229E0876	HEATER, ELECTRIC, PUMP SKID
HTR4	13229E1271-1	HEATER, ELECTRIC, RAW WATER PUMP
HTR5	13229E1271-2	HEATER, ELECTRIC, DISTRIBUTION PUMP
J1	13229E1205-2	CONNECTOR, RECEPTACLE
J2	13229E1206-10	CONNECTOR, RECEPTACLE
J3, J4, J5	13229E1206-4	CONNECTOR, RECEPTACLE
J6, J7, J28, J31, J37	13229E1206-1	CONNECTOR, RECEPTACLE
J42, J45, J47, J49	13229E1206-1	CONNECTOR, RECEPTACLE
J8	MS27144-2	CONNECTOR, PART OF HARNESS 13229E0158-1 ITEM 7
J9	MS27144-2	CONNECTOR, PART OF HARNESS 13229E0158-2 ITEM 8
J10	13229E1204-2	CONNECTOR, RECEPTACLE
J11	13229E1204-11	CONNECTOR, RECEPTACLE
J12	13229E1204-14	CONNECTOR, RECEPTACLE
J13	13229E1204-16	CONNECTOR, RECEPTACLE
J14	13229E1204-17	CONNECTOR, RECEPTACLE
J15	13229E1204-13	CONNECTOR, RECEPTACLE
J16	13229E1204-15	CONNECTOR, RECEPTACLE
J17	13229E1204-5	CONNECTOR, RECEPTACLE
J18, J20	13229E1204-8	CONNECTOR, RECEPTACLE
J19, J57, J62, J67	13229E1204-3	CONNECTOR, RECEPTACLE
J21	13229E1204-9	CONNECTOR, RECEPTACLE
J22, J23, J34, J58	13229E1206-8	CONNECTOR, RECEPTACLE
J24	13229E1204-10	CONNECTOR, RECEPTACLE
J25, J44	13229E1206-5	CONNECTOR, RECEPTACLE (MODEL WTA-060 ONLY.)
J26, J43	13229E1206-6	CONNECTOR, RECEPTACLE
J27	13229E1206-7	CONNECTOR, RECEPTACLE
J44	13229E1206-5	CONNECTOR, RECEPTACLE (MODEL ROWPU-1 ONLY.)

SHEET											STATUS OF REVISIONS			
11	10	9	8	7	6	5	4	3	2	ZONE	LTR	DESCRIPTION	DATE	APPROVED
2	2	2	2	2	2	2	2	2	2		2	REVISED AND REDRAWN, ADDED SHEETS 8-11. JWJ	90-4-18	
3	2	2	2	3	2	2	2	2	2		3	ADDED NOTES. JWJ	90-8-22	
4	2	4	2	3	2	2	2	2	2		4	ADDED CMM. JWJ	90-9-11	
5	5	5	5	5	5	5	5	5	2		5	REVISED PER ECR 2814 & 2771 AND ECP 0007 & 0068 JWJ	90-11-28	
5	5	5	5	6	5	5	5	5	2		6	REVISED PER ECR 3339 & 3413 AND ECP 0118 & 0133 PDJ	91-5-2	
5	5	7	7	7	5	7	5	5	7		7	REVISED PER ECR 3680 AND ECP 0168; WLK	91-7-11	
8	5	8	7	7	5	7	8	5	7		8	REVISED PER GOV. COMMENTS ECR 4274 & ECP 0278. GJV	91-11-12	
8	8	8	7	7	5	7	8	5	7		8	REVISED PER ECR 4430 & ECP 0284; WLK	92-4-1	

NOTES:
1. CAUTION: POWER MUST BE SHUT OFF BEFORE ATTEMPTING ANY ELECTRICAL TROUBLE SHOOTING.
2. INTERCHANGE ANY TWO LEADS ON CB6 POWER SIDE TO CHANGE ROTATION OF 60 HP HIGH PRESSURE R.O. PUMP MOTOR (M8).
3. INTERCHANGE ANY TWO LEADS ON RESPECTIVE MOTOR STARTERS POWER SIDE TO CHANGE ROTATION OF THE AIR COMPRESSOR (M1), DISTRIBUTION PUMP (M2), RAW WATER PUMP (M3), OR BOOSTER PUMP (M7) MOTORS.
4. SET TIME DELAY RELAYS AS INDICATED:

LEGEND
- ⊠ – TERMINAL, POWER DISTRIBUTION BLOCK
- □ – TERMINAL, HIGH VOLTAGE COMPARTMENT
- ○ – TERMINAL, LOW VOLTAGE COMPARTMENT
- ⊗ – TERMINAL, REMOTE TERMINAL BLOCK
- – MOV, TRANSIENT SUPPRESSOR
- – CONTROL PANEL GROUND
- – VAN (CONTAINER) GROUND
- – HORN
- – AC POWER OUTLET

CCB Approved
By: [illegible]
Date: 7 Oct 92

DAAK70-88-C-0008

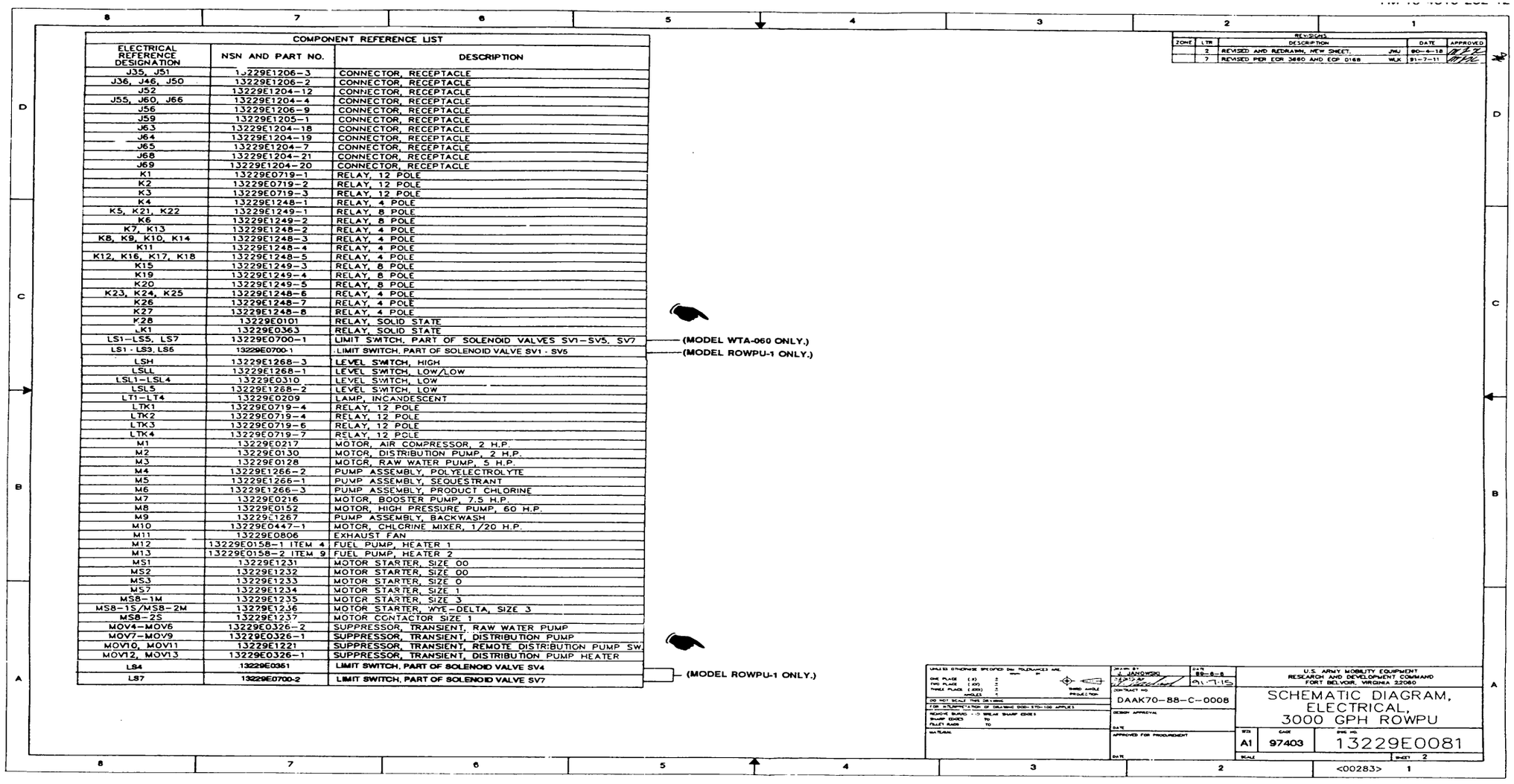
U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22080

SCHEMATIC DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE	CAGE	DWG NO.
A1	97403	13229E0081
SCALE NONE		SHEET 1 OF 11

<00283> 1

Figure FO-1 (Sheet 1 of 11) FP-1/(FP-2 blank)
Change 7



COMPONENT REFERENCE LIST

ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	
J35, J51	13229E1206-3	CONNECTOR, RECEPTACLE	
J36, J46, J50	13229E1206-2	CONNECTOR, RECEPTACLE	
J52	13229E1204-12	CONNECTOR, RECEPTACLE	
J55, J60, J66	13229E1204-4	CONNECTOR, RECEPTACLE	
J56	13229E1206-9	CONNECTOR, RECEPTACLE	
J59	13229E1205-1	CONNECTOR, RECEPTACLE	
J63	13229E1204-18	CONNECTOR, RECEPTACLE	
J64	13229E1204-19	CONNECTOR, RECEPTACLE	
J65	13229E1204-7	CONNECTOR, RECEPTACLE	
J68	13229E1204-21	CONNECTOR, RECEPTACLE	
J69	13229E1204-20	CONNECTOR, RECEPTACLE	
K1	13229E0719-1	RELAY, 12 POLE	
K2	13229E0719-2	RELAY, 12 POLE	
K3	13229E0719-3	RELAY, 12 POLE	
K4	13229E1248-1	RELAY, 4 POLE	
K5, K21, K22	13229E1249-1	RELAY, 8 POLE	
K6	13229E1249-2	RELAY, 8 POLE	
K7, K13	13229E1248-2	RELAY, 4 POLE	
K8, K9, K10, K14	13229E1248-3	RELAY, 4 POLE	
K11	13229E1248-4	RELAY, 4 POLE	
K12, K16, K17, K18	13229E1248-5	RELAY, 4 POLE	
K15	13229E1249-3	RELAY, 8 POLE	
K19	13229E1249-4	RELAY, 8 POLE	
K20	13229E1249-5	RELAY, 8 POLE	
K23, K24, K25	13229E1248-6	RELAY, 4 POLE	
K26	13229E1248-7	RELAY, 4 POLE	
K27	13229E1248-8	RELAY, 4 POLE	
K28	13229E0101	RELAY, SOLID STATE	
LK1	13229E0363	RELAY, SOLID STATE	
LS1-LS5, LS7	13229E0700-1	LIMIT SWITCH, PART OF SOLENOID VALVES SV1-SV5, SV7	(MODEL WTA-060 ONLY.)
LS1 - LS3, LS6	13229E0700-1	LIMIT SWITCH, PART OF SOLENOID VALVE SV1 - SV5	(MODEL ROWPU-1 ONLY.)
LSH	13229E1268-3	LEVEL SWITCH, HIGH	
LSLL	13229E1268-1	LEVEL SWITCH, LOW/LOW	
LSL1-LSL4	13229E0310	LEVEL SWITCH, LOW	
LSL5	13229E1268-2	LEVEL SWITCH, LOW	
LT1-LT4	13229E0209	LAMP, INCANDESCENT	
LTK1	13229E0719-4	RELAY, 12 POLE	
LTK2	13229E0719-4	RELAY, 12 POLE	
LTK3	13229E0719-6	RELAY, 12 POLE	
LTK4	13229E0719-7	RELAY, 12 POLE	
M1	13229E0217	MOTOR, AIR COMPRESSOR, 2 H.P.	
M2	13229E0130	MOTOR, DISTRIBUTION PUMP, 2 H.P.	
M3	13229E0128	MOTOR, RAW WATER PUMP, 5 H.P.	
M4	13229E1266-2	PUMP ASSEMBLY, POLYELECTROLYTE	
M5	13229E1266-1	PUMP ASSEMBLY, SEQUESTRANT	
M6	13229E1266-3	PUMP ASSEMBLY, PRODUCT CHLORINE	
M7	13229E0216	MOTOR, BOOSTER PUMP, 7.5 H.P.	
M8	13229E0152	MOTOR, HIGH PRESSURE PUMP, 60 H.P.	
M9	13229E1267	PUMP ASSEMBLY, BACKWASH	
M10	13229E0447-1	MOTOR, CHLORINE MIXER, 1/20 H.P.	
M11	13229E0806	EXHAUST FAN	
M12	13229E0158-1 ITEM 4	FUEL PUMP, HEATER 1	
M13	13229E0158-2 ITEM 9	FUEL PUMP, HEATER 2	
MS1	13229E1231	MOTOR STARTER, SIZE 00	
MS2	13229E1232	MOTOR STARTER, SIZE 00	
MS3	13229E1233	MOTOR STARTER, SIZE 0	
MS7	13229E1234	MOTOR STARTER, SIZE 1	
MS8-1M	13229E1235	MOTOR STARTER, SIZE 3	
MS8-1S/MS8-2M	13279E1236	MOTOR STARTER, WYE-DELTA, SIZE 3	
MS8-2S	13229E1237	MOTOR CONTACTOR SIZE 1	
MOV4-MOV6	13229E0326-2	SUPPRESSOR, TRANSIENT, RAW WATER PUMP	
MOV7-MOV9	13229E0326-1	SUPPRESSOR, TRANSIENT, DISTRIBUTION PUMP	
MOV10, MOV11	13229E1221	SUPPRESSOR, TRANSIENT, REMOTE DISTRIBUTION PUMP SW.	
MOV12, MOV13	13229E0326-1	SUPPRESSOR, TRANSIENT, DISTRIBUTION PUMP HEATER	
LS4	13229E0361	LIMIT SWITCH, PART OF SOLENOID VALVE SV4	
LS7	13229E0700-2	LIMIT SWITCH, PART OF SOLENOID VALVE SV7	(MODEL ROWPU-1 ONLY.)

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED
	2	REVISED AND REDRAWN, NEW SHEET. JNJ	90-6-18	
	7	REVISED PER ECR 3480 AND ECP 0168 WLK	91-7-11	

DAAK70-88-C-0008

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

SCHEMATIC DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 | CAGE 97403 | DWG NO. 13229E0081 | SHEET 2

<00283>

Figure FO-1 (Sheet 2 of 11) FP-3/(FP-4 blank)
Change 7

AQUA-CHEM PART NUMBER	COMPONENT REFERENCE LIST ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION
120-01153-1	MOV14, MOV15	13229E0326-1	SUPPRESSOR, TRANSIENT, RAW WATER PUMP HEATER
120-01153-1	MOV16-MOV21	13229E0326-1	SUPPRESSOR, TRANSIENT, HIGH PRESSURE PUMP
120-01153-1	MOV22-MOV24	13229E0326-1	SUPPRESSOR, TRANSIENT, AIR COMPRESSOR
120-01153-1	MOV25-MOV27	13229E0326-1	SUPPRESSOR, TRANSIENT, PUMP SKID HEATER (HTR3)
120-02315-14	P1	13229E1207-14	CONNECTOR, PLUG
120-02315-13	P2	13229E1207-13	CONNECTOR, PLUG
120-02315-5	P3, P4, P5	13229E1207-5	CONNECTOR, PLUG
120-02315-1	P6, P7, P28, P31	13229E1207-1	CONNECTOR, PLUG
120-02315-1	P32, P37, P42	13229E1207-1	CONNECTOR, PLUG
120-02315-1	P45, P47, P49	13229E1207-1	CONNECTOR, PLUG
120-02315-1	P53, P54, P61	13229E1207-1	CONNECTOR, PLUG
120-00682-4	P8	MS27142-2	CONNECTOR, PART OF FUEL PUMP 13229E0158-1 ITEM 4
120-00682-9	P9	MS27142-2	CONNECTOR, PART OF FUEL PUMP 13229E0158-2 ITEM 9
120-0215-4	P10	13229E1207-4	CONNECTOR, PLUG
120-02316-7	P11	13229E1208-7	CONNECTOR, PLUG
120-02316-9	P12	13229E1208-9	CONNECTOR, PLUG
120-02316-11	P13	13229E1208-11	CONNECTOR, PLUG
120-02316-13	P14	13229E1208-13	CONNECTOR, PLUG
120-02316-8	P15	13229E1208-8	CONNECTOR, PLUG
120-02316-10	P16	13229E1208-10	CONNECTOR, PLUG
120-02316-3	P17	13229E1208-3	CONNECTOR, PLUG
120-02316-4	P18	13229E1208-4	CONNECTOR, PLUG
120-02316-1	P19, P67	13229E1208-1	CONNECTOR, PLUG
120-02316-4	P20	13229E1208-4	CONNECTOR, PLUG
120-02315-9	P22, P23, P34	13229E1207-9	CONNECTOR, PLUG
120-02315-9	P57, P58, P62	13229E1207-9	CONNECTOR, PLUG
120-02315-15	P24	1322901207-15	CONNECTOR, PLUG
120-02315-6	P25, P44	13229E1207-6	CONNECTOR, PLUG
120-02315-7	P26, P43	13229E1207-7	CONNECTOR, PLUG
120-02315-8	P27	13229E1207-8	CONNECTOR, PLUG
120-02315-16	P29	13229E1207-16	CONNECTOR, PLUG
120-02315-12	P30	13229E1207-12	CONNECTOR, PLUG
120-07549-4	P33, P38-P41, P48	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1
120-02315-3	P35, P51	13229E1207-3	CONNECTOR, PLUG
120-02315-2	P36, P46, P50	13229E1207-2	CONNECTOR, PLUG
120-02316-12	P52	13229E1208-12	CONNECTOR, PLUG
120-02315-10	P55, P56, P60	13229E1207-10	CONNECTOR, PLUG
120-02315-11	P59	13229E1207-11	CONNECTOR, PLUG
120-02316-16	P63	13229E1208-16	CONNECTOR, PLUG
120-02316-17	P64	13229E1208-17	CONNECTOR, PLUG
120-02316-6	P65	13229E1208-6	CONNECTOR, PLUG
120-02316-2	P66	13229E1208-2	CONNECTOR, PLUG
120-02316-15	P68	13229E1208-15	CONNECTOR, PLUG
120-02316-14	P69	13229E1208-14	CONNECTOR, PLUG
120-07622	PB1, PB6, PB8	13229E0733	PUSHBUTTON SWITCH
120-07622	PB11, PB13	13229E0733	PUSHBUTTON SWITCH
120-02377-1	PB2, PB7, PB9	13229E1242-1	PUSHBUTTON SWITCH
120-02377-1	PB12, PB14	13229E1242-1	PUSHBUTTON SWITCH
120-00352	PB3	13229E0108	PUSHBUTTON SWITCH
120-02379	PB4	13229E1244	PUSHBUTTON SWITCH
120-02378	PB5, PB17	13229E1243	PUSHBUTTON SWITCH
120-07624	PB10, PB16	13229E0735	PUSHBUTTON SWITCH
120-07624	PB19, PB20	13229E0735	PUSHBUTTON SWITCH
120-02377-2	PB15, PB18	13229E1242-2	PUSHBUTTON SWITCH
120-07620-1	PL1, PL4. PL23-PL25	13229E0731-1	PILOT LIGHT
120-07620-1	PL27-PL29	13229E0731-1	PILOT LIGHT
120-07620-3	PL2, PL3, PL5-PL11	13229E0731-3	PILOT LIGHT
120-07620-3	PL20	13229E0731-3	PILOT LIGHT
120-07620-4	PL12-PL19	13229E0731-4	PILOT LIGHT
120-07620-2	PL21, PL22	13229E0731-2	PILOT LIGHT
120-07620-2	PL26, PL30	13229E0731-2	PILOT LIGHT
120-07615	PRA, PRB, PRC	13229E0730	POWER RESISTOR, FIXED RESISTANCE
120-00337	PDB	13229E0098	POWER DISTRIBUTION BLOCK
120-02316-5	P21	13229E1208-5	CONNECTOR, PLUG
120-02315-6	P44	13229E1207-6	CONNECTOR, PLUG

(MODEL WTA-060 ONLY.)

(MODEL ROWPU-1 ONLY.)

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	2	REVISED AND REDRAWN, NEW SHEET. JWJ	90-4-18	
	5	REVISED PER ECR 2771 AND ECP 0068) WLK	90-11-28	

DRAWN BY: JANOWSKI — DATE: 89-6-8
CHECKED BY: — 90/5/23
CONTRACT NO: DAAK70-88-C-0008
DESIGN APPROVAL
APPROVED FOR PROCUREMENT
DO NOT SCALE THIS DRAWING
THIRD ANGLE PROJECTION

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

SCHEMATIC DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 — CAGE 97403 — DWG NO. 13229E0081 — SHEET 3

Figure FO-1 (Sheet 3 of 11)

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	2	REVISED AND REDRAWN, NEW SHEET. JMU	90-4-18	
	5	REVISED PER ECR 2814 & 2771 AND ECP 0007 & 0088 JMU	90-11-26	
	8	REVISED PER GOV. COMMENTS; REVISED COMPONENT REF. LIST FOR 120-02180 GJV	91-11-12	

COMPONENT REFERENCE LIST

ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION
PL21, PL22	13229E0731-2	PILOT LIGHT
PL26, PL30	13229E0731-2	PILOT LIGHT
PRA, PRB, PRC	13229E0730	POWER RESISTOR, FIXED RESISTANCE
PDB	13229E0C98	POWER DISTRIBUTION BLOCK
PDSH1, PDSH3	13229E0105-2	PRESSURE DIFFERENTIAL SWITCH
PDSH2	13229E0105-1	PRESSURE DIFFERENTIAL SWITCH
PSH5	13229E0104	PRESSURE SWITCH (HIGH)
PSH6	13229E0106	PRESSURE SWITCH (HIGH)
PSH7	13229E0107	PRESSURE SWITCH (HIGH)
PSL4	13229E0106-1	PRESSURE SWITCH (LOW)
PSL8	13229E1115	PRESSURE SWITCH (LOW)
PS1	13229E0754	POWER SUPPLY, 12VDC
PS2	13229E1176	POWER SUPPLY, 28VDC
PSK1	13229E1218	POWER SUPPLY, 9VDC
R1, R2	MIL-R-39008/4E	RESISTOR, GROUND, 1.1 MEG
SR2, SR4	13229E0151-2	RECEPTACLE, 120VAC, EXTERIOR
SR5, SR6	13229E0151-1	RECEPTACLE, 120VAC, INTERIOR
SR7	13229E0597	RECEPTACLE, 120VAC, PLUG
SR9	13229E0187	RECEPTACLE, 120VAC, DUPLEX
SS1	13229E0503	SELECTOR SWITCH, 2 POSITION
SS2	13229E1245	SELECTOR SWITCH, 2 POSITION
SS3	13229E1247	SELECTOR SWITCH, 3 POSITION
SS4, SS5, SS7, SS8	13229E0736	SELECTOR SWITCH, 2 POSITION
SS6	13229E1246	SELECTOR SWITCH, 2 POSITION
SV1-SV5, SV7	13229E0700-1	SOLENOID VALVE
SV6	13229E0700-2	SOLENOID VALVE
SV1 - SV3, SV5	13229E0700-1	SOLENOID VALVE
SV7	13229E0700-2	SOLENOID VALVE
SV8	13229E1269-3	SOLENOID VALVE ASSEMBLY
SV9	13229E1269-1	SOLENOID VALVE ASSEMBLY
SV10	13229E0445	SOLENOID VALVE ASSEMBLY
T1	13229E0716	TRANSFORMER, 3KVA
T2	13229E0840	TRANSFORMER, 5KVA
TB1-1 THRU -91	13229E0093-1	TERMINAL, 15 AMP
TB1-92 THRU -99	13229E0094-2	TERMINAL, GROUND, 20 AMP
TB2-1 THRU -5	13229E0093-1	TERMINAL, 15 AMP
TB3-1 THRU -22	13229E0093-2	TERMINAL, 20 AMP
TB3-23 THRU -25	13229E0094-2	TERMINAL, GROUND, 20 AMP
TB4-1, TB4-5	13229E0093-1	TERMINAL, 15 AMP
TB4-2 THRU -4	13229E0094-1	TERMINAL, GROUND, 15 AMP
TB5-1 THRU -12	13229E0093-1	TERMINAL, 15 AMP
TB5-13 THRU -15	13229E0094-1	TERMINAL, GROUND, 15 AMP
TB6-1 THRU -16	13229E0093-1	TERMINAL, 15 AMP
TB6-17, TB6-18	13229E0094-1	TERMINAL, GROUND, 15 AMP
TB7-1 THRU -13	13229E0093-1	TERMINAL, 15 AMP
TB7-14	13229E0094-1	TERMINAL, GROUND, 15 AMP
TBM	13229E0289	TURBIDITY METER
TDK1	13229E0109	TIMER, CYCLE
TDK2	13229E0720-3	RELAY, TIME DELAY
TDK3, TDK4	13229E0720-2	RELAY, TIME DELAY
TDK5	13229E0720-1	RELAY, TIME DELAY
TDS	13229E0413	TOTAL DISSOLVED SOLIDS METER (CONDUCTIVITY)
TDSS	13229E0387	TOTAL DISSOLVED SOLIDS SENSOR (CONDUCTIVITY)
SV4	13229E0361	SOLENOID
ST1	MS24523-27	SWITCH, TOGGLE, SP (ON) - OFF - (ON)

(MODEL WTA-060 ONLY.) — SV1-SV5, SV7; SV6

(MODEL ROWPU-1 ONLY.) — SV1 - SV3, SV5; SV7

(MODEL WTA-060 ONLY.) — TBM through TDSS

(MODEL ROWPU-1 ONLY.) — SV4; ST1

DRAWN BY J. JANOWSKI DATE 89-6-8
CHECKED BY DATE 91-11-18
CONTRACT NO. DAAK70-88-C-0008
DESIGN APPROVAL
APPROVED FOR PROCUREMENT

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

SCHEMATIC DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 CAGE 97403 DWG NO. 13229E0081

SHEET 4

<00283>

Figure FO-1 (Sheet 4 of 11)

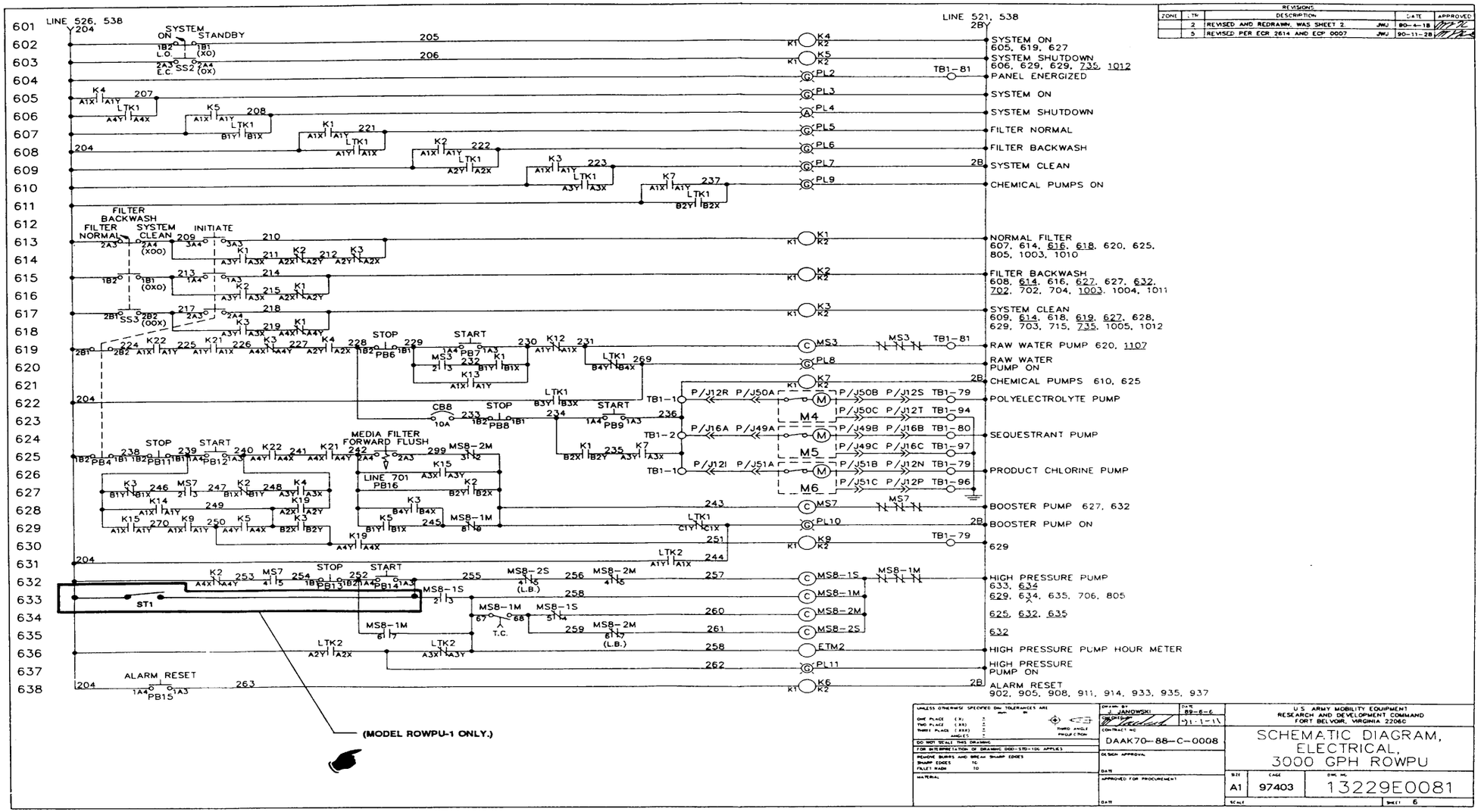


Figure FO-1 (Sheet 5 of 11)
Change 7 FP-1 1/(FP-12 blank)

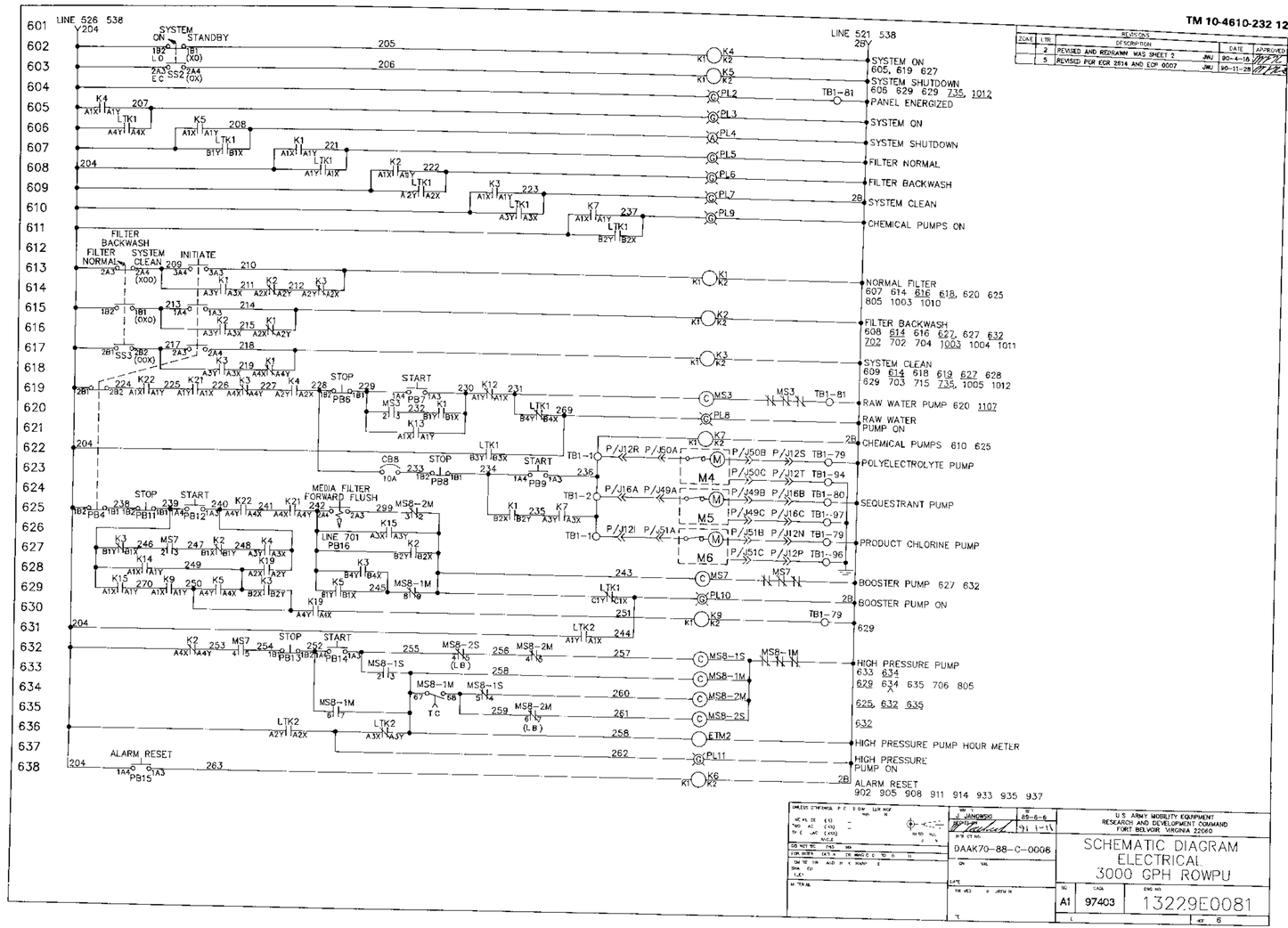
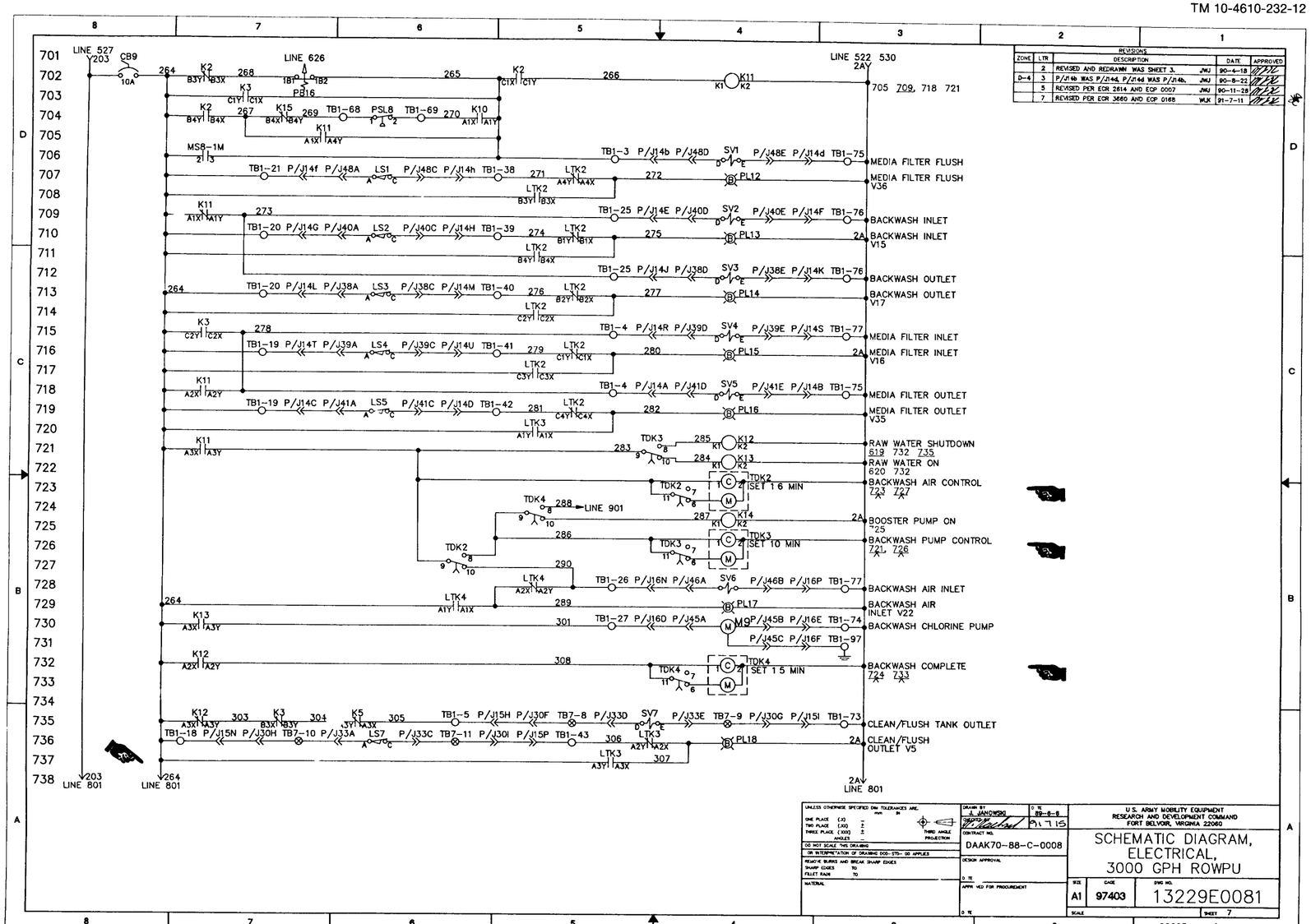


Figure FO 1 (Sheet 6 of 11)



Change 2 Figure FO-1 (Sheet 7 of 11)
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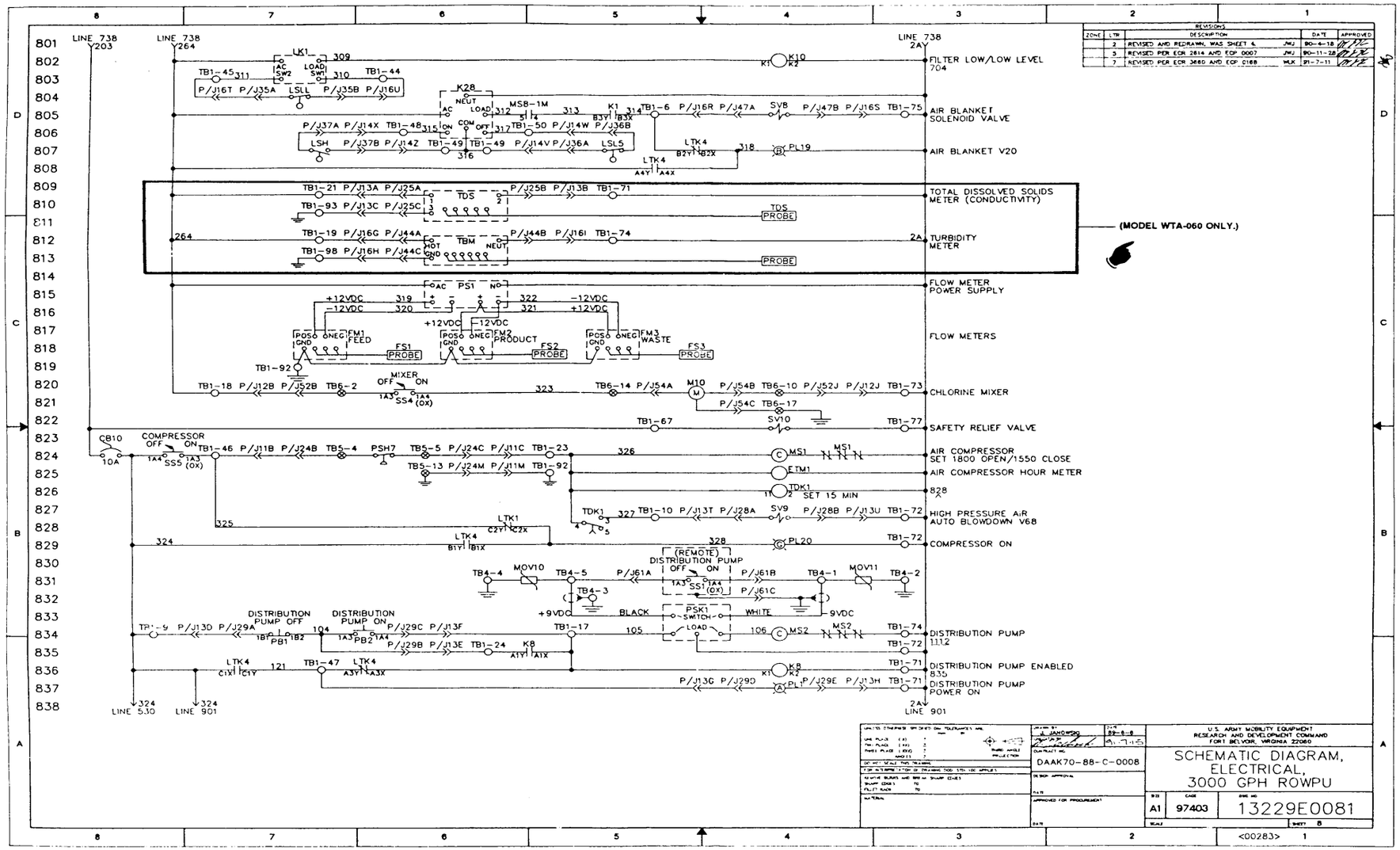

Figure FO-1 (Sheet 8 of 11)
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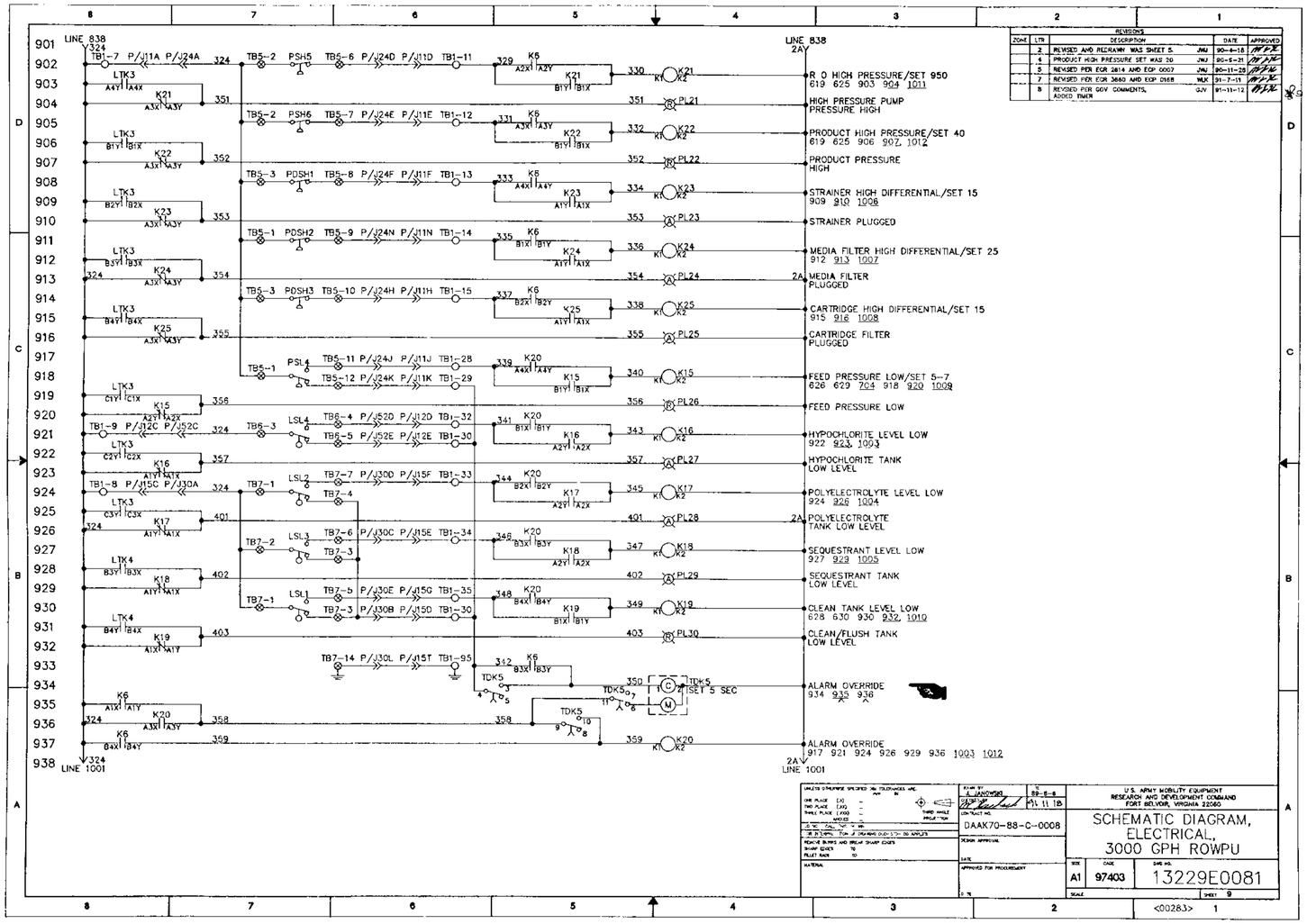

LINE 838
LINE 838 2A
R O HIGH PRESSURE/SET 950
619 625 903 904 1011
HIGH PRESSURE PUMP PRESSURE HIGH
PRODUCT HIGH PRESSURE/SET 40
619 625 906 907 1012
PRODUCT PRESSURE HIGH
STRAINER HIGH DIFFERENTIAL/SET 15
909 910 1006
STRAINER PLUGGED
MEDIA FILTER HIGH DIFFERENTIAL/SET 25
912 913 1007
MEDIA FILTER PLUGGED
CARTRIDGE HIGH DIFFERENTIAL/SET 15
915 916 1008
CARTRIDGE FILTER PLUGGED
FEED PRESSURE LOW/SET 5-7
626 629 704 918 920 1009
FEED PRESSURE LOW
HYPOCHLORITE LEVEL LOW
922 923 1003
HYPOCHLORITE TANK LOW LEVEL
POLYELECTROLYTE LEVEL LOW
924 926 1004
POLYELECTROLYTE TANK LOW LEVEL
SEQUESTRANT LEVEL LOW
927 929 1005
SEQUESTRANT TANK LOW LEVEL
CLEAN TANK LEVEL LOW
628 630 930 932 1010
CLEAN/FLUSH TANK LOW LEVEL
ALARM OVERRIDE
934 935 936
ALARM OVERRIDE
917 921 924 926 929 936 1003 1012
LINE 1001
LINE 1001
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
2 REVISED AND REDRAWN WAS SHEET 5. JMJ 90-6-18
4 PRODUCT HIGH PRESSURE SET WAS 30 JMJ 90-8-31
5 REVISED PER ECR 2814 AND ECP 0007 JMJ 90-11-28
7 REVISED PER ECR 3680 AND ECP 0168 WLK 91-7-11
8 REVISED PER GOV COMMENTS. ADDED TIMER GJV 91-11-12
U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060
DAAK70-88-C-0008
SCHEMATIC DIAGRAM, ELECTRICAL, 3000 GPH ROWPU
SIZE A1 CAGE 97403 SHT NO. 13229E0081
SCALE SHEET 9
<00283> 1

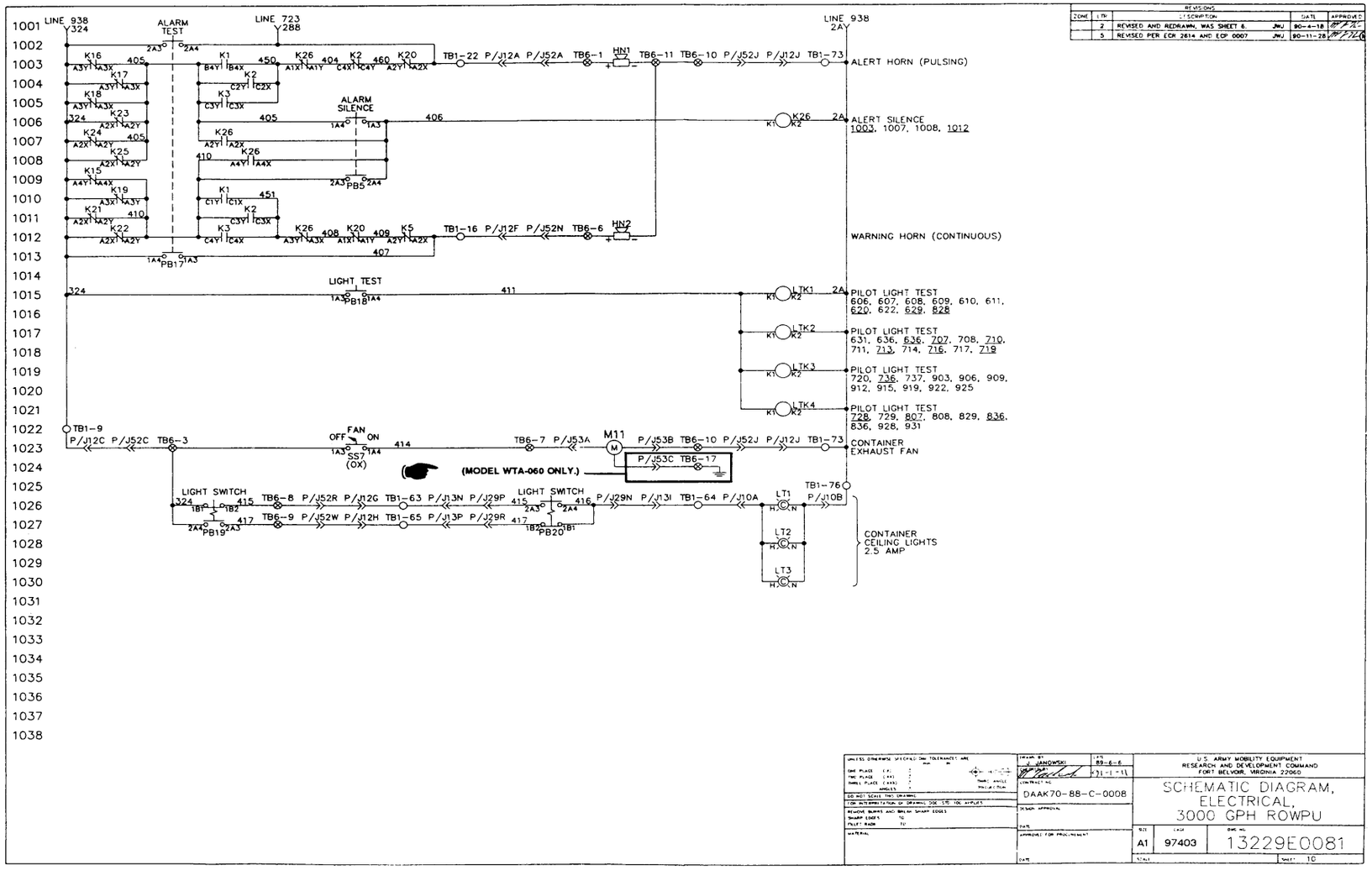
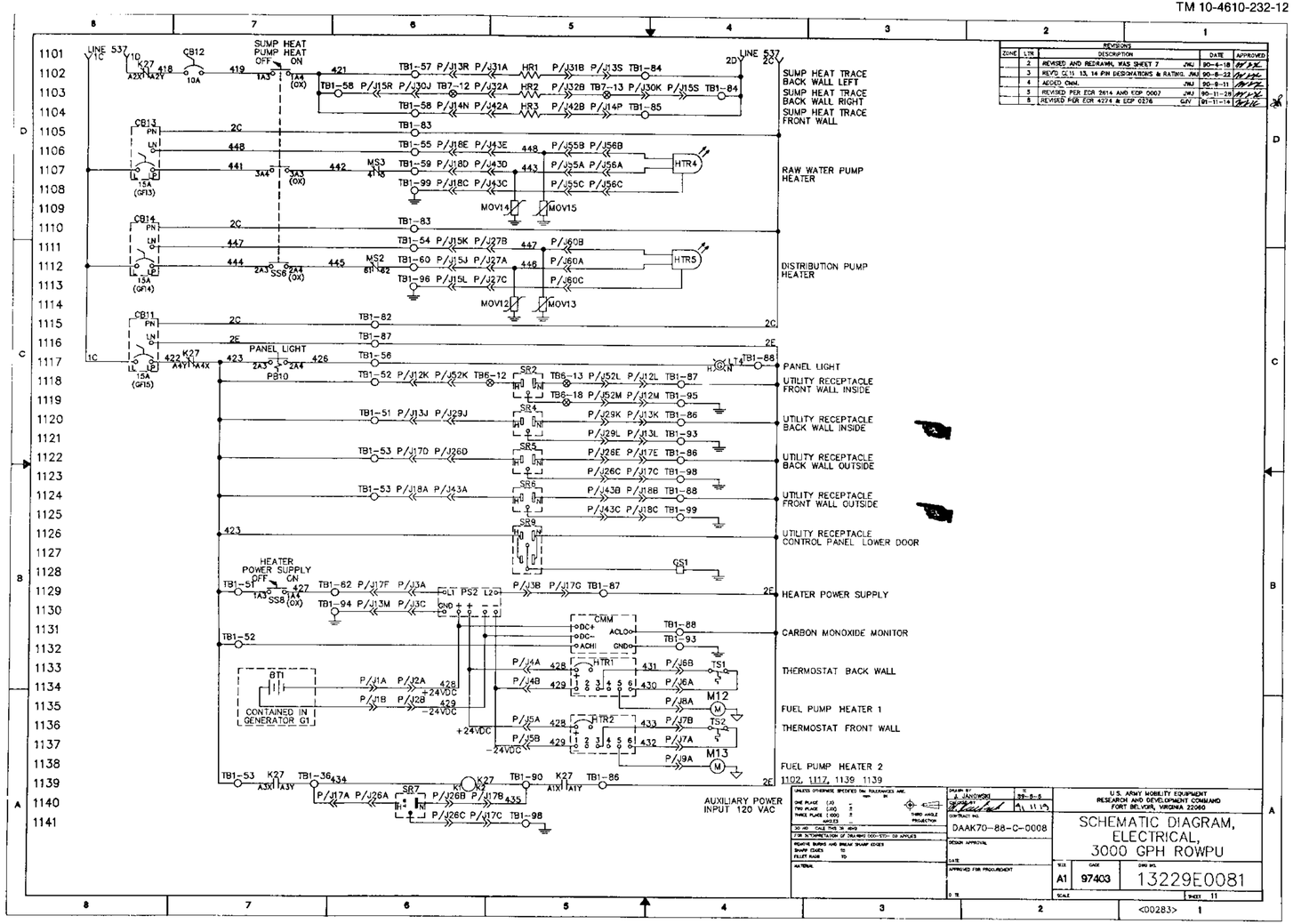


Figure FO-1 (Sheet 10 of 11)



Change 2 Figure FO-1 (Sheet 11 of 11)

SHEET 16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	ZONE	LTR	DESCRIPTION		DATE	APPROVED
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	REVISED AND REDRAWN ADDED SHEETS 7-16	JWJ	90-10-10	
3	3	3	3	3	3	3	3	3	3	3	3	2	3	2		3	REVISED PER ECR 2616 & 2772 AND ECP 0007 & 0068	JWJ	90-11-28	
3	3	3	4	3	3	3	3	3	3	3	3	2	4	2		4	REVISED PER ECR 3659 AND ECP 0188	WLK	91-7-15	
3	5	3	4	3	3	3	3	3	3	3	3	2	4	2		5	REVISED PER ECR 4429 & ECP 0294,	WLK	92-4-1	

STATUS OF REVISIONS

COMPONENT REFERENCE LIST

ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO	DESCRIPTION	LOCATION
BT1	———	BATTERY PART OF GENERATOR SET G1	SH 5-B2
CB1	13229E0718-5	CIRCUIT BREAKER MAIN POWER	SH 10-C8
CB2	13229E0718-6	CIRCUIT BREAKER AIR COMPRESSOR	SH 10-B4
CB3	13229E0718-8	CIRCUIT BREAKER DISTRIBUTION PUMP	SH 10-B4
CB4	13229E0718-2	CIRCUIT BREAKER, RAW WATER PUMP	SH 10-B4
CB5	13229E0718-3	CIRCUIT BREAKER BOOSTER PUMP	SH 10-A5
CB6	13229E0718-4	CIRCUIT BREAKER HIGH PRESSURE PUMP	SH 10-B5
CB7	13229E0717-3	CIRCUIT BREAKER MAIN INTERNAL POWER	SH 8-B4
CB8	13229E0717-1	CIRCUIT BREAKER CHEMICAL PUMPS	SH 8-B4
CB9	13229E0717-1	CIRCUIT BREAKER SOLENOID VALVES METERS	SH 8-B4
CB10	13229E0717-1	CIRCUIT BREAKER LIMIT & PRESSURE SWITCHES, FAN	SH 8-B4
CB11	13229E0717-2	CIRCUIT BREAKER, A C OUTLETS, DIESEL HEATERS	SH 8-B3
CB12	13229E0717-1	CIRCUIT BREAKER, SUMP HEATERS	SH 8-B3
CB13	13229E0717-2	CIRCUIT BREAKER RAW WATER PUMP HEATER	SH 8-B3
CB14	13229E0717-2	CIRCUIT BREAKER DISTRIBUTION PUMP	SH 8-B3
CB15	13229E0718-7	CIRCUIT BREAKER, MAIN POWER T1	SH 10-A5
CB16	13229E0718-1	CIRCUIT BREAKER MAIN POWER, T2	SH 10-A4
CB17	13229E0718-6	CIRCUIT BREAKER PUMP SKID HEATER, HTR3	SH 10-A4
CMM	13229E1334	CARBON MONOXIDE MONITOR	SH 14-C5
CS1	13229E1220	CURRENT SENSOR GROUND FAULT	SH 10-C4
CS2	13229E1220	CURRENT SENSOR GROUND FAULT	SH 10-B7
ETM1	13229E0215	ELAPSED TIME METER	SH 13-C4
ETM2	13229E0215	ELAPSED TIME METER	SH 13-D4
FM1	13229E0732-1	FLOWMETER, POWERED, FEED FLOW	SH 11-B4
FM2	13229E0732-3	FLOWMETER POWERED PRODUCT FLOW	SH 11-B6
FM3	13229E0732-2	FLOWMETER POWERED WASTE FLOW	SH 11-B8
FS1	13229E0210-1	FLOW SENSOR FEED	SH 15-B4
FS2	13229E0210-2	FLOW SENSOR, PRODUCT	SH 14-D3
FS3	13229E0210-3	FLOW SENSOR, WASTE	SH 14-D3
G1	6115-00-118-1243	GENERATOR SET 50/60 HERTZ	SH 5-B2
GFI 1	13229E1219	GROUND FAULT RELAY	SH 13-C6
GFI 2	13229E1219	GROUND FAULT RELAY	SH 13-C8
GS1	13229E0244	GROUND STRIP	SH 10-B8
HN1	13229E0090-2	HORN, PULSING	SH 15-D6
HN2	13229E0090-1	HORN CONTINUOUS	SH 15-D6
HR1	13229E1270-1	SUMP HEATER, BACK WALL	SH 14-A6
HR2	13229E1270-2	SUMP HEATER, BACK WALL	SH 14-A4
HR3	13229E1270-3	SUMP HEATER, FRONT WALL	SH 15-B4
HTR1	13229E0158-1	HEATER, MULTI-FUEL, INTERIOR	SH 14-C3
HTR2	13229E0158-2	HEATER, MULTI-FUEL, INTERIOR	SH 14-C3
HTR3	13229E0876	HEATER, ELECTRIC, PUMP SKID	SH 16-C3
HTR4	13229E1271-1	HEATER, ELECTRIC, RAW WATER PUMP	SH 16-B2
HTR5	13229E1271-2	HEATER ELECTRIC, DISTRIBUTION PUMP	SH 16-D3
J1	13229E1205-2	CONNECTOR, RECEPTACLE	SH 14-C4
J2	13229E1206-10	CONNECTOR, RECEPTACLE	SH 14-C5
J3	13229E1206-4	CONNECTOR, RECEPTACLE	SH 14-C7

NOTES
1 REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY NOT APPEAR ON PART
2 FOR ELECTRICAL SCHEMATIC DIAGRAM SEE 13229E0081 (120-00283)

CCB Approved
By RDlayer
Date 2 APR 92

UNLESS OTHERWISE SPECIFIED DIM TOLERANCES ARE:
DO NOT SCALE THIS DRAWING
FOR INTERPRETATION OF DRAWING DOD-STD-100 APPLIES
REMOVE BURRS AND BREAK SHARP EDGES
MATERIAL

DRAWN BY J. JANOWSKI — DATE 90-10-10
CHECKED BY — 92-4-2
CONTRACT NO. DAAK70-88-C-0008
DESIGN APPROVAL
APPROVED FOR PROCUREMENT

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

INTERCONNECTION DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 | CAGE 97403 | DWG NO. 13229E1079
SCALE NONE | SHEET 1 OF 16

<00289>

Change 2 Figure FO-2 (Sheet 1 of 16)

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	2	REVISED AND REDRAWN JWJ	90-10-10	

COMPONENT REFERENCE LIST

AQUA-CHEM PART NUMBER	ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	LOCATION
120-02314-4	J4	13229E1206-4	CONNECTOR, RECEPTACLE	SH 14-C5
120-02314-4	J5	13229E1206-4	CONNECTOR, RECEPTACLE	SH 14-C5
120-02314-1	J6	13229E1206-1	CONNECTOR, RECEPTACLE	SH 14-C2
120-02314-1	J7	13229E1206-1	CONNECTOR, RECEPTACLE	SH 14-C2
120-00682-7	J8	MS27144-2	CONNECTOR, PART OF HARNESS 13229E0158-1 ITEM 7	SH 14-C2
120-00682-8	J9	MS27144-2	CONNECTOR, PART OF HARNESS 13229E0158-2 ITEM 8	SH 14-C2
120-02312-2	J10	13229E1204-2	CONNECTOR, RECEPTACLE	SH 9-D3
120-02312-11	J11	13229E1204-11	CONNECTOR, RECEPTACLE	SH 9-D3
120-02312-14	J12	13229E1204-14	CONNECTOR, RECEPTACLE	SH 9-C3
120-02312-16	J13	13229E1204-16	CONNECTOR, RECEPTACLE	SH 9-B3
120-02312-17	J14	13229E1204-17	CONNECTOR, RECEPTACLE	SH 9-D3
120-02312-13	J15	13229E1204-13	CONNECTOR, RECEPTACLE	SH 9-B3
120-02312-15	J16	13229E1204-15	CONNECTOR, RECEPTACLE	SH 9-C2
120-02312-5	J17	13229E1204-5	CONNECTOR, RECEPTACLE	SH 9-B2
120-02312-8	J18	13229E1204-8	CONNECTOR, RECEPTACLE	SH 9-B2
120-02312-3	J19	13229E1204-3	CONNECTOR, RECEPTACLE	SH 16-C8
120-02312-8	J20	13229E1204-8	CONNECTOR, RECEPTACLE	SH 16-C8
120-02312-9	J21	13229E1204-9	CONNECTOR, RECEPTACLE	SH 1F-B8
120-02314-8	J22	13229E1206-8	CONNECTOR, RECEPTACLE	SH 16-B7
120-02314-8	J23	13229E1206-8	CONNECTOR, RECEPTACLE	SH 16-B7
120-02312-10	J24	13229E1204-10	CONNECTOR, RECEPTACLE	SH 14-D7
120-02314-5	J25	13229E1206-5	CONNECTOR, RECEPTACLE **(MODEL WTA-060 ONLY.)**	SH 14-C7
120-02314-6	J26	13229E1206-6	CONNECTOR, RECEPTACLE	SH 14-B7
120-02314-7	J27	13229E1206-7	CONNECTOR, RECEPTACLE	SH 14-B7
120-02314-1	J28	13229E1206-1	CONNECTOR, RECEPTACLE	SH 14-B7
120-02314-11	J29	13229E1206-11	CONNECTOR, RECEPTACLE	SH 14-B3
120-02312-6	J30	13229E1204-6	CONNECTOR, RECEPTACLE	SH 14-A7
120-02314-1	J31	13229E1206-1	CONNECTOR, RECEPTACLE	SH 14-A7
120-02312-1	J32	13229E1204-1	CONNECTOR, RECEPTACLE	SH 14-A5
120-07549-3	J33	13229E0700-1 ITEM 3	CONNECTOR, RECEPTACLE	SH 14-B5
120-02314-8	J34	13229E1206-8	CONNECTOR, RECEPTACLE	SH 16-C7
120-02314-3	J35	13229E1206-3	CONNECTOR, RECEPTACLE	SH 15-C7
120-02314-2	J36	13229E1206-2	CONNECTOR, RECEPTACLE	SH 15-C7
120-02314-1	J37	13229E1206-1	CONNECTOR, RECEPTACLE	SH 15-C7
120-07549-3	J38	13229E0700-1 ITEM 3	CONNECTOR, RECEPTACLE	SH 15-C7
120-07549-3	J39	13229E0700-1 ITEM 3	CONNECTOR, RECEPTACLE	SH 15-B5
120-07549-3	J40	13229E0700-1 ITEM 3	CONNECTOR, RECEPTACLE	SH 15-B5
120-07549-3	J41	13229E0700-1 ITEM 3	CONNECTOR, RECEPTACLE	SH 15-B5
120-02314-1	J42	13229E1206-1	CONNECTOR, RECEPTACLE	SH 15-B5
120-02314-6	J43	13229E1206-6	CONNECTOR, RECEPTACLE	SH 15-A2
120-02314-5	J44	13229E1206-5	CONNECTOR, RECEPTACLE **(MODEL WTA-060 ONLY.)**	SH 15-B2
120-02314-1	J45	13229E1206-1	CONNECTOR, RECEPTACLE	SH 15-B2
120-02314-2	J46	13229E1206-2	CONNECTOR, RECEPTACLE	SH 15-B2
120-02314-1	J47	13229E1206-1	CONNECTOR, RECEPTACLE	SH 15-B2
120-07549-3	J48	13229E0700-1 ITEM 3	CONNECTOR, RECEPTACLE	SH 15-C2
120-02314-1	J49	13229E1206-1	CONNECTOR, RECEPTACLE	SH 15-C2

COMPONENT REFERENCE LIST

AQUA-CHEM PART NUMBER	ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	LOCATION
120-02314-2	J50	13229E1206-2	CONNECTOR, RECEPTACLE	SH 15-C2
120-02314-3	J51	13229E1206-3	CONNECTOR, RECEPTACLE	SH 15-C2
120-02312-12	J52	13229E1204-12	CONNECTOR, RECEPTACLE	SH 15-D7
120-02312-1	J53	13229E1204-1	CONNECTOR, RECEPTACLE	SH 15-D3
120-02312-1	J54	13229E1204-1	CONNECTOR, RECEPTACLE	SH 15-C3
120-02312-4	J55	13229E1204-4	CONNECTOR, RECEPTACLE	SH 16-B3
120-02314-9	J56	13229E1206-9	CONNECTOR, RECEPTACLE	SH 16-B2
120-02312-3	J57	13229E1204-3	CONNECTOR, RECEPTACLE	SH 16-A3
120-02314-8	J58	13229E1206-8	CONNECTOR, RECEPTACLE	SH 16-A3
120-02313-1	J59	13229E1205-1	CONNECTOR, RECEPTACLE	SH 16-A2
120-02312-4	J60	13229E1204-4	CONNECTOR, RECEPTACLE	SH 16-D4
120-02312-1	J61	13229E1204-1	CONNECTOR, RECEPTACLE	SH 16-D4
120-02312-3	J62	13229E1204-3	CONNECTOR, RECEPTACLE	SH 16-C4
120-02312-18	J63	13229E1204-18	CONNECTOR, RECEPTACLE	SH 16-C3
120-02312-19	J64	13229E1204-19	CONNECTOR, RECEPTACLE	SH 16-C3
120-02312-7	J65	13229E1204-7	CONNECTOR, RECEPTACLE	SH 16-C3
120-02312-4	J66	13229E1204-4	CONNECTOR, RECEPTACLE	SH 16-C4
120-02312-3	J67	13229E1204-3	CONNECTOR, RECEPTACLE	SH 16-C4
120-02312-21	J68	13229E1204-21	CONNECTOR, RECEPTACLE	SH 16-C4
120-02312-20	J69	13229E1204-20	CONNECTOR, RECEPTACLE	SH 16-B4
120-07603-1	K1	13229E0719-1	RELAY, 12 POLE	SH 6-D8
120-07603-2	K2	13229E0719-2	RELAY, 12 POLE	SH 6-D6
120-07603-3	K3	13229E0719-3	RELAY, 12 POLE	SH 6-D4
120-02391-1	K4	13229E1248-1	RELAY, 4 POLE	SH 6-D3
120-02392-1	K5	13229E1249-1	RELAY, 8 POLE	SH 7-D8
120-02392-2	K6	13229E1249-2	RELAY, 8 POLE	SH 7-D6
120-02391-2	K7	13229E1248-2	RELAY, 4 POLE	SH 7-D5
120-02391-3	K8	13229E1248-3	RELAY, 4 POLE	SH 7-D3
120-02391-3	K9	13229E1248-3	RELAY, 4 POLE	SH 8-D8
120-02391-3	K10	13229E1248-3	RELAY, 4 POLE	SH 6-C8
120-02391-4	K11	13229E1248-4	RELAY, 4 POLE	SH 6-C6
120-02391-5	K12	13229E1248-5	RELAY, 4 POLE	SH 6-C4
120-02391-2	K13	13229E1248-2	RELAY, 4 POLE	SH 6-C3
120-02391-3	K14	13229E1248-3	RELAY, 4 POLE	SH 7-C8
120-02392-3	K15	13229E1249-3	RELAY, 8 POLE	SH 7-C6
120-02391-5	K16	13229E1248-5	RELAY, 4 POLE	SH 7-C5
120-02391-5	K17	13229E1248-5	RELAY, 4 POLE	SH 7-C3
120-02391-5	K18	13229E1248-5	RELAY, 4 POLE	SH 8-C8
120-02392-4	K19	13229E1249-4	RELAY, 8 POLE	SH 8-B8
120-02392-5	K20	13229E1249-5	RELAY, 8 POLE	SH 6-B6
120-02392-1	K21	13229E1249-1	RELAY, 8 POLE	SH 6-B4
120-02392-1	K22	13229E1249-1	RELAY, 8 POLE	SH 6-B3
120-02391-6	K23	13229E1248-6	RELAY, 4 POLE	SH 7-B8
120-02391-6	K24	13229E1248-6	RELAY, 4 POLE	SH 7-B6
120-02391-6	K25	13229E1248-6	RELAY, 4 POLE	SH 7-B5
120-02391-7	K26	13229E1248-7	RELAY, 4 POLE	SH 7-B3

UNLESS OTHERWISE SPECIFIED DIM TOLERANCES ARE: ONE PLACE (.X) ±; TWO PLACE (.XX) ±; THREE PLACE (.XXX) ±; ANGLES ±. DO NOT SCALE THIS DRAWING. FOR INTERPRETATION OF DRAWING DOD-STD-100 APPLIES. REMOVE BURRS AND BREAK SHARP EDGES. SHARP EDGES TO. FILLET RADII TO. MATERIAL.

DRAWN BY J. JANOWSKI DATE 90-10-10
DESIGNED BY DATE 90-10-10
CONTRACT NO. DAAK70-88-C-0008
DESIGN APPROVAL DATE
APPROVED FOR PROCUREMENT DATE

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

INTERCONNECTION DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 | CODE 97403 | DWG NO 13229E1079 | SCALE | SHEET 2

Figure FO-2 (Sheet 2 of 16)

REVISIONS

ZONE	LTR	DESCRIPTION		DATE	APPROVED
	2	REVISED AND REDRAWN	JWJ	90-10-10	
	3	REVISED PER ECR 2772 AND ECP 0068	JWJ	90-11-28	
	4	REVISED PER ECR 3650 AND ECP 0168	WLK	91-7-15	

COMPONENT REFERENCE LIST

ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO	DESCRIPTION	LOCATION
K27	13229E1248-8	RELAY 4 POLE	SH 8-B8
K28	13229E0101	RELAY SOLID STATE	SH 6-B2
LK1	13229E0363	RELAY SOLID STATE	SH 6-B5
LS1/SV1	13229E0700-1	LIMIT SWITCH PART OF SOLENOID VALVE SV1	SH 15-B2
LS2/SV2	13229E0700-1	LIMIT SWITCH PART OF SOLENOID VALVE SV2	SH 15-B4
LS3/SV3	13229E0700-1	LIMIT SWITCH PART OF SOLENOID VALVE SV3	SH 15-C4
LS4/SV4	13229E0700-1	LIMIT SWITCH PART OF SOLENOID VALVE SV4	SH 15-C4
LS5/SV5	13229E0700-1	LIMIT SWITCH PART OF SOLENOID VALVE SV5	SH 15-B4
LS7/SV7	13229E0700-1	LIMIT SWITCH PART OF SOLENOID VALVE SV7	SH 14-A4
LSH	13229E1268-3	LEVEL SWITCH HIGH	SH 15-C7
LSLL	13229E1268-1	LEVEL SWITCH LOW/LOW	SH 15-C7
LSL1	13229E0310	LEVEL SWITCH LOW	SH 14-C5
LSL2	13229E0310	LEVEL SWITCH LOW	SH 14-C5
LSL3	13229E0310	LEVEL SWITCH LOW	SH 14-C5
LSL4	13229E0310	LEVEL SWITCH LOW	SH 15-C3
LSL5	13229E1268-2	LEVEL SWITCH LOW	SH 15-C7
LT1	W-L-101/77A	LAMP INCANDESCENT	SH 14-D7
LT2	W-L-101/77A	LAMP INCANDESCENT	SH 14-D6
LT3	W-L-101/77A	LAMP INCANDESCENT	SH 14-D5
LT4	W-L-101/77A	LAMP INCANDESCENT	SH 14-D4
LTK1	13229E0719-4	RELAY 12 POLE	SH 7-B7
LTK2	13229E0719-4	RELAY 12 POLE	SH 7-B5
LTK3	13229E0719-6	RELAY 12 POLE	SH 7-B3
LTK4	13229E0719-7	RELAY 12 POLE	SH 8-B8
M1	13229E0217	MOTOR AIR COMPRESSOR 2 H P	SH 16-C3
M2	13229E0130	MOTOR DISTRIBUTION PUMP 2 H P	SH 16-C3
M3	13229E0128	MOTOR RAW WATER PUMP 5 H P	SH 16-A1
M4	13229E1266-2	PUMP ASSEMBLY POLYELECTROLYTE	SH 15-C2
M5	13229E1266-1	PUMP ASSEMBLY SEQUESTRANT	SH 15-C2
M6	13229E1266-3	PUMP ASSEMBLY PRODUCT CHLORINE	SH 15-C2
M7	13229E0216	MOTOR BOOSTER PUMP 7 5 H P	SH 16-B6
M8	13229E0152	MOTOR HIGH PRESSURE PUMP 60 H P	SH 16-C3
M9	13229E1267	PUMP ASSEMBLY BACKWASH	SH 15-B2
M10	13229E0447-1	MOTOR CHLORINE MIXER 1/20 H P	SH 15-C3
M11	13229E0806	EXHAUST FAN	SH 15-D3
M12	13229E0158-1 ITEM 4	FUEL PUMP HEATER 1	SH 14-C1
M13	13229E0158-2 ITEM 9	FUEL PUMP HEATER 2	SH 14-C1
MOV4	13229E0326-2	SUPPRESSOR TRANSIENT, RAW WATER PUMP	SH 16-A4
MOV5	13229E0326-2	SUPPRESSOR TRANSIENT RAW WATER PUMP	SH 16-A4
MOV6	13229E0326-2	SUPPRESSOR TRANSIENT, RAW WATER PUMP	SH 16-A5
MOV7	13229E0326-1	SUPPRESSOR TRANSIENT DISTRIBUTION PUMP	SH 16-C5
MOV8	13229E0326-1	SUPPRESSOR TRANSIENT DISTRIBUTION PUMP	SH 16-C6
MOV9	13229E0326-1	SUPPRESSOR TRANSIENT DISTRIBUTION PUMP	SH 16-D6
MOV10	13229E1221	SUPPRESSOR TRANSIENT REMOTE DISTRIBUTION PUMP SW	SH 16-D5
MOV11	13229E1221	SUPPRESSOR TRANSIENT REMOTE DISTRIBUTION PUMP SW	SH 16-D5
MOV12	13229E0326-1	SUPPRESSOR TRANSIENT DISTRIBUTION PUMP HEATER	SH 16-D6

COMPONENT REFERENCE LIST

ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO	DESCRIPTION	LOCATION
MOV13	13229E0326-1	SUPPRESSOR TRANSIENT DISTRIBUTION PUMP HEATER	SH 16-D6
MOV14	13229E0326-1	SUPPRESSOR TRANSIENT RAW WATER PUMP HEATER	SH 16-A5
MOV15	13229E0326-1	SUPPRESSOR TRANSIENT, RAW WATER PUMP HEATER	SH 16-A6
MOV16	13229E0326-1	SUPPRESSOR TRANSIENT HIGH PRESSURE PUMP	SH 16-C5
MOV17	13229E0326-1	SUPPRESSOR TRANSIENT, HIGH PRESSURE PUMP	SH 16-C5
MOV18	13229E0326-1	SUPPRESSOR TRANSIENT HIGH PRESSURE PUMP	SH 16-C6
MOV19	13229E0326-1	SUPPRESSOR TRANSIENT, HIGH PRESSURE PUMP	SH 16-C5
MOV20	13229E0326-1	SUPPRESSOR TRANSIENT HIGH PRESSURE PUMP	SH 16-C5
MOV21	13229E0326-1	SUPPRESSOR TRANSIENT HIGH PRESSURE PUMP	SH 16-C6
MOV22	13229E0326-1	SUPPRESSOR, TRANSIENT, AIR COMPRESSOR	SH 16-B5
MOV23	13229E0326-1	SUPPRESSOR TRANSIENT AIR COMPRESSOR	SH 16-B5
MOV24	13229E0326-1	SUPPRESSOR TRANSIENT AIR COMPRESSOR	SH 16-B6
MOV25	13229E0326-1	SUPPRESSOR TRANSIENT PUMP SKID HEATER (HTR3)	SH 16-B5
MOV26	13229E0326-1	SUPPRESSOR TRANSIENT PUMP SKID HEATER (HTR3)	SH 16-B5
MOV27	13229E0326-1	SUPPRESSOR TRANSIENT PUMP SKID HEATER (HTR3)	SH 16-B6
MS1	13229E1231	MOTOR STARTER, SIZE 00	SH 10-D5
MS2	13229E1232	MOTOR STARTER, SIZE 00	SH 10-C7
MS3	13229E1233	MOTOR STARTER, SIZE 0	SH 10-B6
MS7	13229E1234	MOTOR STARTER SIZE 1	SH 10-D8
MS8-1M	13229E1235	MOTOR STARTER SIZE 3	SH 10-D6
MS8-1S/2M	13229E1236	MOTOR STARTER WYE-DELTA SIZE 3	SH 10-D4
MS8-2S	13229E1237	MOTOR CONTACTOR SIZE 1	SH 10-C5
P1	13229E1207-14	CONNECTOR PLUG	SH 14-C3
P2	13229E1207-13	CONNECTOR PLUG	SH 14-C5
P3	13229E1207-5	CONNECTOR PLUG	SH 14-C7
P4	13229E1207-5	CONNECTOR PLUG	SH 14-C5
P5	13229E1207-5	CONNECTOR PLUG	SH 14-C5
P6	13229E1207-1	CONNECTOR PLUG	SH 14-C2
P7	13229E1207-1	CONNECTOR PLUG	SH 14-C2
P8	MS27142-2	CONNECTOR PART OF FUEL PUMP 13229E0158-1 ITEM 4	SH 14-C2
P9	MS27142-2	CONNECTOR PART OF FUEL PUMP 13229E0158-2 ITEM 9	SH 14-C2
P10	13229E1207-4	CONNECTOR, PLUG	SH 14-D8
P11	13229E1208-7	CONNECTOR PLUG	SH 14-D8
P12	13229E1208-9	CONNECTOR PLUG	SH 15-D8
P13	13229E1208-11	CONNECTOR, PLUG	SH 14-C8
P14	13229E1208-13	CONNECTOR PLUG	SH 15-C8
P15	13229E1208-8	CONNECTOR PLUG	SH 14-B8
P16	13229E1208-10	CONNECTOR PLUG	SH 15-B8
P17	13229E1208-3	CONNECTOR PLUG	SH 14-A8
P18	13229E1208-4	CONNECTOR, PLUG	SH 15-A7
P19	13229E1208-1	CONNECTOR PLUG	SH 16-C8
P20	13229E1208-4	CONNECTOR PLUG	SH 16-C8
P21	13229E1208-5	CONNECTOR PLUG	SH 16-B8
P22	13229E1207-9	CONNECTOR PLUG	SH 16-B7
P23	13229E1207-9	CONNECTOR PLUG	SH 16-B7
P24	1322901207-15	CONNECTOR PLUG	SH 14-D7

UNLESS OTHERWISE SPECIFIED DIM TOLERANCES ARE:
ONE PLACE (X)
TWO PLACE (XX)
THREE PLACE (XXX)
ANGLES
THIRD ANGLE PROJECTION
DO NOT SCALE THIS DRAWING
FOR INTERPRET OF DRAWING DOD-STD-100 APPLIES
REMOVE BURRS AND BREAK SHARP EDGES
SHARP EDGES TO
FILLET RADII TO
MATERIAL

DRAWN BY J. JANOWSKI 90-10-10
CHECKED BY 91 7 16
CONTRACT NO. DAAK70-88-C-0008
DESIGN APPROVAL
DATE
APPROVED FOR PROCUREMENT
DATE

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

INTERCONNECTION DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 CAGE 97403 DWG NO. 13229E1079
SCALE SHEET 3

<00289>

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	2	REVISED AND REDRAWN. JWJ	80-10-10	

COMPONENT REFERENCE LIST				
AQUA-CHEM PART NUMBER	ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	LOCATION
120-02315-6	P25	13229E1207-6	CONNECTOR, PLUG (MODEL WTA-060 ONLY.)	SH 14-C7
120-02315-7	P26	13229E1207-7	CONNECTOR, PLUG	SH 14-B7
120-02315-8	P27	13229E1207-8	CONNECTOR, PLUG	SH 14-B7
120-02315-1	P28	13229E1207-1	CONNECTOR, PLUG	SH 14-B7
120-02315-16	P29	13229E1207-16	CONNECTOR, PLUG	SH 14-B2
120-02315-12	P30	13229E1207-12	CONNECTOR, PLUG	SH 14-B7
120-02315-1	P31	13229E1207-1	CONNECTOR, PLUG	SH 14-A7
120-02315-1	P32	13229E1207-1	CONNECTOR, PLUG	SH 14-A5
120-07549-4	P33	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1	SH 14-A5
120-02315-9	P34	13229E1207-9	CONNECTOR, PLUG	SH 16-C7
120-02315-3	P35	13229E1207-3	CONNECTOR, PLUG	SH 15-C7
120-02315-2	P36	13229E1207-2	CONNECTOR, PLUG	SH 15-C7
120-02315-1	P37	13229E1207-1	CONNECTOR, PLUG	SH 15-C7
120-07549-4	P38	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1	SH 15-C5
120-07549-4	P39	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1	SH 15-C5
120-07549-4	P40	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1	SH 15-B5
120-07549-4	P41	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1	SH 15-B5
120-02315-1	P42	13229E1207-1	CONNECTOR, PLUG	SH 15-B5
120-02315-7	P43	13229E1207-7	CONNECTOR, PLUG	SH 15-B5
120-02315-6	P44	13229E1207-6	CONNECTOR, PLUG (MODEL WTA-060 ONLY.)	SH 15-A2
120-02315-1	P45	13229E1207-1	CONNECTOR, PLUG	SH 15-B2
120-02315-2	P46	13229E1207-2	CONNECTOR, PLUG	SH 15-B2
120-02315-1	P47	13229E1207-1	CONNECTOR, PLUG	SH 15-B2
120-07549-4	P48	13229E0700-1 ITEM 3	CONNECTOR, PLUG, PART OF VALVE 13229E0700-1	SH 15-B2
120-02315-1	P49	13229E1207-1	CONNECTOR, PLUG	SH 15-C2
120-02315-2	P50	13229E1207-2	CONNECTOR, PLUG	SH 15-C2
120-02315-3	P51	13229E1207-3	CONNECTOR, PLUG	SH 15-C2
120-02316-12	P52	13229E1208-12	CONNECTOR, PLUG	SH 15-D7
120-02315-1	P53	13229E1207-1	CONNECTOR, PLUG	SH 15-D3
120-02315-1	P54	13229E1207-1	CONNECTOR, PLUG	SH 15-C3
120-02315-10	P55	13229E1207-10	CONNECTOR, PLUG	SH 16-B3
120-02315-10	P56	13229E1207-10	CONNECTOR, PLUG	SH 16-B2
120-02315-9	P57	13229E1207-9	CONNECTOR, PLUG	SH 16-A3
120-02315-9	P58	13229E1207-9	CONNECTOR, PLUG	SH 16-A2
120-02315-11	P59	13229E1207-11	CONNECTOR, PLUG	SH 16-A2
120-02315-10	P60	13229E1207-10	CONNECTOR, PLUG	SH 16-D4
120-02315-1	P61	13229E1207-1	CONNECTOR, PLUG	SH 16-D4
120-02315-9	P62	13229E1207-9	CONNECTOR, PLUG	SH 16-C4
120-02316-16	P63	13229E1208-16	CONNECTOR, PLUG	SH 16-C7
120-02316-17	P64	13229E1208-17	CONNECTOR, PLUG	SH 16-C7
120-02316-6	P65	13229E1208-6	CONNECTOR, PLUG	SH 16-C7
120-02316-2	P66	13229E1208-2	CONNECTOR, PLUG	SH 16-C4
120-02316-1	P67	13229E1208-1	CONNECTOR, PLUG	SH 16-C4
120-02316-15	P68	13229E1208-15	CONNECTOR, PLUG	SH 16-C4
120-02316-14	P69	13229E1208-14	CONNECTOR, PLUG	SH 16-B4
120-07622	PB1	13229E0733	PUSHBUTTON SWITCH	SH 14-B1

COMPONENT REFERENCE LIST				
AQUA-CHEM PART NUMBER	ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	LOCATION
120-02377-1	PB2	13229E1242-1	PUSHBUTTON SWITCH	SH 14-B1
120-00352	PB3	13229E0108	PUSHBUTTON SWITCH	SH 11-C8
120-02379	PB4	13229E1244	PUSHBUTTON SWITCH	SH 12-C8
120-02378	PB5	13229E1243	PUSHBUTTON SWITCH	SH 11-A2
120-07622	PB6	13229E0733	PUSHBUTTON SWITCH	SH 11-C4
120-02377-1	PB7	13229E1242-1	PUSHBUTTON SWITCH	SH 11-C4
120-07622	PB8	13229E0733	PUSHBUTTON SWITCH	SH 11-C5
120-02377-1	PB9	13229E1242-1	PUSHBUTTON SWITCH	SH 11-C5
120-07624	PB10	13229E0735	PUSHBUTTON SWITCH	SH 12-B2
120-07622	PB11	13229E0733	PUSHBUTTON SWITCH	SH 11-C4
120-02377-1	PB12	13229E1242-1	PUSHBUTTON SWITCH	SH 11-C4
120-07622	PB13	13229E0733	PUSHBUTTON SWITCH	SH 11-C7
120-02377-1	PB14	13229E1242-1	PUSHBUTTON SWITCH	SH 11-C7
120-02377-2	PB15	13229E1242-2	PUSHBUTTON SWITCH	SH 11-A4
120-07624	PB16	13229E0735	PUSHBUTTON SWITCH	SH 12-B5
120-02378	PB17	13229E1243	PUSHBUTTON SWITCH	SH 12-C2
120-02377-2	PB18	13229E1242-2	PUSHBUTTON SWITCH	SH 12-B2
120-07624	PB19	13229E0735	PUSHBUTTON SWITCH	SH 15-D6
120-07624	PB20	13229E0735	PUSHBUTTON SWITCH	SH 14-B1
120-07620-1	PL1	13229E0731-1	PILOT LIGHT	SH 14-C1
120-07620-3	PL2	13229E0731-3	PILOT LIGHT	SH 11-D8
120-07620-3	PL3	13229E0731-3	PILOT LIGHT	SH 12-D2
120-07620-1	PL4	13229E0731-1	PILOT LIGHT	SH 12-D4
120-07620-3	PL5	13229E0731-3	PILOT LIGHT	SH 12-D5
120-07620-3	PL6	13229E0731-3	PILOT LIGHT	SH 12-D6
120-07620-3	PL7	13229E0731-3	PILOT LIGHT	SH 12-D8
120-07620-3	PL8	13229E0731-3	PILOT LIGHT	SH 11-D3
120-07620-3	PL9	13229E0731-3	PILOT LIGHT	SH 11-D4
120-07620-3	PL10	13229E0731-3	PILOT LIGHT	SH 11-D6
120-07620-3	PL11	13229E0731-3	PILOT LIGHT	SH 11-D7
120-07620-4	PL12	13229E0731-4	PILOT LIGHT	SH 12-C8
120-07620-4	PL13	13229E0731-4	PILOT LIGHT	SH 12-C7
120-07620-4	PL14	13229E0731-4	PILOT LIGHT	SH 12-C7
120-07620-4	PL15	13229E0731-4	PILOT LIGHT	SH 12-C6
120-07620-4	PL16	13229E0731-4	PILOT LIGHT	SH 12-C6
120-07620-4	PL17	13229E0731-4	PILOT LIGHT	SH 12-B7
120-07620-4	PL18	13229E0731-4	PILOT LIGHT	SH 12-C8
120-07620-4	PL19	13229E0731-4	PILOT LIGHT	SH 12-C6
120-07620-3	PL20	13229E0731-3	PILOT LIGHT	SH 11-D2
120-07620-2	PL21	13229E0731-2	PILOT LIGHT	SH 12-A7
120-07620-2	PL22	13229E0731-2	PILOT LIGHT	SH 12-A8
120-07620-1	PL23	13229E0731-1	PILOT LIGHT	SH 12-A2
120-07620-1	PL24	13229E0731-1	PILOT LIGHT	SH 12-A4
120-07620-1	PL25	13229E0731-1	PILOT LIGHT	SH 12-A5
120-07620-2	PL26	13229E0731-2	PILOT LIGHT	SH 12-B8
120-07620-1	PL27	13229E0731-1	PILOT LIGHT	SH 12-B5

UNLESS OTHERWISE SPECIFIED ON TOLERANCES ARE — IN
ONE PLACE (.X) ±
TWO PLACE (.XX) ±
THREE PLACE (.XXX) ±
ANGLES ±
THIRD ANGLE PROJECTION
DO NOT SCALE THIS DRAWING
FOR INTERPRETATION OF DRAWING DOD-STD-100 APPLIES
REMOVE BURRS AND BREAK SHARP EDGES
SHARP EDGES TO
FILLET RADII TO
MATERIAL

DRAWN BY J. JANOWSKI DATE 80-10-10
APPROVED BY DATE
CONTRACT NO. DAAK70-88-C-0008
DESIGN APPROVAL DATE
APPROVED FOR PROCUREMENT DATE

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

INTERCONNECTION DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 | CAGE 97403 | DWG NO. 13229E1079

SCALE | SHEET 4

Figure FO-2 (Sheet 4 of 16)

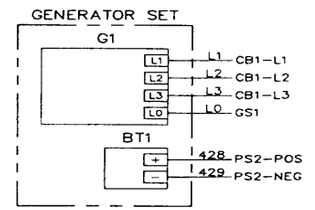
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	J	REVISED AND REDRAWN JWJ	90-10-10	
	K	REVISED PER ECR 2772 WLK AND ECP 0068;	90-11-26	

(MODEL WTA-060 ONLY.)

AQUA-CHEM PART NUMBER	COMPONENT REFERENCE LIST			
	ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	LOCATION
120-07620-1	PL28	13229E0731-1	PILOT LIGHT	SH 12-B2
120-07620-1	PL29	13229E0731-1	PILOT LIGHT	SH 12-B4
120-07620-2	PL30	13229E0731-2	PILOT LIGHT	SH 12-B7
120-07615	PRA/B/C	13229E0730	POWER RESISTORS, FIXED RESISTANCE	SH 10-C3
120-00337	PDB	13229E0098	POWER DISTRIBUTION BLOCK	SH 10-B8
120-00346-2	PDSH1	13229E0105-2	PRESSURE DIFFERENTIAL SWITCH	SH 14-D5
120-00346-1	PDSH2	13229E0105-1	PRESSURE DIFFERENTIAL SWITCH	SH 14-D5
120-00346-2	PDSH3	13229E0105-2	PRESSURE DIFFERENTIAL SWITCH	SH 14-D5
120-00345	PSH5	13229E0104	PRESSURE SWITCH (HIGH)	SH 14-D5
120-00347-2	PSH6	13229E0106	PRESSURE SWITCH (HIGH)	SH 14-C5
120-00350	PSH7	13229E0107	PRESSURE SWITCH (HIGH)	SH 14-C5
120-00347-1	PSL4	13229E0106-1	PRESSURE SWITCH (LOW)	SH 14-D5
120-02182	PSL8	13229E1115	PRESSURE SWITCH (LOW)	SH 14-D3
120-02325	PSK1	13229E1218	POWER SUPPLY, 9VDC	SH 8-B5
120-07693	PS1	13229E0754	POWER SUPPLY, 12VDC	SH 8-B6
120-02238	PS2	13229E1176	POWER SUPPLY, 28VDC	SH 14-C6
120-02180	R1	MIL-R-11 TYPE BB	RESISTOR, GROUND, 1.1 MEG	SH 10-B7
120-02180	R2	MIL-R-11 TYPE BB	RESISTOR, GROUND, 1.1 MEG	SH 10-B7
120-0611-1	SR2	13229E0151-1	RECEPTACLE, 120VAC, INTERIOR	SH 15-D4
120-0611-1	SR4	13229E0151-1	RECEPTACLE, 120VAC, INTERIOR	SH 14-A1
120-0611-2	SR5	13229E0151-2	RECEPTACLE, 120VAC, EXTERIOR	SH 16-D7
120-0611-2	SR6	13229E0151-2	RECEPTACLE, 120VAC, EXTERIOR	SH 16-A5
120-01724	SR7	13229E0597	RECEPTACLE, 120VAC, PLUG, EXTERIOR	SH 16-D7
120-00745	SR9	13229E0187	RECEPTACLE, 120VAC, DUPLEX, INTERIOR	SH 13-C5
120-01492	SS1	13229E0503	SELECTOR SWITCH, 2 POSITION	SH 16-D3
120-02380	SS2	13229E1245	SELECTOR SWITCH, 2 POSITION	SH 12-D3
120-02382	SS3	13229E1247	SELECTOR SWITCH, 3 POSITION	SH 12-C7
120-07625	SS4	13229E0736	SELECTOR SWITCH, 2 POSITION	SH 15-D5
120-07625	SS5	13229E0736	SELECTOR SWITCH, 2 POSITION	SH 11-C2
120-02381	SS6	13229E1246	SELECTOR SWITCH, 2 POSITION	SH 12-B4
120-07625	SS7	13229E0736	SELECTOR SWITCH, 2 POSITION	SH 15-D4
120-07625	SS8	13229E0736	SELECTOR SWITCH, 2 POSITION	SH 13-C5
120-07549-1	SV1	13229E0700-1	SOLENOID VALVE	SH 15-B2
120-07549-1	SV2	13229E0700-1	SOLENOID VALVE	SH 15-B4
120-07549-1	SV3	13229E0700-1	SOLENOID VALVE	SH 15-C4
120-07549-1	SV4	13229E0700-1	SOLENOID VALVE	SH 15-C4
120-07549-1	SV5	13229E0700-1	SOLENOID VALVE	SH 15-B4
120-07549-2	SV6	13229E0700-2	SOLENOID VALVE	SH 15-B2
120-07549-1	SV7	13229E0700-1	SOLENOID VALVE	SH 14-B4
120-02414-3	SV8	13229E1269-3	SOLENOID VALVE ASSEMBLY	SH 15-B2
120-02414-1	SV9	13229E1269-1	SOLENOID VALVE ASSEMBLY	SH 14-B6
120-02230	SV10	13229E0445	SOLENOID VALVE ASSEMBLY	SH 15-B7
120-07600	T1	13229E0716	TRANSFORMER, 3KVA	SH 10-A6
120-01896	T2	13229E0840	TRANSFORMER, 5KVA	SH 10-A7
120-00331-1	TB1-1/-91	13229E0093-1	TERMINAL, 15 AMP	SH 9-D8
120-00332-2	TB1-92/-99	13229E0094-2	TERMINAL, GROUND, 20 AMP	SH 9-B5

AQUA-CHEM PART NUMBER	COMPONENT REFERENCE LIST			
	ELECTRICAL REFERENCE DESIGNATION	NSN AND PART NO.	DESCRIPTION	LOCATION
120-00331-1	TB2-1/-5	13229E0093-1	TERMINAL, 15 AMP	SH 10-A7
120-00331-2	TB3-1/-22	13229E0093-2	TERMINAL, 20 AMP	SH 10-C1
120-00332-2	TB3-23/-25	13229E0094-2	TERMINAL, GROUND, 20 AMP	SH 10-B1
120-00331-1	TB4-1, -5	13229E0093-1	TERMINAL, 15 AMP	SH 16-D5
120-00332-1	TB4-2/-4	13229E0094-1	TERMINAL, GROUND, 15 AMP	SH 16-D5
120-00331-1	TB5-1/-12	13229E0093-1	TERMINAL, 15 AMP	SH 14-D6
120-00332-1	TB5-13/-15	13229E0094-1	TERMINAL, GROUND, 15 AMP	SH 14-C6
120-00331-1	TB6-1/-16	13229E0093-1	TERMINAL, 15 AMP	SH 15-D5
120-00332-1	TB6-17,-18	13229E0094-1	TERMINAL, GROUND, 15 AMP	SH 15-C5
120-00331-1	TB7-1/-13	13229E0093-1	TERMINAL, 15 AMP	SH 14-B6
120-00332-1	TB7-14	13229E0094-1	TERMINAL, GROUND, 15 AMP	SH 14-A6
120-01082	TBM	13229E0289	TURBIDITY METER	SH 15-A2
120-00353	TDK1	13229E0109	TIMER, CYCLE	SH 8-D3
120-07604-3	TDK2	13229E0720-3	RELAY, TIME DELAY	SH 8-C6
120-07604-2	TDK3	13229E0720-2	RELAY, TIME DELAY	SH 8-D6
120-07604-2	TDK4	13229E0720-2	RELAY, TIME DELAY	SH 8-D5
120-07604-1	TDK5	13229E0720-1	RELAY, TIME DELAY	SH 8-C5
120-01318	TDS	13229E0413	TOTAL DISSOLVED SOLIDS METER (CONDUCTIVITY)	SH 14-C6
120-01280	TDSS	13229E0387	TOTAL DISSOLVED SOLIDS SENSOR (CONDUCTIVITY)	SH 14-C5
———	ST1	MS24523-22	SWITCH, TOGGLE	SH13-B4

(MODEL ROWPU-1 ONLY.)



UNLESS OTHERWISE SPECIFIED DIM. TOLERANCES ARE
ONE PLACE (.X) ±
TWO PLACE (.XX) ±
THREE PLACE (.XXX) ±
ANGLES ±
THIRD ANGLE PROJECTION
DO NOT SCALE THIS DRAWING
FOR INTERPRETATION OF DRAWING DOD-STD-100 APPLIES
REMOVE BURRS AND BREAK SHARP EDGES
SHARP EDGES TO
FILLET RADII TO
MATERIAL

DRAWN BY: J. JANOWSKI DATE 90-10-10
APPROVED: DATE 90-10-13
CONTRACT NO. DAAK70-88-C-0008
DESIGN APPROVAL
DATE
APPROVED FOR PROCUREMENT
DATE

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND FORT BELVOIR, VIRGINIA 22060

INTERCONNECTION DIAGRAM, ELECTRICAL, 3000 GPH ROWPU

SIZE A1 | CAGE 97403 | DWG NO 13229E1079 | SCALE | SHEET 5

Figure FO-2 (Sheet 5 of 16)

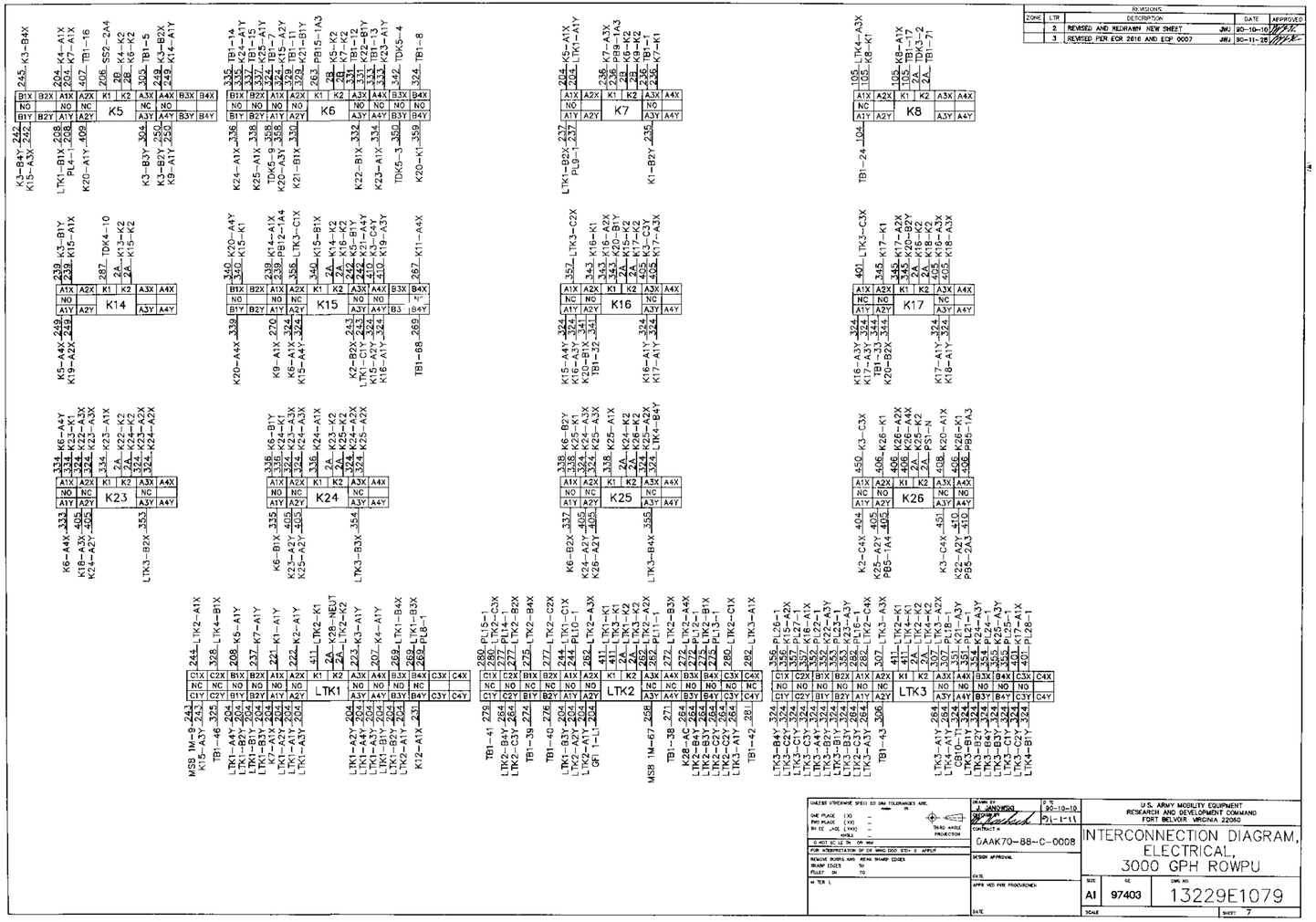


Figure FO 2 (Sheet 7 of 16)

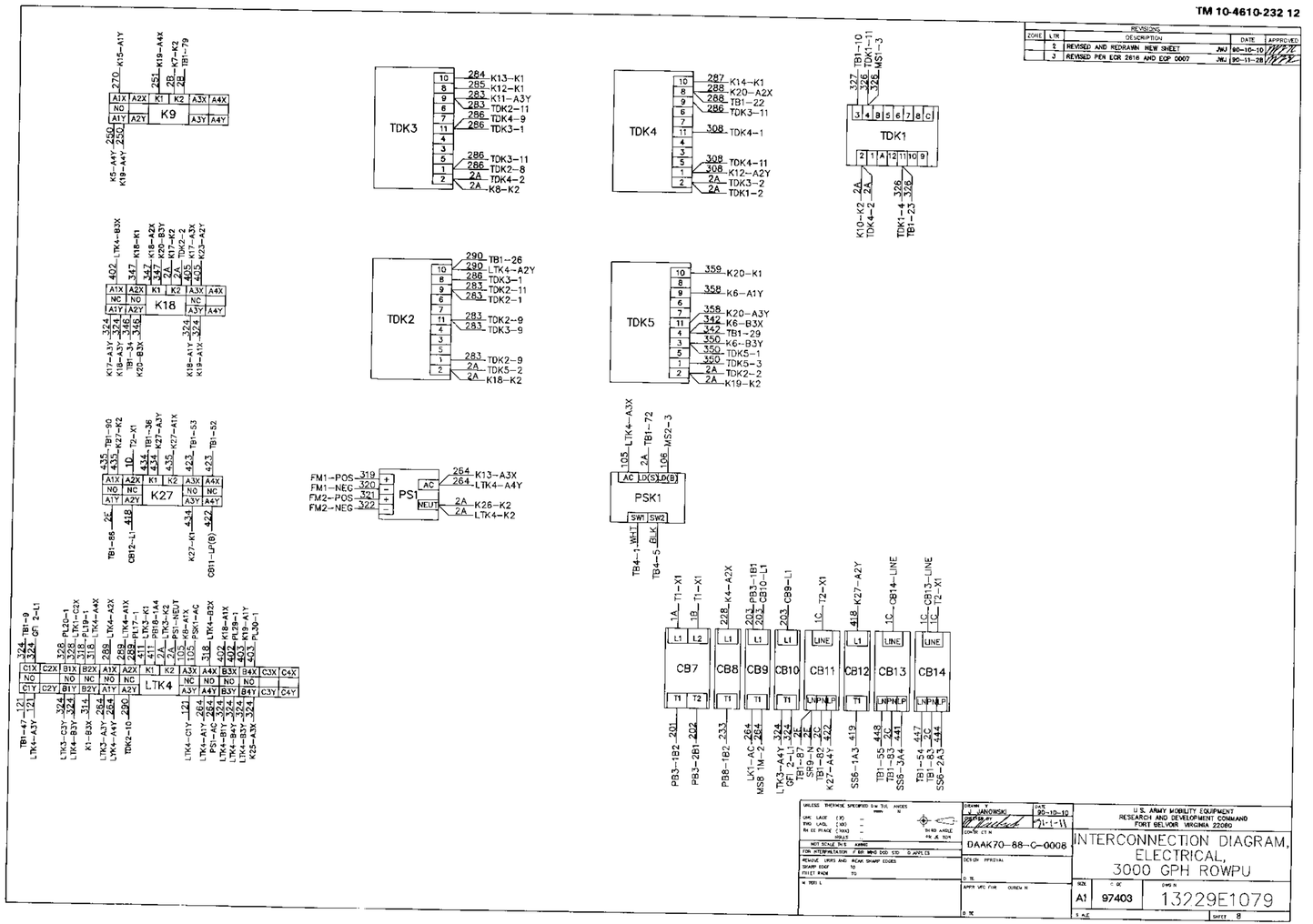


Figure FO 2 (Sheet 8 of 16)

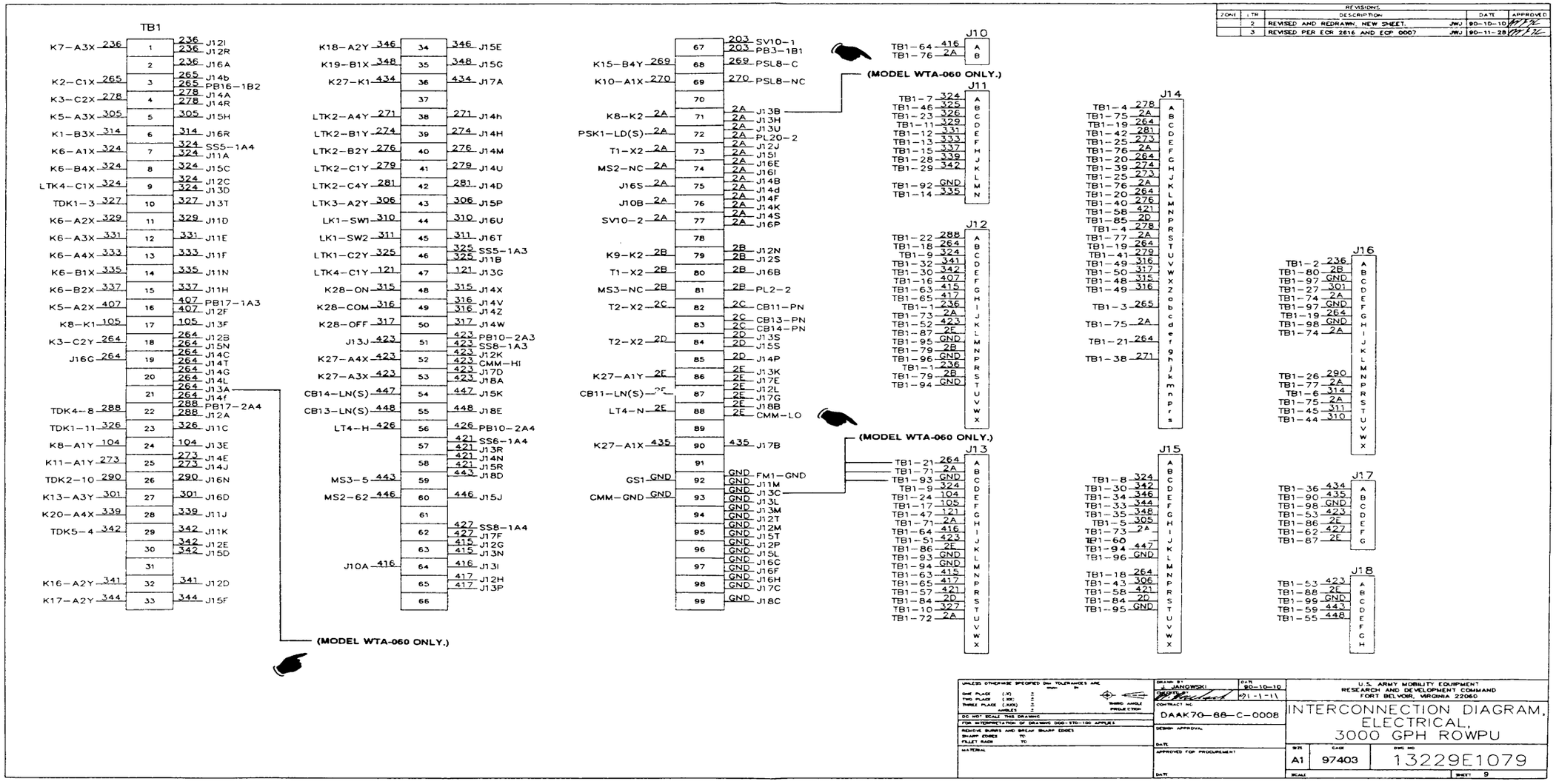


Figure FO-2 (Sheet 9 of 16)
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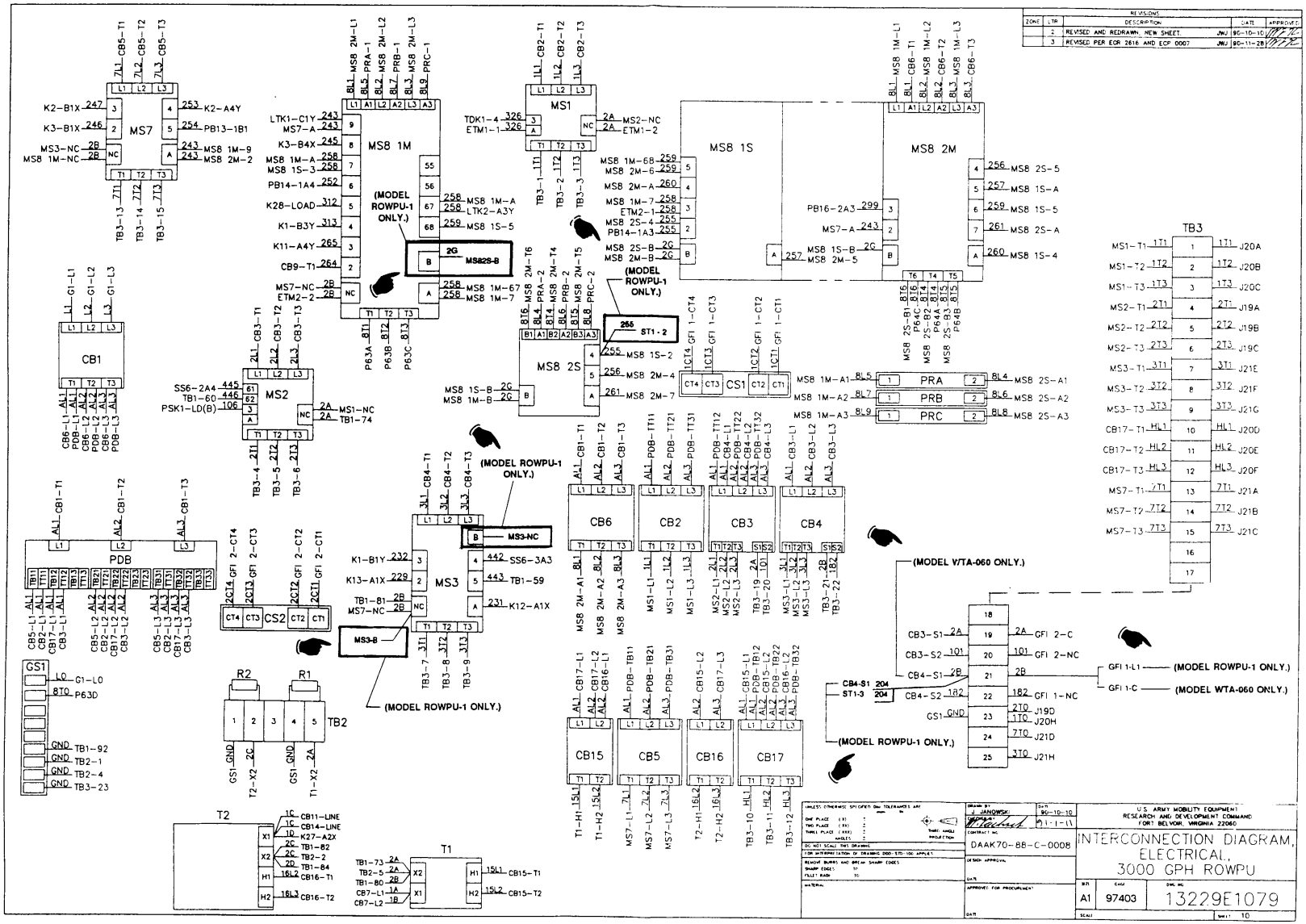

Figure FO-2 (Sheet 10 of 16)
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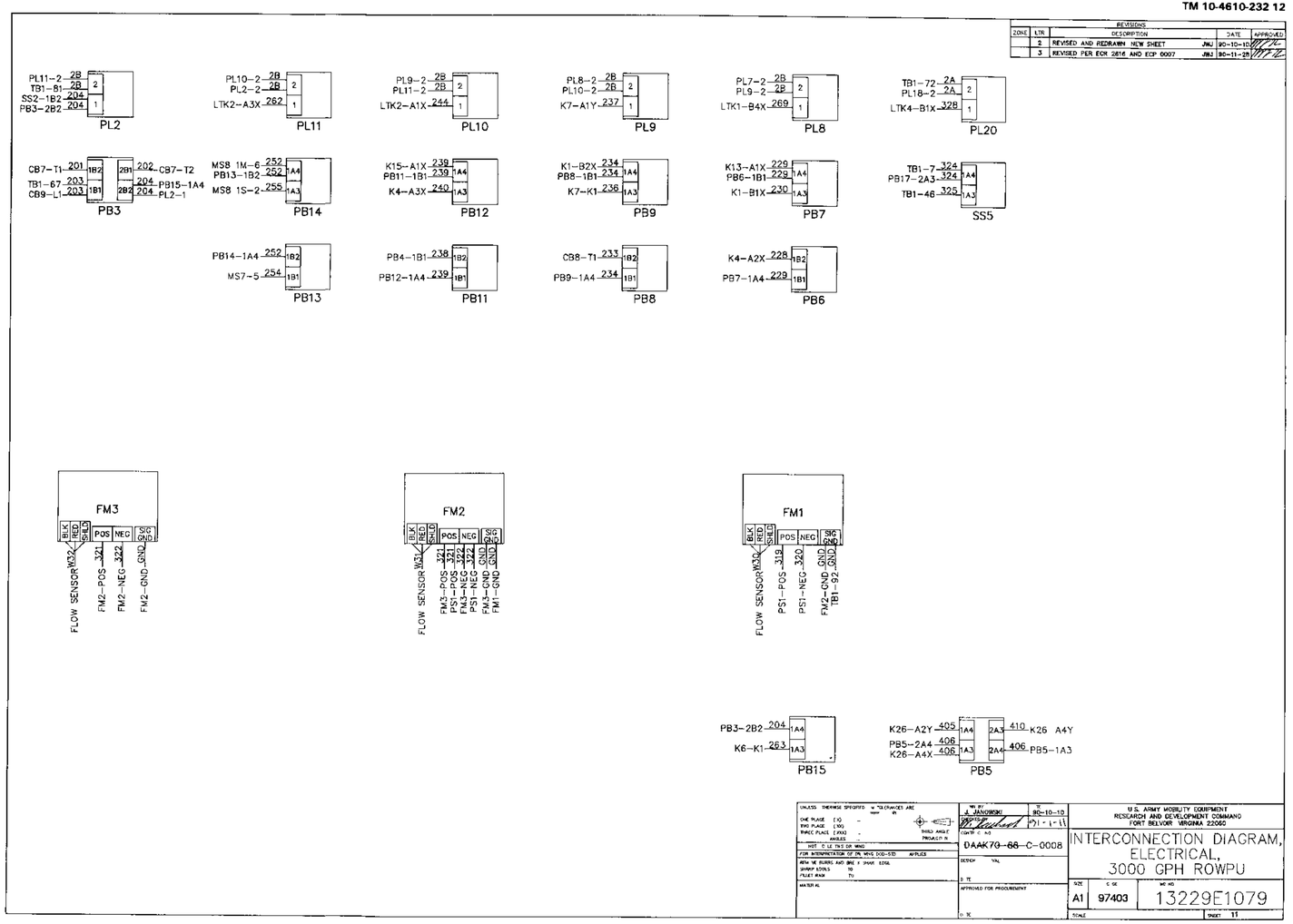

Figure FO 2 (Sheet 11 of 16)

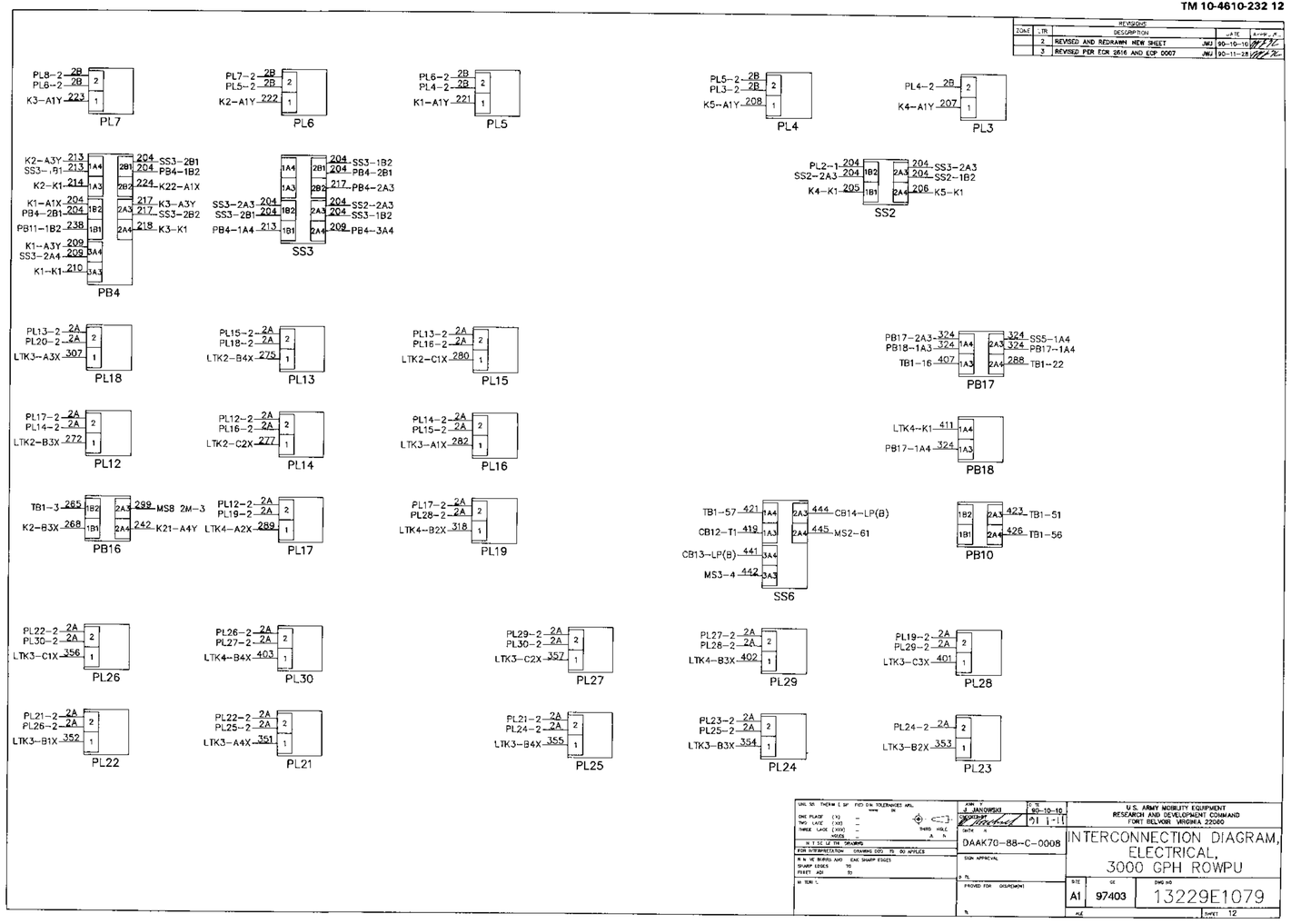

Figure FO 2 (Sheet 12 of 16)

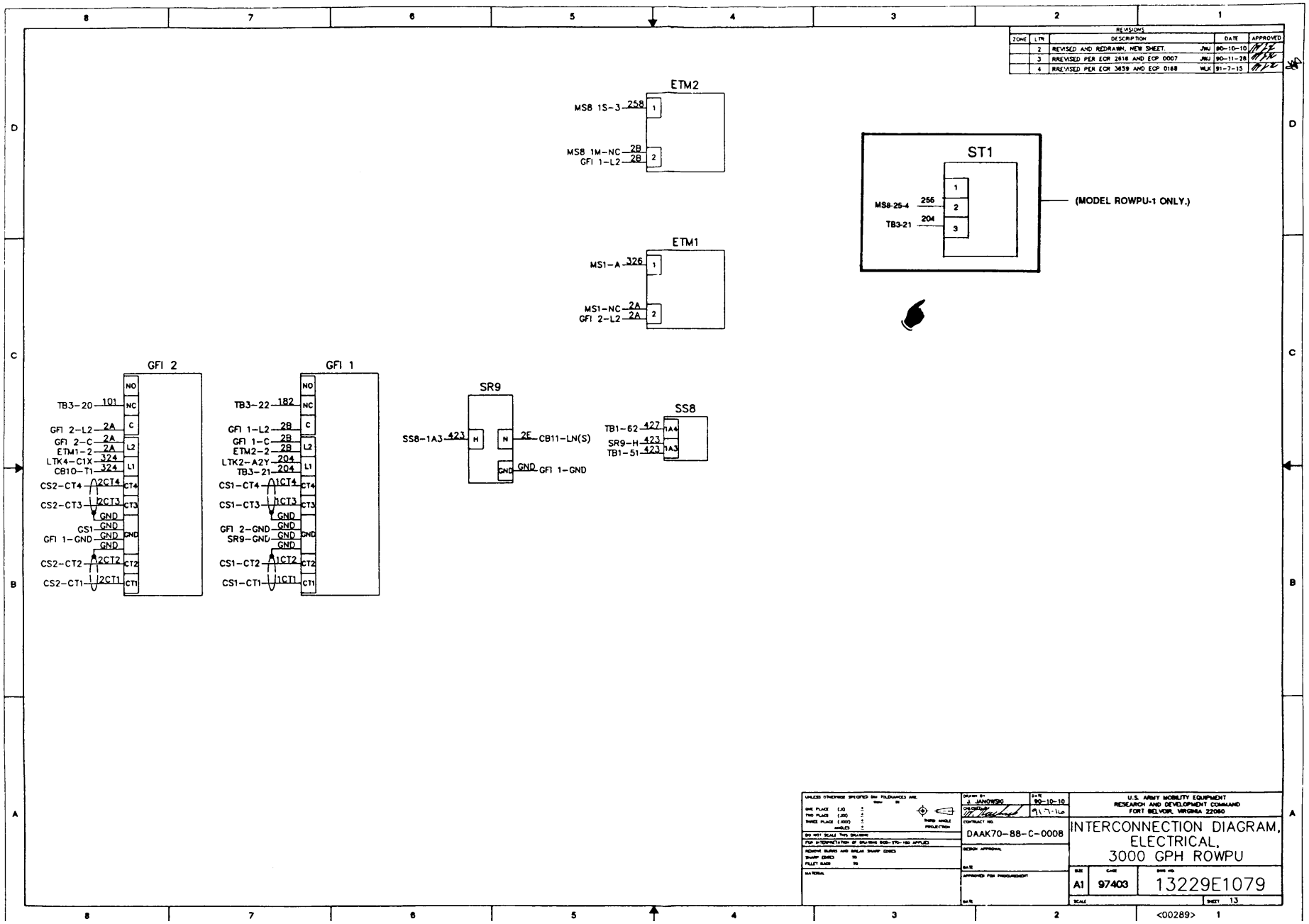

Figure FO-2 (Sheet 13 of 16)

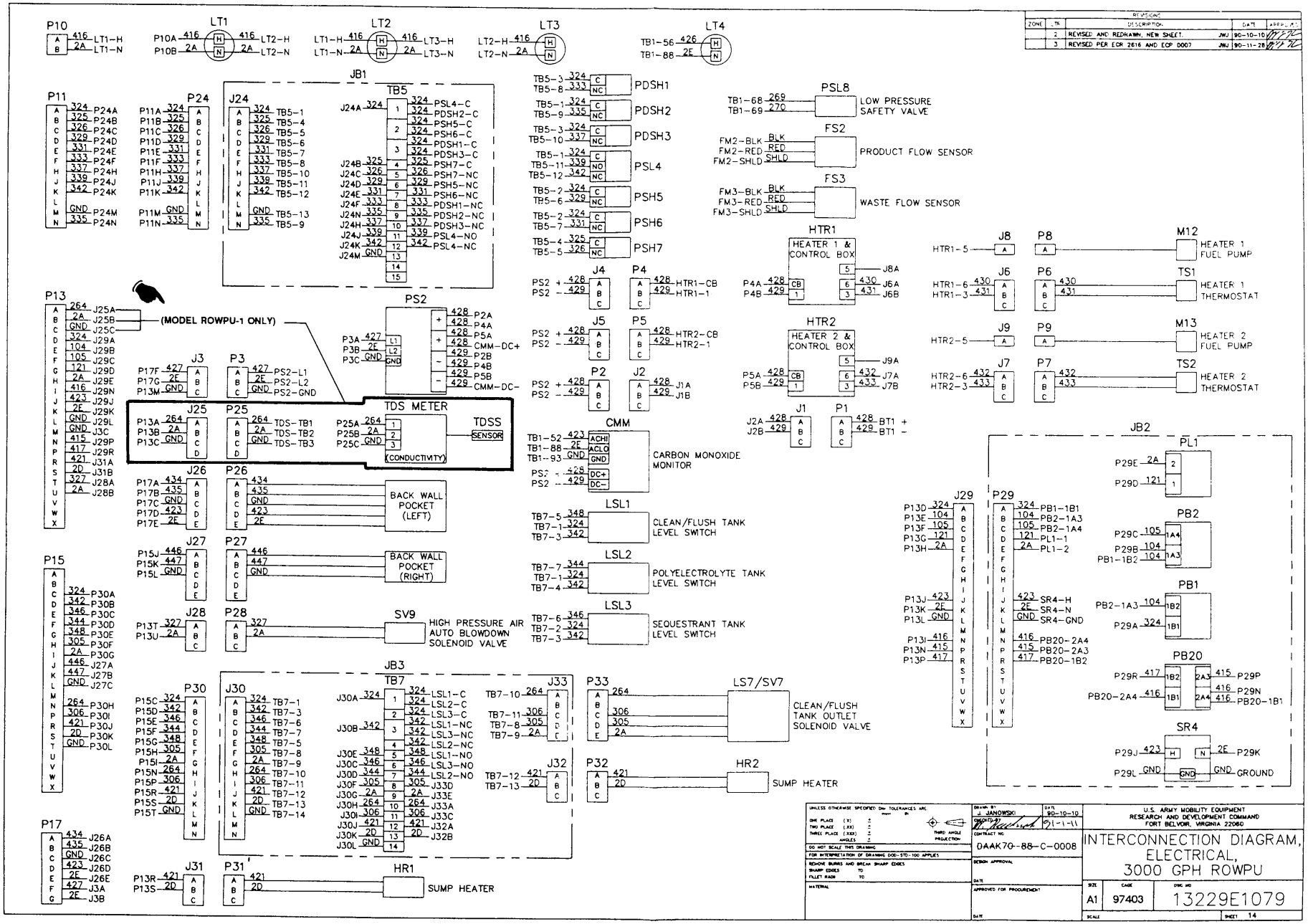

Figure FO-2 (Sheet 14 of 16)

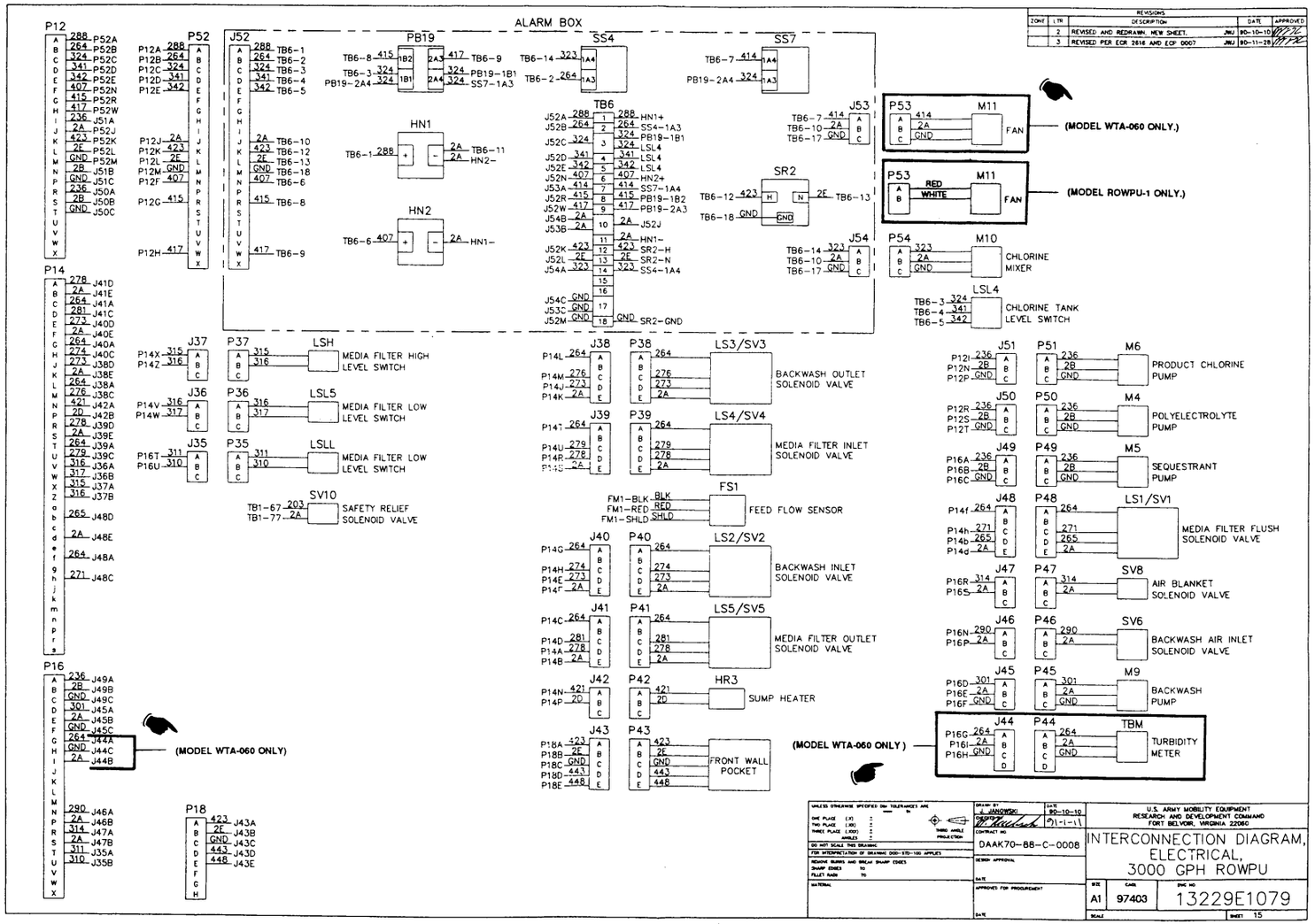

Figure FO-2 (Sheet 15 of 16)

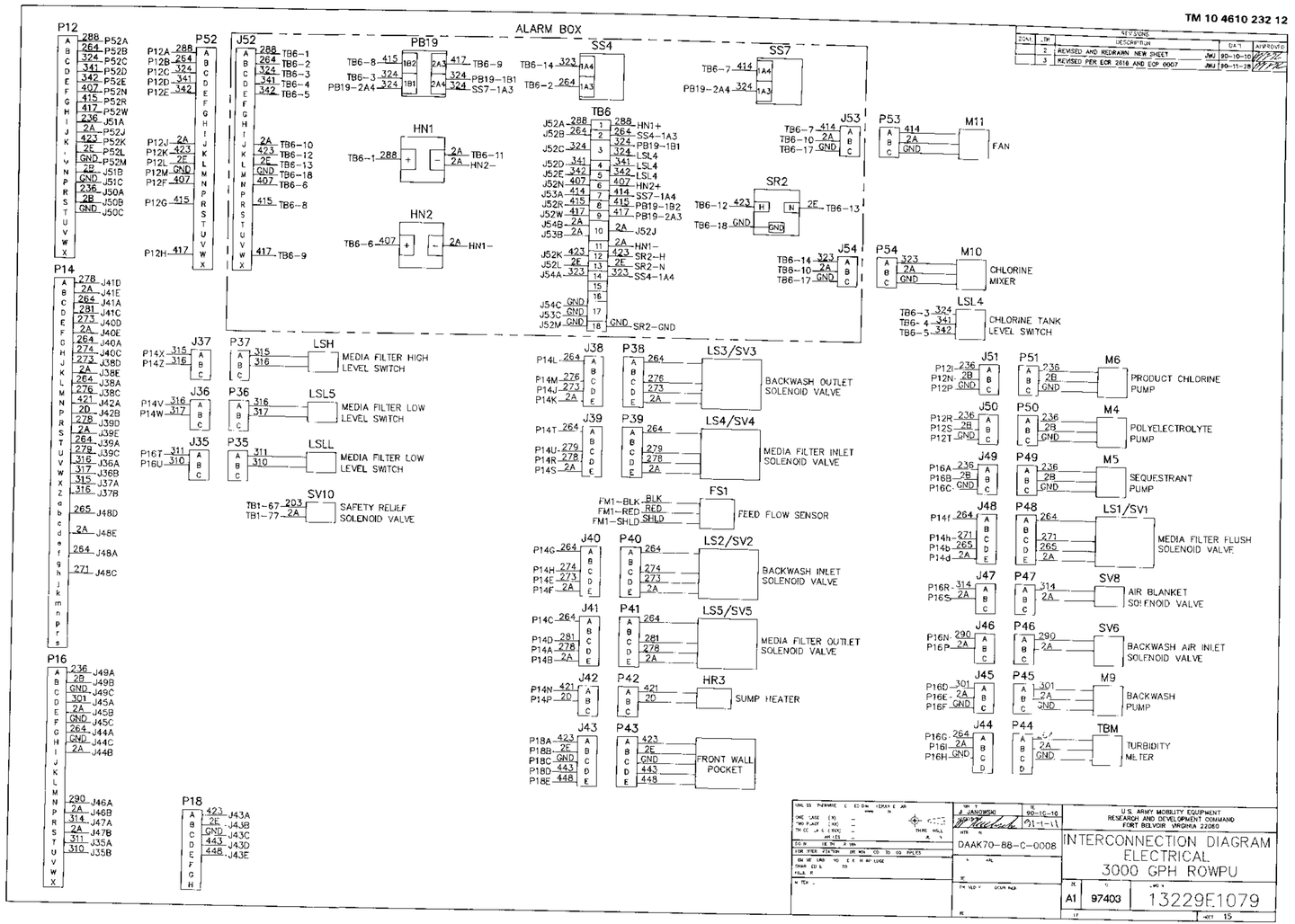

Figure FO 2 (Sheet 15 of 16)

GLOSSARY

SECTION I. ABBREVIATIONS

A or amp . . . . . Amperes
ac . . . . . Alternating current
AG . . . . . Aggregate (filter material)
BC . . . . . Biological contamination
BE . . . . . Biological warfare
C . . . . . Celclus (centlgracfe)
CBR . . . . . Chemical- biological- radiological
CC . . . . . Chemical contamination
cm . . . . . Centimeter
cm-kg . . . . . Centimeter-kilogram
CR . . . . . Purge (position on backwash timer)
crs . . . . . Corrosion resistant steel
CW . . . . . Chemical warfare
DI . . . . . Dionizer
DIS . . . . . Discharge
DS . . . . . Direct support (maintenance)
EIR . . . . . Equipment improvement recommendation
emd . . . . . Electric motor driven
EM . . . . . Electro magnetic pulse
F . . . . . Fahrenheit
fig . . . . . Figure
FM . . . . . Field manual
ft . . . . . Foot
gal . . . . . Gallon
GB . . . . . Green band (a type of nerve gas)
gph . . . . . Gallons per hour
gpm . . . . . Gallons per minute
GS . . . . . General support (maintenance)
HP . . . . . High pressure
hp . . . . . Horsepower
Hz . . . . . Hertz (cycles per second)
in . . . . . Inch
ID . . . . . Inside diameter
ISO . . . . . international Standards Organization
kg . . . . . Kilogram
kg/cm^2 . . . . . Kilograms per square centimeter
kg/cm^2d . . . . . Kilograms per square centimeter (differential)
kg/cm^2g . . . . . Kilograms per square centimeter, gage
kg/sqm . . . . . Kilograms per square meter
kPa . . . . . KiloPascals(metric pressure)
Kw . . . . . Kilowatts (1,000 watts)
l . . . . . Liter
LK . . . . . Lock
lph . . . . . Liters per hour
lpm . . . . . Liters per minute
MAC . . . . . Maintenance Allocation Chart
m-kg . . . . . Meter-kilograms
mg/l . . . . . Milligrams per liter
ml . . . . . Milliliter
MOV . . . . . Metallic oxide varistor
N.O. . . . . Normally open

NBC . . . . . Nuclear, biological or chemical
NC . . . . . Nuclear contamination
No. . . . . Number
Nom. . . . . Nominal
NTU . . . . . Nephelometrlc turbidity units
NW . . . . . Nuclear warfare
OD . . . . . Outside diameter
pC . . . . . PicoCuries (radiation)
pC/l . . . . . Picocuries per lier
pH . . . . . Potential for hydrogen (acidity)
ppm . . . . . Parts per million
POLY . . . . . Polyelectrolyte
PMCS . . . . . Preventive maintenance checks and services
psi . . . . . Pounds per square inch
psid . . . . . Pounds per square inch(differential)
psig . . . . . Pouncfs per square inch gravity (pressure)
RO . . . . . Reverse Osmosis
ROWPU . . . . . Reverse Osmosis Water Purification Unit
RPSTL . . . . . Repair Parts and Special Tools List
s . . . . . A built-in internal standard
SF . . . . . Standard form
SR . . . . . Service (position on backwash timer)
tbc . . . . . Total biological count
TBS . . . . . To be supplied
TDS . . . . . Total dissolved solids
TM . . . . . Technical manual
Vac . . . . . Volts, alternating current
Vdc . . . . . Volts,direct current

SECTION II. DEFINITION OF UNUSUAL TERMS

Accumulator — A device to reduce pressure surges caused by the high pressure pump (a vibration dampner).

AG *media* — Lightweight filter material turning the top media layer in the media filter

Backwash — Semi-automatic process of cleaning the media filter.

Brackish water — Slightly salty water such as that found where a river enters the ocean and the outlet of a bed or lagoon flooded by ocean tides.

Brine — Very salty rejected feedwater. Also called waste, concentrate, and reject.

Biological warfare agents — These are removed in the carbon filter of the NBC system.

Calcium/carbonate — (Lime) A typeof dissolved salt found in the raw water which may form scale on the reverse osmosis elements.

Calcium hypochlorite — A form of chlorine used to control biological growth in water.

Calcium sulfate — A type of dissolved salt found in the raw water which may form scale on the reverse osmosis elements.

Chlorination — The addition of chlorine to product water to prevent growth of micro organisms.

Concentrate – *See* “brine “

Conductivity – Salinity or amount of salt in solution.

Contaminants — Any foreign substance found in the raw water or in the ROWPU systems.

Creep – Gradual increase in outlet pressure.

Cuvette — Glass test tubes that are matched exactly in all dimensions. Cuvettes must not be scratchedor get dirty or results from chemical analyses will be Inaccurate.

Cyclone separators – Devices which remove solids from a liquid through centrifugal action The liquid is rotated at high speed by its own velocity forcing the heavier solids out of the liquid.

Deionizer – A device for removing any remaining nuclear radiation in the product water The deionizer is part of the NBC filtration system.

Differential pressure – The difference between inlet and outlet pressures of a component Also called pressure drop.

Dissolved solids – Solid substances that must be removed from the raw water during purification.

Electro Magnetic Pulse (EMP) – The electrical and magnetic pulse wave generated by a nuclear weapon.

Feed water – Water input to the Water Purificationn System of the ROWPU.

Free chlorine level – Amount of chlorine present in product water, measured in ppm or mg I.

Fouling – The deposit of solids on the surface of the reverse osmosis (RO) elements Fouling is caused by dissolved solids or biological growth.

Hypochlorite - Calcium hyypochlorite (chlorine) used to destroy biological growth in water.

Inlet pressure - Pressure measured at the inlet of a component.

Nuclear, Biologlial, Chemical (NBC) -- Flitratlon unit of the ROWPU used to filter out nuclear, biological, or chemilcal contaminants, includes carbon and deionizing (Dl) filtration.

Neutralize - To counteract the effects of contaminants in the water or ROWPU.

Nephelometric Turbidity Unit (NTU). -- A measurement of turbidity as determined by a turbtdity meter.

Nuclear warfare agents. – These are removed in the deionizing (Dl) filter of the NBC filtration unit.

Osmosis - Process in which water diffuses through a membrane from a less concentrated saline solution to a more concentrated saline solution.

Osmostic pressure – The pressure generated by the osmotic passage of water into a more saline water.

Outlet pressure - Pressure measured at the outlet of a component.

PicoCuries. A measurement of nuclear radlatlon.

Polyelectrolyte - Chemilcal mixed with water to produce floe particles.

Portable wafer – Water meeting military standards for drinkability.

Potential for hydrogen (pH) - This symbol IS used with a numeric value to Indicate the relative acidity or alkalinity of a solution. The pH scale runs from 0-14 with number 7 being a neutral solution (pure water). The numbers6 to 1 Indicate increasing acidity and the numbers 8 to 14 indicate Increasing alkalinity.

Product – Water produced by the Water Purification System of the ROWPU before adding hypochlorite.

Pulse dampener – Unit to smooth out regularly repeated variations in output of RO pump.

Raw water – Contaminated or untreated source of water for the Raw Water Intake System of the ROWPU.

Reagents – Chemicals used to cause a reaction or change.

Reject — See " brine ".

Reverse Osmosis (RO) – A reversal of the osmosis process brought about by applying a water pressure greater than osmotic pressure on water containing dissolved solids.

Reverse Osmosis (RO) Element — A device containing the membrane material which provides the reverse osmosis separation, a feed channel for water passage and a product channel and collector for gathering the purified water.

Reverse Osmosis (RO) Vessel — A high pressure cylinder which holds one or more RO elements.

Saline water – A water containing dissolved solids (salts).

Scale - A build up of salts such as calcium carbonate or calcium sulfate on the reverse osmosis elements.

Semi-automatic — A device or system which, when manually started, will continue to operate until an operational cycle is complete.

Sequestrant — A chemical used to prevent scale from building up in the reverse osmosis elements.

Silica — A hard glossy sandy material found in turbulent water sources.

Sodium bisulfite — A chemical compound used for sanitized cleaning of the ROWPU to prevent bacterial growth within the reverse osmosis elements during long-term, secured shutdown. Sodium bisulifite is mixed with sequestrant.

Surges — Sudden, momentary increases in pressure.

Suspended solids — Particlesof dirt and organics in water which do not rapidly settle out. These cause the water to appear dark or cloudy.

Total biological count — A measure of biological contaminants.

Total Dissolved Solids (TDS) — The measure of the total dissolved solids (salts) in water measured in ppm or mg/l.

Turbidity — Mud and other suspended solids found in the raw water which cause the water to appear cloudy.

Waste — See “brine.”

Subject — **Paragraph or Appendix Number**

Subject — **Paragraph or Appendix Number**

M

N

O

P

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Colonel, United States Army
The Adjutant General

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7. ***Date Sent:*** 19-OCT-93
8. ***Pub no:*** 55-1915-200-10
9. ***Pub Title***: TM
10. ***Publication Date:*** 11-APR-88
11. ***Change Number:*** 12
12. ***Submitter Rank:*** MSG
13. ***Submitter Fname:*** Joe
14. ***Submitter Mname:*** T
15. ***Submitter Lname:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. ***Page:*** 1
19. ***Paragraph:*** 3
20. ***Line:*** 4
21. ***NSN:*** 5
22. ***Reference:*** 6
23. ***Figure:*** 7
24. ***Table:*** 8
25. ***Item:*** 9
26. ***Total:*** 123
27. ***Text:***
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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR-25-30; the proponent agency is ODISC4.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

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PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C