R30-00-C-007-JA-001
R30-00-C-009-JA-001

GOULDS PUMPS, INC.
TYPE I MANUAL

TM INSL - 771.2

CUSTOMER: DETROIT EDISON COMPANY

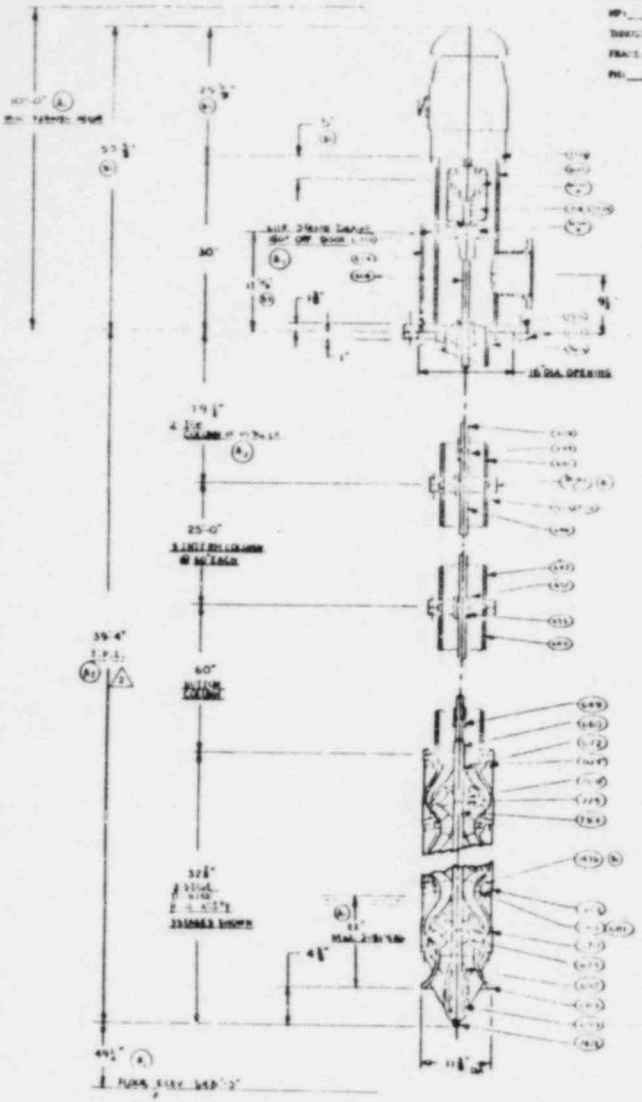
P.O. # 1A 95618

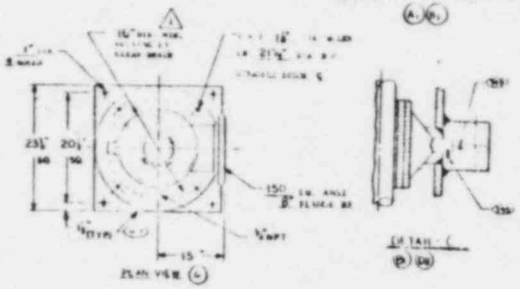
S.O. # N302276-1, 2, 3, 4

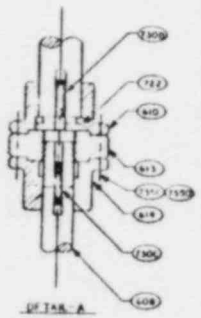
ITEM: DIESEL GENERATOR SERVICE WATER PUMPS

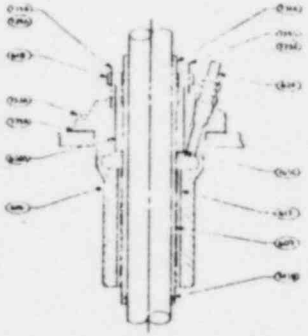
ESTIMATED SHIPPING WEIGHT (EA.): 2625 LBS.

TABLE OF CONTENTS









NUCLEAR PART

SECTIONAL-VIT—8x12 JMC-2276

N3-2276

GOULDS PUMPS

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: NO COLUMN LOSSES ARE INCLUDED

CHART EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES

NOTE ANY CHANGE IN EFFICIENCY CHANGES EITHER THE HEAD OR HORSEPOWER IN PROPORTION

DETROIT EDISON COMPANY

P.O. No. 1A-95618

SPEC. No. 3071-134

ITEM. NO. R30-00-C005 (A)

DIESEL GENERATOR SERVICE WATER PUMPS

S.O. No. N 302276-1

TCN No. N0007

CERTIFIED

Roger Marshall

GOULDS PUMPS

HEAD-CAPACITY

EFFICIENCY

B. HP, SP GR. 1.0

HEAD IN FEET

160 140 120 100 80 60

50 40 30 20

200 400 600 800 1000 1200 1400

U.S. GALLONS PER MINUTE

IMPELLER CLOSED

7 1/8 DIA

UP 3/16 IN

DATE 10-27-77 R.M.

GOULDS PUMPS

VERTICAL PUMP DIVISION

INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGES

8x12 JMC

1760 RPM

CURVE SHT. NO. 1-77-486

REV. (A) 11-15-77

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

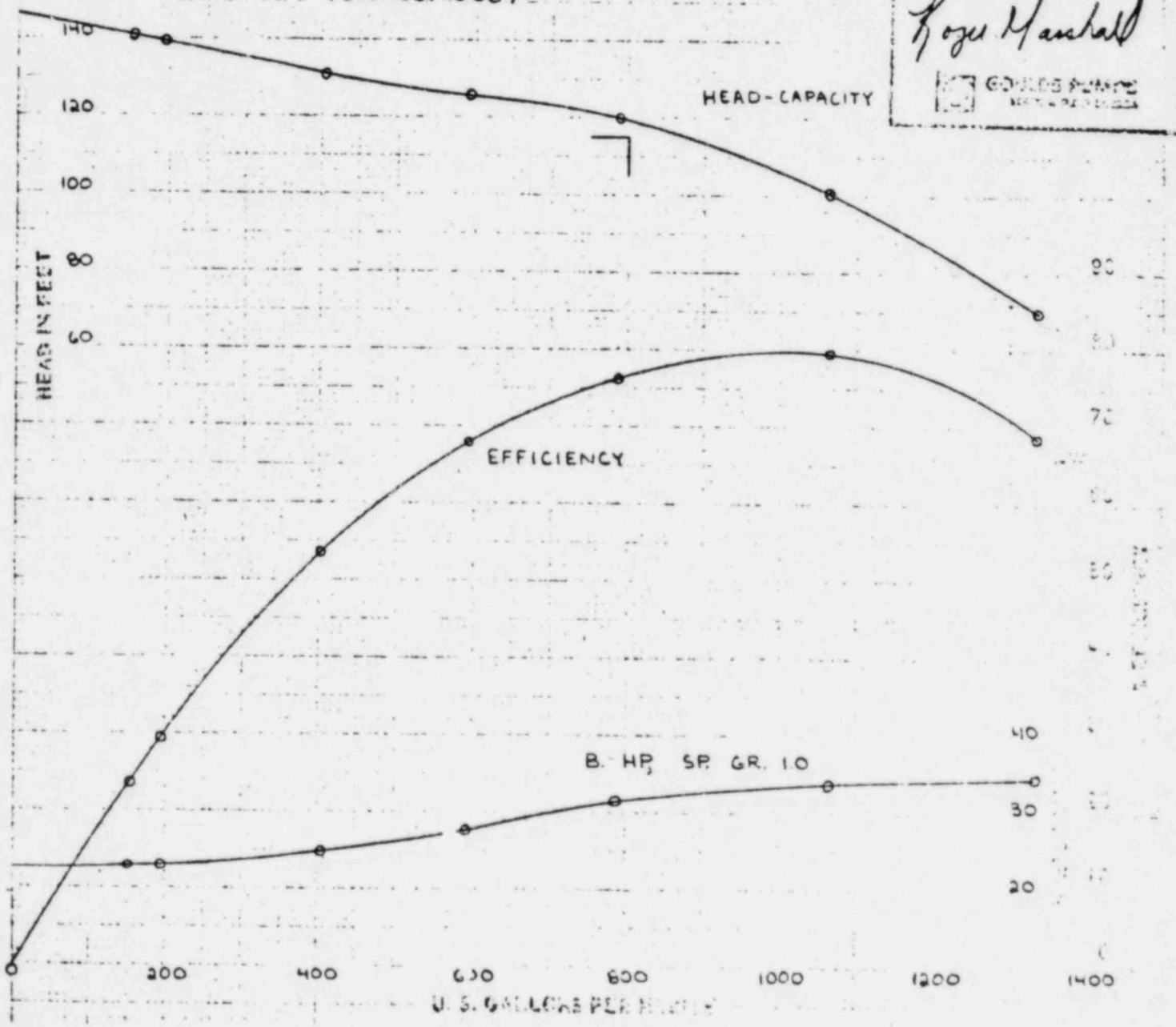
NOTE: No COLUMN LOSSES ARE INCLUDED

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	PER NUMBER OF STAGES

NOTE ANY CHANGE IN EFFICIENCY CHANGES THE HEAD OR HORSEPOWER CORRECTIONS

DETROIT EDISON COMPANY
P.O. NO. 1A-95618
SPEC. NO. 3071-134
ITEM NO. R 30-00-C006 (A)
DIESEL GENERATOR SERVICE WATER PUMPS
S.O. NO. N 302276-2
TCN NO. N0007

CERTIFIED
Roger Marshall
GOULDS PUMPS



IMPELLER CLOSED
7 3/8 DIA.
UP 3/16 IN
DATE 10-26-77 BY R.M.

GOULDS PUMPS
VERTICAL PUMP DIVISION
INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGES
8 x 12 JMC
1760 R.P.M.
T-77-483
REV. (A) 11-15-77

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

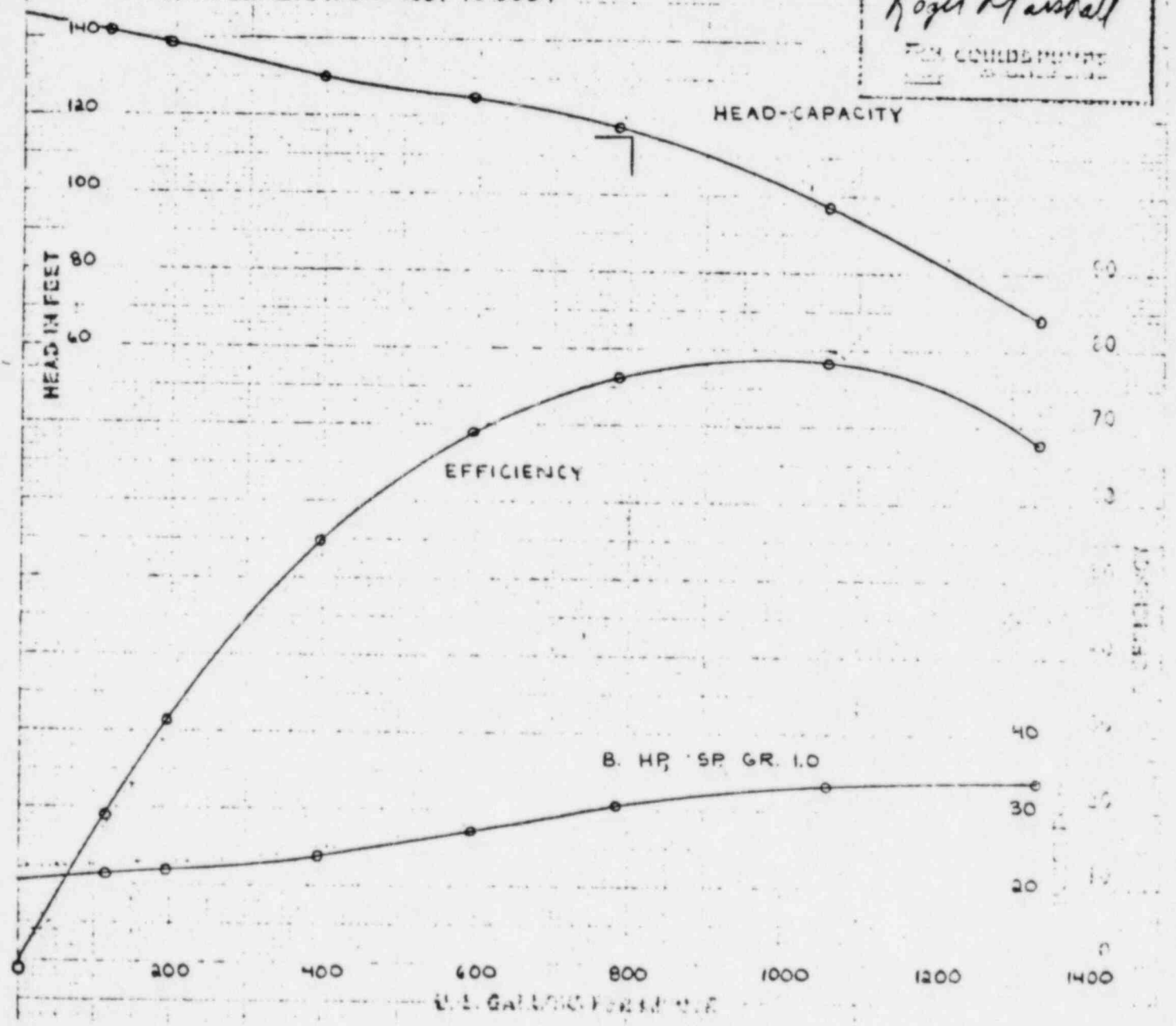
NOTE: No COLUMN LOSSES ARE INCLUDED

DETROIT EDISON COMPANY
P.O. No. 1A-95618
SPEC. No. 3071-134
ITEM NO. R30-00-C007 (A)
DIESEL GENERATOR SERVICE WATER PUMPS
S.O. No. N 302276-3
TCN NO. N 0007

CHANGE EFFICIENCY AS PER CURVE	NUMBER OF POINTS	PER NUMBER OF STAGES

NO CHANGE EITHER THE HEAD OR CAPACITY AT THE RATED POINT

CERTIFIED
Roger Marshall
FOR GOULDS PUMPS



IMPELLER CLOSED
7 1/8 DIA.
UP 3/16 IN.
DATE 10-26-77 R.M.

GOULDS PUMPS
VERTICAL PUMP DIVISION
INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGE
8 x 12 JMC
DEEP WELL TURBINE PUMP
1760 R.P.M.
CURVE UNIT NO. T-77-484
REV. (A) 11-15-77

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: NO COLUMN LOSSES ARE INCLUDED

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES

NOTE ANY CHANGE IN EFFICIENCY CHANGES EITHER THE HEAD OR POWER AS IT IS INCREASED

DETROIT EDISON COMPANY

P.O. NO. 1A-95618

SPEC. NO. 3071-134

ITEM NO. R30-00-C008 Ⓐ

DIESEL GENERATOR SERVICE WATER PUMPS

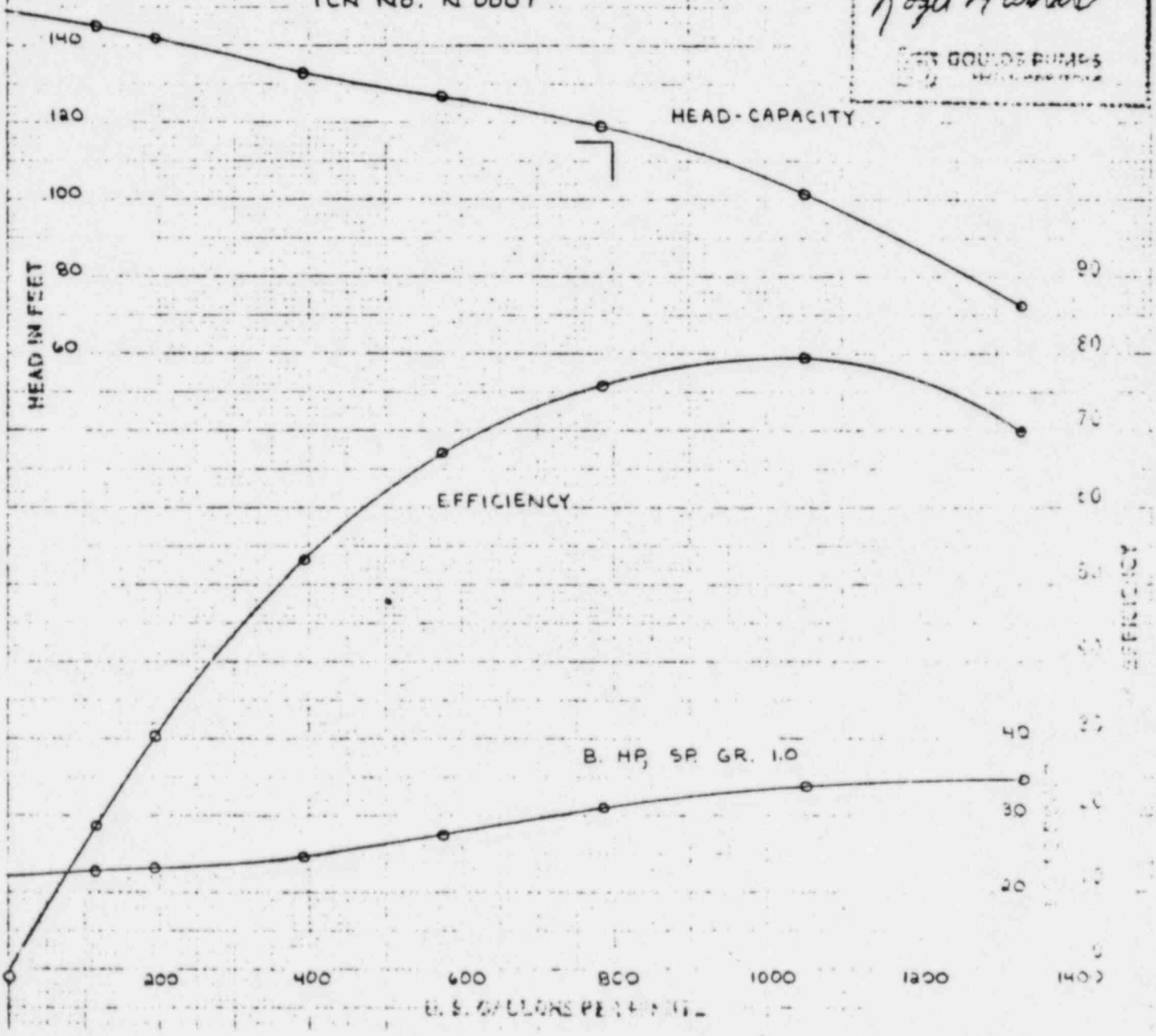
S.O. NO. N 302276-4

TCN NO. N 0007

CERTIFIED

Roger Hadall

FOR GOULDS PUMPS



IMPELLER CLOSED

7 7/8 DIA.

UP 2/16 IN.

DATE 10-27-77 BY R.M.

GOULDS PUMPS

VERTICAL PUMP DIVISION

INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGES

8 x 12 JMC

1760 RPM

CURVE SHEET NO T-77-487

REV. Ⓐ 11-15-77

GOULDS PUMPS - VERTICAL PUMP DIVISION

PUMP TEST DATA

TEST NO. T-77-486 REV (A) 11-15-77

TYPE 8x12 JMC STAGES 2	GUARANTEED PERFORMANCE						FOR: DETROIT EDISON COMPANY
SERIAL NO. N 302276-1		RPM	GPM	HEAD	HP	SP.GR.	VISC.	SPEC. No. 3071-134
2 IMP'S 7 7/8 DIA 3/16 UF b2	LAB							P.O. NO. 1A-95618
IMP'S DIA UF b2	FIELD	1760	800	115	50	1.0	32.554	ITEM NO. R30-00-0005 (A)
AXIAL RUNNING CLEARANCE 0.083	TEST MOTOR 60 HP 4 POLES							DIESEL GENERATOR SERVICE WATER PUMPS
CASE SA 216	WATTMETER SCALE MULTIPLIER - 40							TCN No. N0007
IMPELLERS 316 S/S	LINE 8 " MAGN. FLOWMTR d - 8 " C - 154.6							TESTED BY P LARSON DATE 10-27-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1794	1794	1794	1794	1793	1791	1791					
DISCH. PRESSURE-PSI x5	320.3	312.0	290.6	277.1	258.2	215.5	147.7					
x1	64.06	62.40	58.12	55.42	51.64	43.10	29.54					
DISCH. HEAD-FT.	146.0	144.1	134.3	128.0	119.3	98.2	68.2					
ELEVATION CORRECTION-FT.	1.2	1.2	1.2	1.2	1.2	1.2	1.2					
VELOCITY HEAD-FT.	0.0	0.0	0.1	0.2	0.4	0.7	1.2					
TOTAL PUMP HEAD-FT.	149.2	145.4	135.6	129.5	120.9	100.1	70.6					
FLOW VELOCITY FT/SEC.	0.75	1.41	2.71	3.90	5.28	6.98	8.85					
FLOW - INCHES OF Hg												
FLOW - INCHES OF BLUE												
FLOW - GPM	116	218	419	603	816	1079	1368					
WATTMETER READING	0.461	0.496	0.529	0.558	0.657	0.710	0.731					
INPUT TO MOTOR - KW	19.2	19.8	21.2	23.5	26.3	28.4	29.2					
BRAKE HORSEPOWER	23.8	24.6	26.2	29.2	32.6	35.3	36.3					
PUMP EFFICIENCY - %	18.34	32.56	54.66	67.50	76.37	77.37	67.24					

CERTIFIED

Roger Marshall

GOULDS PUMPS

PERFORMANCE CONVERTED TO 1760 RPM, SP.GR. 1.0

TOTAL PUMP HEAD-FT.	143.6	139.9	130.5	124.6	116.5	96.7	68.2
FLOW-GPM	114	214	411	592	801	1060	1345
BRAKE HORSEPOWER	22.5	23.2	24.8	27.6	30.9	33.5	34.4
PUMP EFFICIENCY-%	18.34	32.56	54.66	67.50	76.37	77.37	67.24

GOULDS PUMPS - VERTICAL PUMP DIVISION

PUMP TEST DATA

TEST NO. T-77-483 REV. (A) 11-15-77

TYPE 8x12 JMC STAGES 2	GUARANTEED PERFORMANCE							FOR: DETROIT EDISON COMPANY
SERIAL NO. N 302276-2		RPM	GPM	HEAD	HP	SP.GR.	VISC.	SPEC. NO. 3071-134
2 IMP'S 7 1/8 DIA 1/16 UF b2	LAB							P.O. NO. 1A-95618
IMP'S DIA UF b2	FIELD	1760	800	115	50	1.0	32SSU	ITEM NO. R30-C0-C1106 (A)
AXIAL RUNNING CLEARANCE 0.083	TEST MOTOR 60 HP 4 POLES							DIESEL GENERATOR SERVICE WATER PUMPS
BOWLS SA-216	WATTMETER SCALE MULTIPLIER 40							TCN NO. N0017
IMPELLERS 316 S.S.	LINE 8 " MAGN. FLOWMTR d- 8 " C- 154.6							TESTED BY P. KAVANAUGH DATE 10-26-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1794	1795	1795	1794	1793	1792	1792					
DISCH. PRESSURE-PSI x5	314.9	311.0	292.3	279.6	266.2	220.6	151.9					
DISCH. PRESSURE-PSI x1	62.98	62.20	58.46	55.92	53.24	44.12	30.38					
DISCH. HEAD-FT.	145.5	143.7	135.0	129.2	123.0	101.9	70.2					
ELEVATION CORRECTION-FT.	1.2	1.2	1.2	1.2	1.2	1.2	1.2					
VELOCITY HEAD-FT.	0.0	0.0	0.1	0.2	0.4	0.8	1.2					
TOTAL PUMP HEAD-FT.	146.7	144.9	136.4	130.6	124.6	103.9	72.6					
FLOW VELOCITY FT/SEC.	1.00	1.27	2.66	3.90	5.20	7.01	8.80					
FLOW - INCHES OF Hg												
FLOW - INCHES OF BLUE												
FLOW - GPM	155	196	411	603	804	1084	1360					
WATTMETER READING	0.489	0.491	0.532	0.590	0.668	0.719	0.733					
INPUT TO MOTOR - KW	19.6	19.6	21.3	23.6	26.7	28.8	29.3					
BRAKE HORSEPOWER	24.2	24.3	26.4	29.3	33.2	35.7	36.4					
PUMP EFFICIENCY - %	23.64	29.54	53.65	67.87	76.23	79.61	68.50					

CERTIFIED

Roger Marshall

GOULDS PUMPS

PERFORMANCE CONVERTED TO 1760 RPM, SP.GR. 1.0

TOTAL PUMP HEAD-FT.	141.2	139.3	131.1	125.7	120.1	100.2	70.0
FLOW-GPM	152	193	403	592	789	1064	1336
BRAKE HORSEPOWER	22.9	22.9	24.9	27.7	31.4	33.8	34.5
PUMP EFFICIENCY-%	23.64	29.54	53.65	67.87	76.23	79.61	68.50

GOULDS PUMPS - VERTICAL PUMP DIVISION
PUMP TEST DATA

TEST NO. T-77-484 REV. (A) 11-15-77

TYPE 8x12 JMC STAGES 2	GUARANTEED PERFORMANCE						FOR: DETROIT EDISON COMPANY
SERIAL NO. N 302276-3		RPM	GPM	HEAD	HP	SP.GR.	VISC.	SPEC. NO. 3071-134
2 IMP'S 7 7/8 DIA 3/16 UF b2	LAB							P.O. NO. 1A-95618
IMP'S DIA UF b2	FIELD	1760	800	115	50	1.0	32554	ITEM NO. R 30-00-0007 (1)
AXIAL RUNNING CLEARANCE 0.083	TEST MOTOR 60 HP 4 POLES							DIESEL GENERATOR SERVICE WATER PUMPS
BOWLS SA 216	WATTMETER SCALE MULTIPLIER = 40							TCN NO. N0007
IMPELLERS 316 SS	LINE 8 " MAGN. FLOWMTR d - 8 " C = 154.6							TESTED BY P. KAVANAUGH DATE 10-26-77

READING		1	2	3	4	5	6	7	8	9	10	11	12
RPM		1795	1795	1795	1794	1793	1792	1792					
DISCH. PRESSURE-PSI	x5	316.0	309.5	289.6	277.4	260.0	213.6	147.5					
	x1	63.20	61.90	57.92	55.48	52.00	42.72	29.50					
DISCH. HEAD-FT.		146.0	143.0	133.8	128.2	120.1	98.7	68.1					
ELEVATION CORRECTION-FT.		1.2	1.2	1.2	1.2	1.2	1.2	1.2					
VELOCITY HEAD-FT.		0.0	0.0	0.1	0.2	0.4	0.7	1.2					
TOTAL PUMP HEAD-FT.		147.2	144.2	135.1	129.6	121.7	100.6	70.5					
FLOW VELOCITY FT/SEC.		0.75	1.30	2.63	3.91	5.17	6.98	8.80					
FLOW - INCHES OF Hg													
FLOW - INCHES OF BLUE													
FLOW - GPM		116	201	407	604	799	1079	1360					
WATTMETER READING		0.460	0.470	0.509	0.577	0.649	0.706	0.718					
INPUT TO MOTOR - KW		18.4	16.8	20.4	23.1	26.0	28.2	28.7					
BRAKE HORSEPOWER		22.8	23.3	25.2	28.7	32.2	35.1	35.7					
PUMP EFFICIENCY - %		18.94	31.47	54.98	69.05	76.21	78.20	67.96					

CERTIFIED
Roger Murdoff
(A) GOULDS PUMPS

PERFORMANCE CONVERTED TO 1760 RPM, SP.GR. 1.0

TOTAL PUMP HEAD-FT.	141.5	138.6	129.9	124.7	117.3	97.1	68.0
FLOW-GPM	114	197	399	593	785	1060	1336
BRAKE HORSEPOWER	21.4	21.9	23.8	27.1	30.5	33.2	33.8
PUMP EFFICIENCY-%	18.94	31.47	54.98	69.05	76.21	78.21	67.96

GOULDS PUMPS - VERTICAL PUMP DIVISION

PUMP TEST DATA

TEST NO. T-77-487 REV. Ⓐ 11-15-77

TYPE 8x12 3MC STAGES 2	GUARANTEED PERFORMANCE							FOR: DETROIT EDISON COMPANY
SERIAL NO. N 302276-4		RPM	GPM	HEAD	HP	SP.GR.	VISC.	SPEC. No. 3071-134
2 IMP'S 7 7/8 DIA 3/16 UF b2	LAB							P.O. NO. 1A-95618
IMP'S DIA UF b2	FIELD	1760	800	115	50	1.0	32 SSU	ITEM NO. R30-00-C008 Ⓐ
AXIAL RUNNING CLEARANCE 0.083	TEST MOTOR 60 HP 4 POLES							DIESEL GENERATOR SERVICE WATER PUMPS
BOWLS SA 216	WATTMETER SCALE MULTIPLIER = 40							TCN NO. N0007
IMPELLERS 316 SS	LINE 8 " MAGN. FLOWMTR d - 8 " C - 154.6							TESTED BY P. KAVANAUGH DATE 10-27-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1794	1794	1793	1793	1793	1792	1792					
DISCH. PRESSURE-PSI ×5	323.3	316.2	295.3	282.0	263.3	223.7	15.70					
DISCH. PRESSURE-PSI ×1	64.66	63.24	59.06	56.40	52.66	44.74	31.40					
DISCH. HEAD-FT.	149.4	146.1	136.4	130.3	121.6	103.3	72.5					
ELEVATION CORRECTION-FT.	1.2	1.2	1.2	1.2	1.2	1.2	1.2					
VELOCITY HEAD-FT.	0.0	0.0	0.1	0.2	0.4	0.7	1.1					
TOTAL PUMP HEAD-FT.	150.6	147.3	137.7	131.7	123.3	105.3	74.9					
FLOW VELOCITY FT/SEC.	0.77	1.29	2.58	3.78	5.17	6.92	8.77					
FLOW - INCHES OF Hg												
FLOW - INCHES OF BLUE												
FLOW - GPM	119	199	399	584	799	1070	1356					
WATTMETER READING	0.489	0.495	0.527	0.583	0.661	0.720	0.740					
INPUT TO MOTOR - KW	19.6	19.8	21.1	23.3	26.4	28.8	29.6					
BRAKE HORSEPOWER	24.2	24.5	26.1	29.0	32.8	35.8	36.7					
PUMP EFFICIENCY - %	18.69	30.25	53.07	67.14	75.76	79.55	69.81					

CERTIFIED

Lyle Marshall

GOULDS PUMPS

PERFORMANCE CONVERTED TO 1760 RPM, SP.GR. 1.0

TOTAL PUMP HEAD-FT.	144.9	141.8	132.7	126.9	118.8	101.6	72.3					
FLOW-GPM	117	196	392	574	785	1051	1332					
BRAKE HORSEPOWER	22.9	23.2	24.7	27.4	31.1	33.9	34.8					
PUMP EFFICIENCY-%	18.69	30.25	53.07	67.14	75.76	79.55	69.81					

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: NO COLUMN LOSSES ARE INCLUDED

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES

NOTE ANY CHANGE IN EFFICIENCY CHANGES TO KEEP THE HEAD OR HORSEPOWER IN PROPORTION

DETROIT EDISON COMPANY

P.O. No. 1A-95618

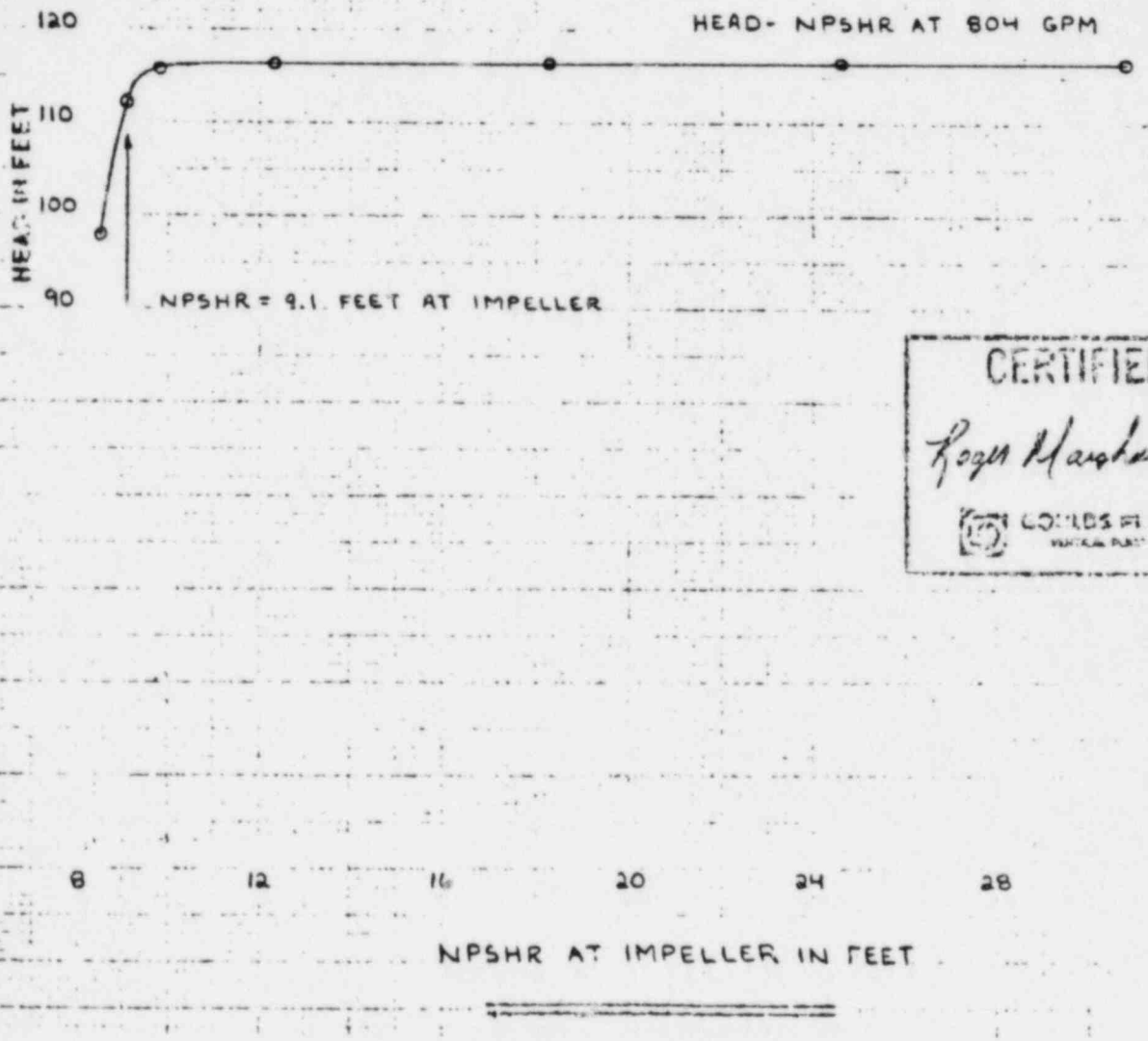
SPEC. NO 3071-134

ITEM NO. R 30-00-0005 (A)

DIESEL GENERATOR SERVICE WATER PUMPS

TCN NO. N0007

S.O. No. N302276-1



CERTIFIED

Roger Marshall

COMBS PUMP

IMPELLER CLOSED

7 2/8 DIA.

UP 3/16 IN

DATE 10-29-77 BY R.M.

COMBS PUMPS

VERTICAL PUMP DIVISION

INDUSTRY, CALIFORNIA

PERFORMANCE ___ TWO ___ STAGES

8x12 JMC

1760 R.P.M.

CURVE SHEET NO. T-77-493

REV. (A) 11-15-77

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: No COLUMN LOSSES ARE INCLUDED

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES

NOTE ANY CHANGE IN EFFICIENCY CAUSED EITHER BY HEAD OR BRAKE POWER IN PERCENTAGE

DETROIT EDISON COMPANY

P.O. No. 1A-95618

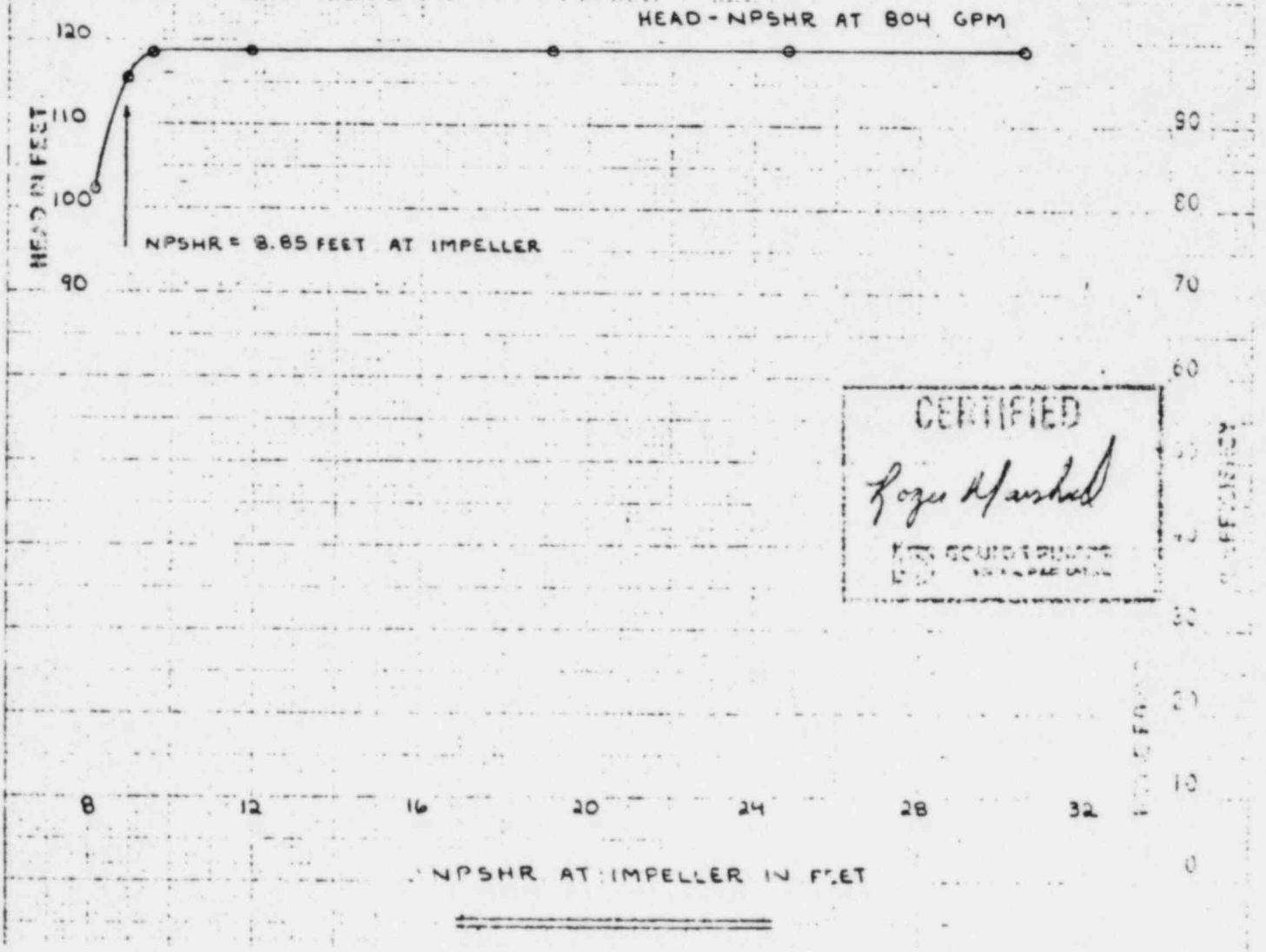
SPEC. No. 3071-134

ITEM NO. R 30-00-C006 (A)

DIESEL GENERATOR SERVICE WATER PUMPS

TCN. No. N0007

S.O. No. N 302276-2



CERTIFIED

Roger Marshall

SCHEDULE PUMPS

IMPELLER CLOSED

7 1/8 DIA.

UP 3/16 IN

DATE 10-27-77 BY R.M.

SCHEDULE PUMPS

VERTICAL PUMP DIVISION

INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGES

8 x 12 JMC

DEEP WELL TURBINE PUMP

1760 R.P.M.

CURVE SHEET NO. T-77-455

REV. (A) 11-15-77

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: NO COLUMN LOSSES ARE INCLUDED

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES

NOTE ANY CHANGE IN SPEC. EFFECT CHANGES EITHER THE HEAD OR ...

DETROIT EDISON COMPANY

P.O. NO. 1A-45618

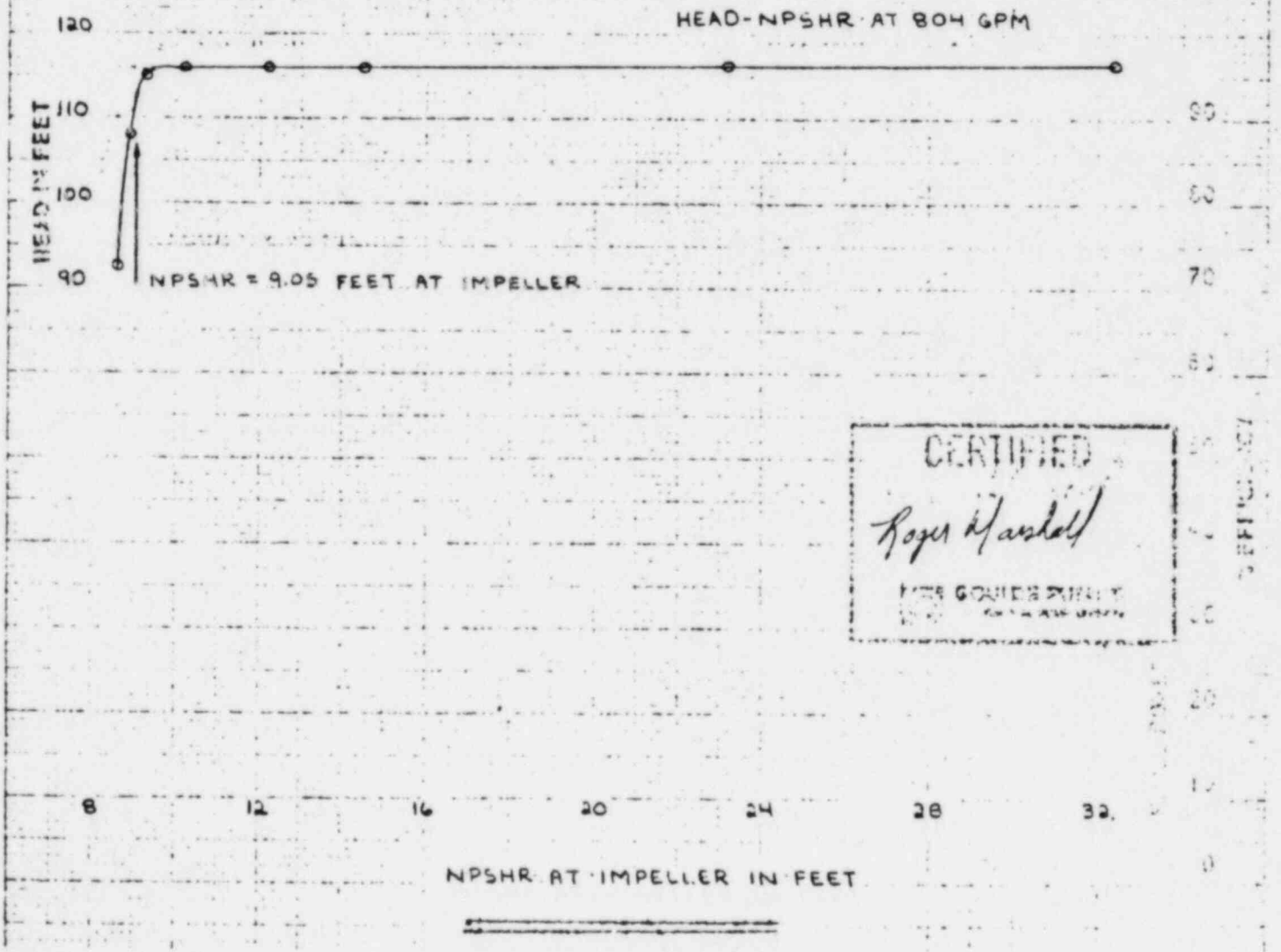
SPEC. NO. 3071-134

ITEM NO. R30-00-C007 (A)

DIESEL GENERATOR- SERVICE WATER PUMPS

TCN NO. N0007

S.O. NO. N302276-3



CERTIFIED

Roger Marshall

GOULDS PUMPS

IMPELLER CLOSED

7 7/8 DIA.

UP 3/16 IN

DATE 10-29-77 BY RM.

GOULDS PUMPS

VERTICAL PUMP DIVISION

INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGES

8 x 12 JMC

DEEP WELL TURBINE PUMP

1760 R.P.M.

CURVE SHEET NO T-77-491

REV. (A) 11-15-77

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: NO COLUMN LOSSES ARE INCLUDED

SINGLE EFFICIENCY AS PUMPED	NUMBER OF POINTS	FOR NUMBER OF STAGES

ANY VARIATION IN EFFICIENCY CHANGES EITHER THE HEAD OR POWER A PROPORTIONAL AMOUNT

DETROIT EDISON COMPANY

P.O. No. HA-95618

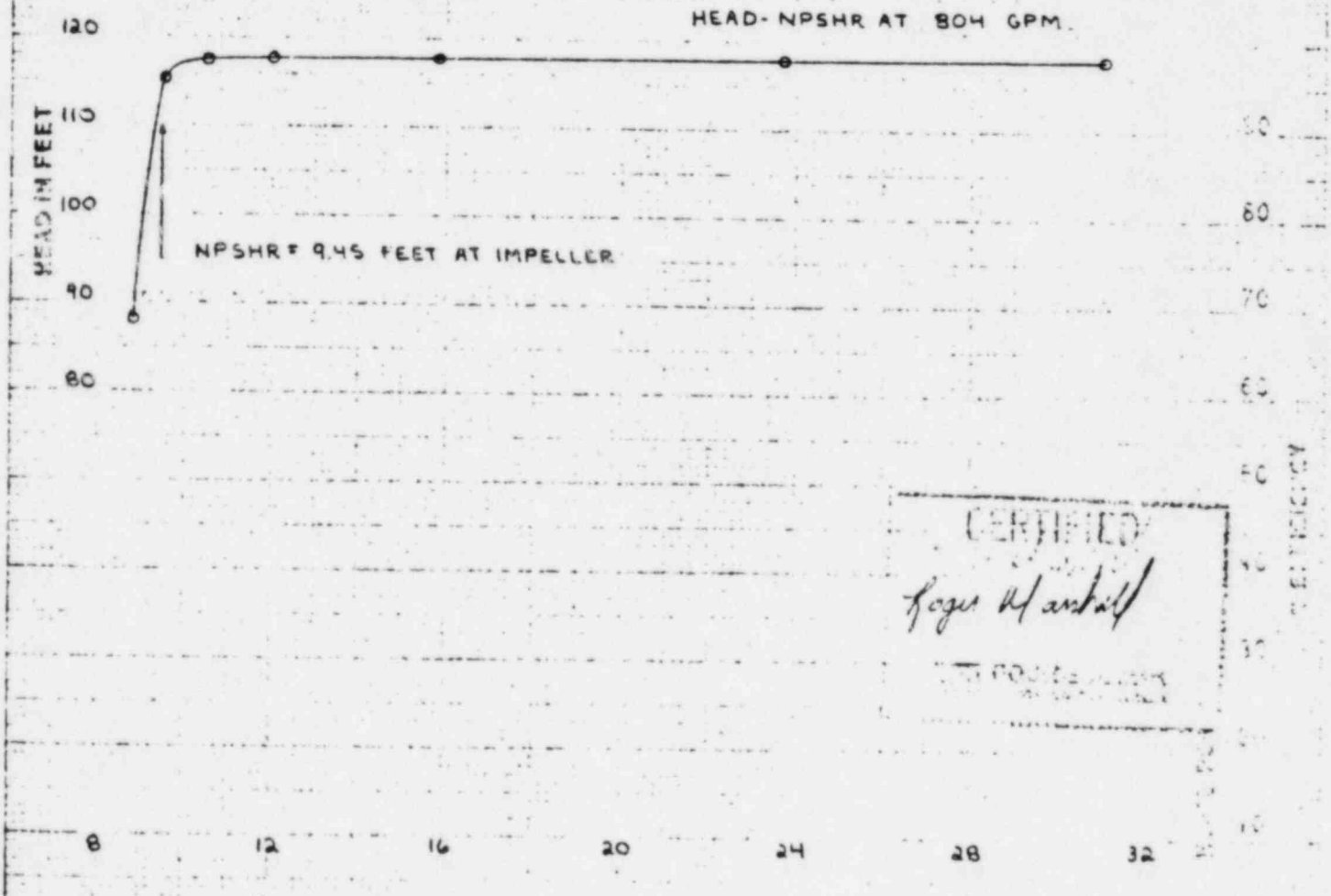
SPEC. No. 3071-134

ITEM No. R30-00-C008 (A)

DIESEL GENERATOR SERVICE WATER PUMPS

TCN No. N0007

S.O. No. N 302276-4



CERTIFIED

Roger M. Antell

ENGINEER

IMPELLER CLOSED

7 1/8 DIA

UP 3/16 IN.

DATE 10-29-77 BY R.M.

GOULDS PUMPS

VERTICAL PUMP DIVISION

INDUSTRY, CALIFORNIA

PERFORMANCE TWO STAGES

8 x 12 JMC

1760 R.P.M.

CURVE SHEET NO. T-77-492

REV. (A) 11-15-77

COULDS PUMPS - VERTICAL PUMP DIVISION
NPSH TEST DATA

T-77-493 REV (A) 11-15-77

TYPE 8 x 12 IMC STAGES 2
SERIAL NO. N 302276-1
IMP'S 7 1/8 DIA 1/16 UF b2
IMP'S DIA UF b2
AXIAL RUNNING CLEARANCE 0.063
BOWLS SA 216
IMPELLER 316 SS

GUARANTEED PERFORMANCE	RPM	GPM	HEAD	HP	SP.GR.	VISC.
LAB						
FIELD	1760	800	115	50	1.0	

TEST MOTOR 60 HP 4 POLES
WATTMETER SCALE MULTIPLIER
4 VENTURI ELEV. CORRECTION + 1.75 FT.

FOR: DETROIT EDISON COMPANY
SPEC. NO. 3071-134
P.O. NO. 1A-95618
ITEM No. R 30-00-0005 (A)
DIESEL GENERATOR SERVICE WATER PUMPS
TCN No. N 0067
TESTED BY R LARSON DATE 10-29-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1793	1793	1793	1793	1793	1793	1794					
DISCHARGE PRESSURE-PSI	50.0	46.8	43.9	41.2	39.9	37.9	31.3					
SUCTION PRESSURE -IN Hg	-3.0	-9.6	-15.3	-20.8	-23.1	-23.7	-24.2					
TOTAL PUMP HEAD - FEET	120.9	120.9	120.7	120.7	120.3	116.4	101.7					
FLOW - INCHES OF BLUE												
FLOW - INCHES OF Hg	17.5	17.5	17.5	17.5	17.5	17.5	17.5					
FLOW-GPM	819.5	819.5	819.5	819.5	819.5	819.5	819.5					
WATTMETER READING												
BRAKE HORSEPOWER												
PUMP EFFICIENCY												
VELOCITY HEAD-FEET	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
ATMOSPHERIC PRESSURE-IN Hg	29.78											
WATER TEMPERATURE- F	70.3	70.6	70.8	70.9	71.1	71.5	72.0					
VAPOR PRESSURE -FEET	0.9	0.9	0.9	0.9	0.9	0.9	0.9					
NPSH AT DATUM-FEET	33.0	25.5	19.0	12.8	10.1	9.4	8.9					

CERTIFIED
Roger Hurst P.E.

PERFORMANCE CONVERTED TO 1760 RPM. SP.GR. 1.0

FLOW-GPM	804.2	804.2	804.2	804.2	804.2	804.2	803.8					
TOTAL PUMP HEAD-FEET	116.4	116.5	116.3	116.3	115.9	112.1	97.9					
BRAKE HORSEPOWER												
NPSH AT DATUM-FEET	31.8	24.6	18.3	12.3	9.8	9.1	8.5					

GOULDS PUMPS - VERTICAL PUMP DIVISION
NPSH TEST DATA

T-77-465 REV. (A) 11-15-77

TYPE 8 x 12 JMC STAGES 2	GUARANTEED PERFORMANCE						FOR: DETROIT EDISON COMPANY
SERIAL NO. N 302276-2		RPM	GPM	HEAD	HP	SP.GR. VISC.	SPEC. NO. 3071-134
2 IMP'S 7 7/8 DIA 1/16 UF b2	LAB						P.O. NO. 1A-95618
IMP'S DIA UF b2	FIELD	1760	800	115	50	1.0 32 SSU	ITEM No. R30-00-C006 (A)
AXIAL RUNNING CLEARANCE 0.083	TEST MOTOR 60 HP 4 POLES						DIESEL GENERATOR SERVICE WATER PUMPS
BOWLS SA 216	WATTMETER SCALE MULTIPLIER						TCN No. N0007
IMPELLER 316 S.S.	4 VENTURI ELEV. CORRECTION +1.75 FT.						TESTED BY P. LARSON DATE 10-27-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1793	1793	1793	1793	1793	1793	1793					
DISCHARGE PRESSURE-PSI	51.1	48.5	45.9	42.6	41.4	39.8	33.5					
SUCTION PRESSURE -IN Hg	-3.2	-8.4	-13.6	-20.2	-22.4	-22.9	-23.6					
TOTAL PUMP HEAD - FEET	123.6	123.6	123.4	123.3	123.0	119.9	106.1					
FLOW - INCHES OF BLUE												
FLOW - INCHES OF Hg	17.5	17.5	17.5	17.5	17.5	17.5	17.5					
FLOW-GPM	819.3	819.3	819.3	819.3	819.3	819.3	819.3					
WATTMETER READING												
BRAKE HORSEPOWER												
PUMP EFFICIENCY												
VELOCITY HEAD-FEET	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
ATMOSPHERIC PRESSURE-IN Hg	28.84											
WATER TEMPERATURE- F	72.1	72.6	72.7	72.9	73.1	73.1	73.3					
VAPOR PRESSURE -FEET	0.9	0.9	0.9	0.9	0.9	0.9	0.9					
NPSH AT DATUM-FEET	31.6	25.7	19.8	12.3	9.8	9.2	8.4					

CERTIFIED
Roger Marshall
GOULDS PUMPS (A DIXON)

PERFORMANCE CONVERTED TO 1760 RPM SP.GR. 1.0

FLOW-GPM	804.2	804.2	804.2	804.2	804.2	804.2	804.2					
TOTAL PUMP HEAD-FEET	119.1	119.0	118.9	118.8	118.5	115.5	102.2					
BRAKE HORSEPOWER												
NPSH AT DATUM-FEET	30.5	24.8	19.1	11.9	9.5	8.9	8.1					

GOULDS PUMPS - VERTICAL PUMP DIVISION
NPSH TEST DATA

T-77-491 REV. (A) 11-15-77

TYPE 8 x 12 JMC STAGES 2
SERIAL NO. N 302276-3
2 IMP'S 7 3/8 DIA 1/16 UF b2
IMP'S DIA UF b2
AXIAL RUNNING CLEARANCE 0.083
SHAFT SA 216
IMPELLER 316 SS

GUARANTEED PERFORMANCE	RPM	GPM	HEAD	BP	SP.GR.	VISC.
LAB						
FIELD	1760	800	115	50	1.0	32.6u

TEST MOTOR 60 HP 4 POLES
WATTMETER SCALE MULTIPLIER 40
4 VENTURI ELEV. CORRECTION + 1.75 FT.

FOR: DETROIT EDISON COMPANY
SPEC. NO 3071-134
P.O. NO. 1A-95618
ITEM NO. R 30-CO-C007 (A)
DIESEL GENERATOR SERVICE WATER PUMPS
TCN NO. N C007
TESTED BY P. LARSON DATE 10-29-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1793	1793	1793	1793	1793	1793	1794	1796				
DISCHARGE PRESSURE-PSI	50.2	46.0	42.0	41.0	40.1	39.3	36.0	29.0				
SUCTION PRESSURE -IN Hg	-2.5	-10.9	-18.9	-21.0	-22.8	-23.6	-24.0	-24.2				
TOTAL PUMP HEAD - FEET	120.7	120.6	120.4	120.5	120.4	119.5	112.3	96.4				
FLOW - INCHES OF BLUE												
FLOW - INCHES OF Hg	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5				
FLOW-GPM	819.3	819.3	819.3	819.3	819.3	819.3	819.3	819.3				
WATTMETER READING												
BRAKE HORSEPOWER												
PUMP EFFICIENCY												
VELOCITY HEAD-FEET	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
ATMOSPHERIC PRESSURE-IN Hg	29.78											
WATER TEMPERATURE- F	66.9	67.1	67.3	67.5	67.8	67.9	68.0	68.3				
VAPOR PRESSURE -FEET	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8				
NPSH AT DATUM-FEET	33.6	24.1	15.0	12.6	10.6	9.7	9.2	9.0				

CERTIFIED
Roger Hunter
RECORD DRAWINGS

PERFORMANCE CONVERTED TO 1760 RPM, SP.GR. 1.0

FLOW-GPM	804.2	804.2	804.2	804.2	804.2	804.2	803.8	802.9				
TOTAL PUMP HEAD-FEET	116.3	116.2	116.0	116.1	116.0	115.1	108.1	92.6				
BRAKE HORSEPOWER												
NPSH AT DATUM-FEET	32.4	23.2	14.5	12.2	10.2	9.3	8.9	8.6				

GOULDS PUMPS - VERTICAL PUMP DIVISION
NPSH TEST DATA

T- 77 - 492 REV. (A) 11-15-77

TYPE 8 x 12 JMC STAGES 2	GUARANTEED PERFORMANCE						FOR: DETROIT EDISON COMPANY
SERIAL NO. N 302276-4		RPM	GPM	HEAD	BP	SP.GR.	VISC.	SPEC. NO. 3071-134
2 IMP'S 7 7/8 DIA 1/16 UF b2	LAB							P.O. NO. 1A-95618
IMP'S DIA UF b2	FIELD	1760	800	115	50	1.0	32SSU	ITEM No. R 30-00-0008 (A)
AXIAL RUNNING CLEARANCE 0.083	TEST MOTOR 60 HP 4 POLES							DIESEL GENERATOR SERVICE WATER PUMPS
BOWLS SA 216	WATTMETER SCALE MULTIPLIER							TCN NO. N 0007
IMPELLER 316 SS	4 VENTURI ELEV. CORRECTION +1.75 FT.							TESTED BY P. LARON DATE 10-29-77

READING	1	2	3	4	5	6	7	8	9	10	11	12
RPM	1793	1793	1793	1793	1793	1794	1795					
DISCHARGE PRESSURE-PSI	50.3	47.0	43.4	41.7	40.9	39.5	27.1					
SUCTION PRESSURE -IN Hg	-3.8	-10.4	-17.7	-21.1	-22.5	-23.4	-24.0					
TOTAL PUMP HEAD - FEET	122.5	122.3	122.3	122.2	121.9	119.7	91.8					
FLOW - INCHES OF BLUE												
FLOW - INCHES OF Hg	17.5	17.5	17.5	17.5	17.5	17.5	17.5					
FLOW-GPM	819.3	819.3	819.3	819.3	819.3	819.3	819.3					
WATTMETER READING												
BRAKE HORSEPOWER												
PUMP EFFICIENCY												
VELOCITY HEAD-FEET	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
ATMOSPHERIC PRESSURE-IN Hg	29.78											
WATER TEMPERATURE- F	67.5	68.2	68.3	69.0	69.2	69.7	70.1					
VAPOR PRESSURE -FEET	0.8	0.8	0.8	0.8	0.8	0.8	0.8					
NPSH AT DATUM-FEET	32.1	24.6	16.3	12.5	10.9	9.8	9.1					

CERTIFIED
Roger Haskell
COULDS PUMPS

PERFORMANCE CONVERTED TO 1760 RPM, SP.GR. 1.0

FLOW-GPM	804.2	804.2	804.2	804.2	804.2	803.8	803.3
TOTAL PUMP HEAD-FEET	118.0	117.9	117.8	117.8	117.5	115.2	88.2
BRAKE HORSEPOWER							
NPSH AT DATUM-FEET	31.0	23.7	15.8	12.0	10.5	9.5	8.8

GOULDS PUMPS
VERTICAL PUMP DIVISION
INDUSTRY, CALIFORNIA

RECOMMENDED SPARE PARTS - PER UNIT

CUSTOMER DETROIT EDISON COMPANY

P.O. NO. 1A-95618 ITEM DIESEL GENERATOR SERVICE WATER PUMPS

PUMP SERIAL NO. N302276 MODEL VIT 8x12JMC/2

P.O.S. Nos. R30-00-C005
R30-00-C006
R30-00-C007
R30-00-C008

ITEM	PART	MTL.	DWG.	QTY.	NET $$ EACH.	DEL
609	HEADSHAFT SLEEVE	ASTM A276 TP. 410	A2290	1	$ 726.00	16 WEEKS ARO
617	STUFFING BOX BEARING	ASTM B144-3B	IE 254	1	$ 53.00	
620A	PACKING RINGS	ASBESTOS GRAPHITE	90855	1 set of 6	$ 9.00/ set	
743B	O-RING - SLEEVE/SHAFT	BUNA N	ARP-568-222	1	$ 4.00	
779A	GASKET - STUFF. BOX/HEAD	VELLUMOID	B2749	1	$ 4.00	
653	LINESHAFT BEARING	RUBBER	C1086	8	$ 24.00	
743	O-RING - COL./COL./HD.	BUNA N	ARP-568-271	8	$ 6.00	
672	INT. BOWL BEARING	RUBBER	A7391	2	$ 24.00	
680	WEAR RING - BOWL	ASTM A-296 GR. CF8	B5857	2	$ 169.00	
681	WEAR RING - IMPELLER	ASTM A-296 GR. CF8	B7726	2	$ 221.00	
690	SUCTION BELL BEARING	ASTM B144 3B	A744	1	$ 71.00	
743D	O-RING - BOWL ASSEMBLY	BUNA N	ARP-568-175	3	$ 6.00	

BY Michael R Foster DATE November 16, 1977
M. J. Foster

NOTE: PRICE AND DELIVERY ARE EFFECTIVE 60 DAYS FROM QUOTATION DATE

ALLIS-CHALMERS
dimensions

VERTICAL SQUIRREL-CAGE INDUCTION MOTORS

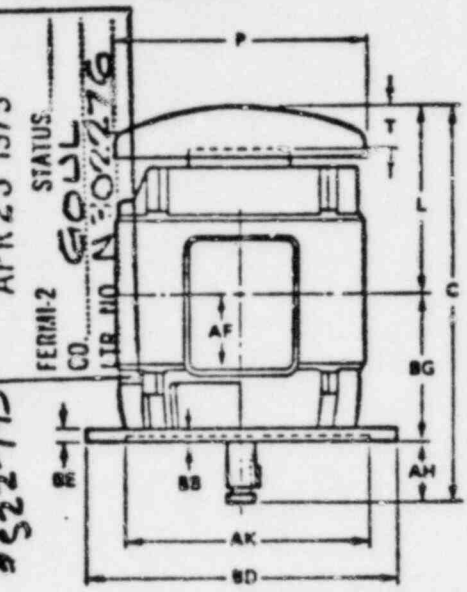
Solid Shaft – Normal Thrust
Type RGV – Open Drip-Proof
Type RGV-S – Super-Seal

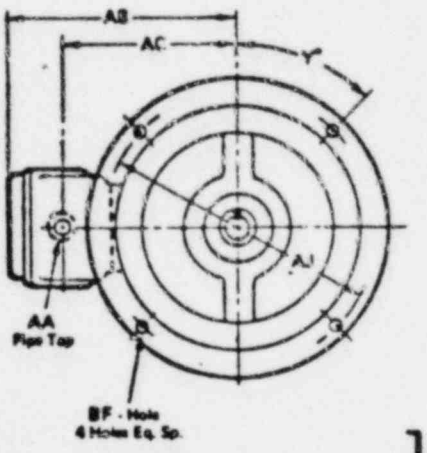
JUL 1 - 1975
N302276
TCN N0007

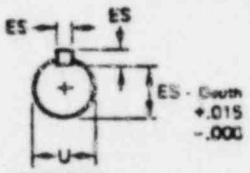
MARCH 1973
Supersedes 3/72 Issue
Formerly MG 1.5 Page 311

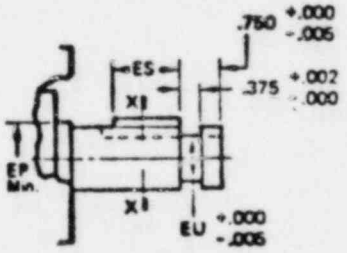
R30-01-C900-DA-003
APR 25 1975
STATUS
FERMI-2
CO. GOULD
LTR NO N-302276
S22-193

NEMA Type P Base – Ball Bearing
FRAMES 324-447









51-810-541

STANDARD DIMENSIONS – IN INCHES

	Frame	324 VP-HP	326 VP-HP	364 VP-HP	365 VP-HP	404 VP-HP	404 HPH	405 VP-HP	405 HPH	444 VP-HP	445 VP-HP	447 VP-HP
	C	28 1/8	30 1/8	30 1/8	31 1/8	33 1/8	33 1/8	34 1/8	34 1/8	36 11/16	38 11/16	42 11/16
	L	13 1/8	14 1/8	14 1/8	15 1/8	15 1/8	15 1/8	15 1/8	15 1/8	12 1/4	12 1/4	12 1/4
	P	17 1/8	17 1/8	20 1/2	20 1/2	22	22	22	22	25 1/8	25 1/8	25 1/8
	T	3 1/4	3 1/4	3 1/2	3 1/2	2 1/2	2 1/2	2 1/2	2 1/2	4 1/4	4 1/4	4 1/4
	U	1.625	1.625	1.625	1.625	1.625	2.125	1.625	2.125	2.125	2.125	2.125
	EU	1.250	1.250	1.250	1.750	1.250	1.750	1.250	1.750	1.750	1.750	1.750
	Y	45°	45°	45°	45°	45°	45°	45°	45°	45°	45°	45°
	AH	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2
	AJ	14 1/8	14 1/8	14 1/8	14 1/8	14 1/4	14 1/8	14 1/8	14 1/8	14 1/8	14 1/8	14 1/8
	AK	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500
	BB	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	BD	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2
	BE	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	1	1	1
	BF	11/16	11/16	11/16	11/16	11/16	11/16	11/16	11/16	11/16	11/16	11/16
	BG	10 1/2	11 1/16	11 1/2	12	13 1/2	13 1/2	14 1/4	14 1/16	19 7/16	21 7/16	24 13/16
	EP	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Conduit Box	AA	2	2	3	3	3	3	3	3	3	3	3
	AB	13 1/4	13 1/4	16 1/8	16 1/8	17 1/8	17 1/8	17 1/8	17 1/8	18 1/2	18 1/2	18 1/2
	AC	10 1/4	10 1/4	12 1/8	12 1/8	13 1/2	13 1/2	13 1/2	13 1/2	15 1/4	15 1/4	15 1/4
	AF	5	5	6 1/4	6 1/4	6 1/4	6 1/4	6 1/4	6 1/4	7 1/2	7 1/2	7 1/2
Key	Mgt.	1/4	1/4	1/4	1/4	1/4	1/2	1/4	1/2	1/2	1/2	1/2
Keyseat ES	Width	1/4	1/4	1/4	1/4	1/4	1/2	1/4	1/2	1/2	1/2	1/2
	Lgth.	3	3	3	3	3	3	3	3	3	3	3
	Dpth.	1.401	1.401	1.401	1.401	1.401	1.830	1.401	1.830	1.830	1.830	1.830
Approx. Ship. Wt. Lbs.		427	547	707	767	916	916	996	996	1176	1296	1600

TOLERANCES

AK Dim.	13.500 +.005 -.000	U Dim.	1.625 – 2.125 +.0000 -.0010
AH Dim.	±.030 ±.060	320 – 360 FR. 400 & 440 FR.	with Motor in vertical position, shaft down.

INDICATOR READING

Frame	Max. Face Runout	Permissible Eccentricity of Mtg. Rabbet	Permissible Shaft Runout
324 VP-HP thru 445 VP-HP -HPH	.006	.006	.002

S. F. 1.15

Goulds Pumps CERTIFIED FOR

Your order 39939 Our order EL-8-5134-90235

Frame No. 326 VP Hp 50 Rpm 1800

Volts 460 Phase 3 Hertz 60

ALLIS-CHALMERS, per E. M. A. Date 3/21/75

NOT FOR CONSTRUCTION, INSTALLATION OR APPLICATION PURPOSES UNLESS CERTIFIED

S. O. N-302276 – Detroit Edison P. O. 1A-95618
NUCLEAR JOB – N-302276

INSTRUCTIONS

VERTICAL "P" FLANGED

(NORMAL & MEDIUM THRUST)

INDUCTION MOTORS

51 X 4159-03

TABLE OF CONTENTS

NOTE: The illustrations, descriptions and instructions in this book include the standard design of the equipment and any common deviations when possible. This book *does not cover all design details* and variations nor does it provide for possible contingency which may be encountered. When information cannot be found in this book, contact the nearest Allis-Chalmers office. See Directory 25X8109.

INTRODUCTION

This manual is furnished to advise you of some of the practical ways to install, operate, and maintain your equipment. Keep it handy for future reference. Additional information may be obtained from the nearest Allis-Chalmers representative. The standards of the National Electrical Manufacturers Association (NEMA) are an excellent source for more detailed advice.

WARRANTY

See your sales contract for coverages.

RECEIVING

Common dangers during unpacking are mechanical damage and moisture condensation.

The unit should be unpacked with these checks in mind:

(1) Unload and handle the unit carefully.

(2) Check for shortage and damage immediately. (A prompt report, with *notations on the freight bill*, should expedite adjustments by the carrier.)

CAUTION

Remove only the shipping invoice. Do not remove tags pertaining to lubrication, operation and storage instruction. They should be left on motor. Read all tags and instruction to insure no damage to motor bearings (due to condensation) and windings during storage.

CAUTION

Use lifting lugs, NOT attachments. Do not lift by flanges. Check drawings for construction.

TEMPORARY STORAGE

If the equipment is not to be installed and operated soon after arrival, store it in a clean, dry, well-ventilated place free from vibrations and rapid or wide variations in temperature. Rotate the shaft a minimum of 10 complete revolutions monthly to coat the bearings with lubricant, and prevent possible false brinelling, retard oxidation, or corrosion.

(1) It has been delivered to the job site and is awaiting installation.

(2) It has been installed; but operation is delayed pending completion of plant construction.

(3) There are long, (30 days) periods, between operating cycles.

(4) The plant (or department) is shut down.

Storage requirements vary depending on the length of storage and the climatic environment. For storage periods longer than 3 months or special conditions consult factory instructions 51X3963.

DESCRIPTION

"P" flanged, vertical type motors within NEMA frames 140TP thru 445TP are the subjects of this manual. The instructions include normal thrust motors with grease lubricated, deep-groove ball bearings capable of accepting small values of up and down thrust. Also included are medium thrust type motors in which angular contact thrust bearings are substituted for the deep-grooved bearings. Angular contact bearings are capable of taking higher down-thrust, *but* only momentary up-thrust. Values of thrust, "NORMAL" and "HIGH", are published in the Allis-Chalmers price book. "MEDIUM" thrust values are usually one-half of the "HIGH" thrust values.

There are many variations just within these three classifications. Check the name plate for your particular type of construction.

NOTE: High thrust oil lubricated bearings, or hollow shaft motors *are not* included in these instructions. (See special insert.)

MOTOR TYPE DESIGNATIONS

Type designations are formed by combining letters in this order: basic, mechanical, and electrical (see following table).

Example Motor Designation:
RGZ V RG — Basic Type Z — TEFC V — Vertical Design

Some of the mechanical and electrical modifications we may encounter are listed below.

Z — Totally-enclosed, fan-cooled, standard,(TEFC)

ZZ — Totally-enclosed, fan-cooled, explosion-proof.

V — Vertical motors of normal, medium and high-thrust type with drip covers. This applies to solid shaft type with; C, D, or P flange.

T — High locked-rotor torque and normal slip squirrel-cage motors. In general purpose ratings this indicates a NEMA design C motor.

H — High locked-rotor and break down torque, high slip, squirrel-cage motor. This letter denotes a NEMA design "D" motor, often used for elevator and punch-press service.

INSTALLATION

CAUTION

The information contained in this book is intended to assist operating personnel by providing information on the general characteristics of the purchased equipment. *It does not* relieve the user of the responsibility of using accepted engineering practices in the installation, operation and maintenance of this equipment.

LOCATION

Select a location for the unit that will:

(1) Be clean, dry, well ventilated, properly drained, and provide accessibility for inspection, lubrication, and maintenance (see dimensions). Out-door installations may require protection from the elements.

(2) Provide adequate space for motor removal without shifting the driven unit.

(3) Permit the motor to safely deliver adequate power. Temperature rise of a standard motor is based on operation at an altitude not higher than 3,300 feet above sea level.

CAUTION

Motors should be located in an area that is not subject to rapid temperature change when unit is not in operation.

FOUNDATION

A foundation is required to support the unit to which the flanged motor attaches. Concrete (reinforced as necessary or required) makes the best foundation, particularly for large units. In sufficient mass, concrete provides rigid support that minimizes deflection and vibration. It may be located on; soil, structural steel, or building floors, provided the total weight — (motor, driven unit, and foundation) — does not exceed the allowable bearing load of the support. Allowable bearing loads of structural steel and floors can be obtained from Engineering Handbooks; Building codes of local communities give the recommended allowable bearing loads for different types of soil. For rough calculations the sub foundation should be approximately 2.5 times the total unit weight.

NOTE: If vibration or noise will be objectionable (as in office buildings), it may be advisable to use vibration dampeners between the motor or driven unit, and the foundation.

MOTOR MOUNTING

Mount the machine securely and align accurately with the driven equipment

(1) Direct mounted to driven equipment; the two units must be firmly secured and the driven equipment placed on an adequate foundation.

(2) Floor plate mounted; equipment must be very rigid and free from vibration.

Any excessive vibration of either method will cause loss of alignment, premature bearing wear and eventual break down.

NOTE: If motor is driving a pump and the back pressure is maintained after shut-down, protect the motor with quick-acting check valves.

FLANGE MOUNTING

To mount round frame motor to driven unit, proceed as follows:

NOTE: Round frame motors can be rotated within flange mounting bolt spacing to gain a satisfactory position for grease fittings, conduit attachments, and mate run-out differences to avoid shimming flange fits. Conduit box can be turned to four equally spaced positions for access to conduit system; arrange the system so that water will not accumulate and drain into motor connection box.

(1) Use a hoist; rig a sling around the stator yoke assembly or lifting lugs if provided. Use a spreader bar to prevent damage to fabricated motor parts.

(2) Position motor (per note above) and move toward driven unit — engaging flange surfaces.

(3) Insert flange mounting bolts and snug.

(4) Secure attachments between motor shaft and load. (*i.e.* set screws tightened against shaft key).

(5) Turn shaft by hand; check for free rotation; binding; scraping; sticking.

(6) Tighten all flange bolts. (Tighten bolts in pairs; 180° from each other to avoid warping or springing the flange).

(7) Turn shaft again to check for free rotation.

CAUTION

External connections, i.e. suction or discharge piping for a pump, or shafting to a gear box, are not to impart a strain on the drive unit. Such strains can cause shaft misalignment or preload bearings, which shows up as noisy operation, excessive vibration, or premature bearing failure.

External Wiring. Starting and over-load control devices must be matched to motor rating. For safety or convenience they may need to be installed some distance from the motor. Follow the control manufacturer's instructions to make proper installation and connections. Observe the following:

(1) Connect electrical power supply to conform with National Electrical Code and any local regulations. Line voltage and wire capacity must match motor rating stamped on the nameplate.

(2) Momentarily energize the motor to check that rotation is in the proper direction.

(3) If motor is three-phase type, reverse rotation (if required) by inter-changing any two of the three power leads. If two-phase, inter-change stator leads of either phase, being careful not to change leads from one phase to the other.

VIBRATION

After flange mounting bolts have been tightened, run the motor at no load (or minimum possible). Check for vibration.

The standard vibration limits (NEMA-MG1-12.05) are:

SPEED (RPM)	MAXIMUM APPLITUDE
3500 and above	.001 inches
1700 — 3499 incl.	.0015 inches
Less than 1700	.002 inches

If vibration is excessive, loosen flange mounting bolts and shift within mounting flange clearance. If this shifting does not reduce vibration to acceptable limit, and motor is coupled to load, check shaft alignment.

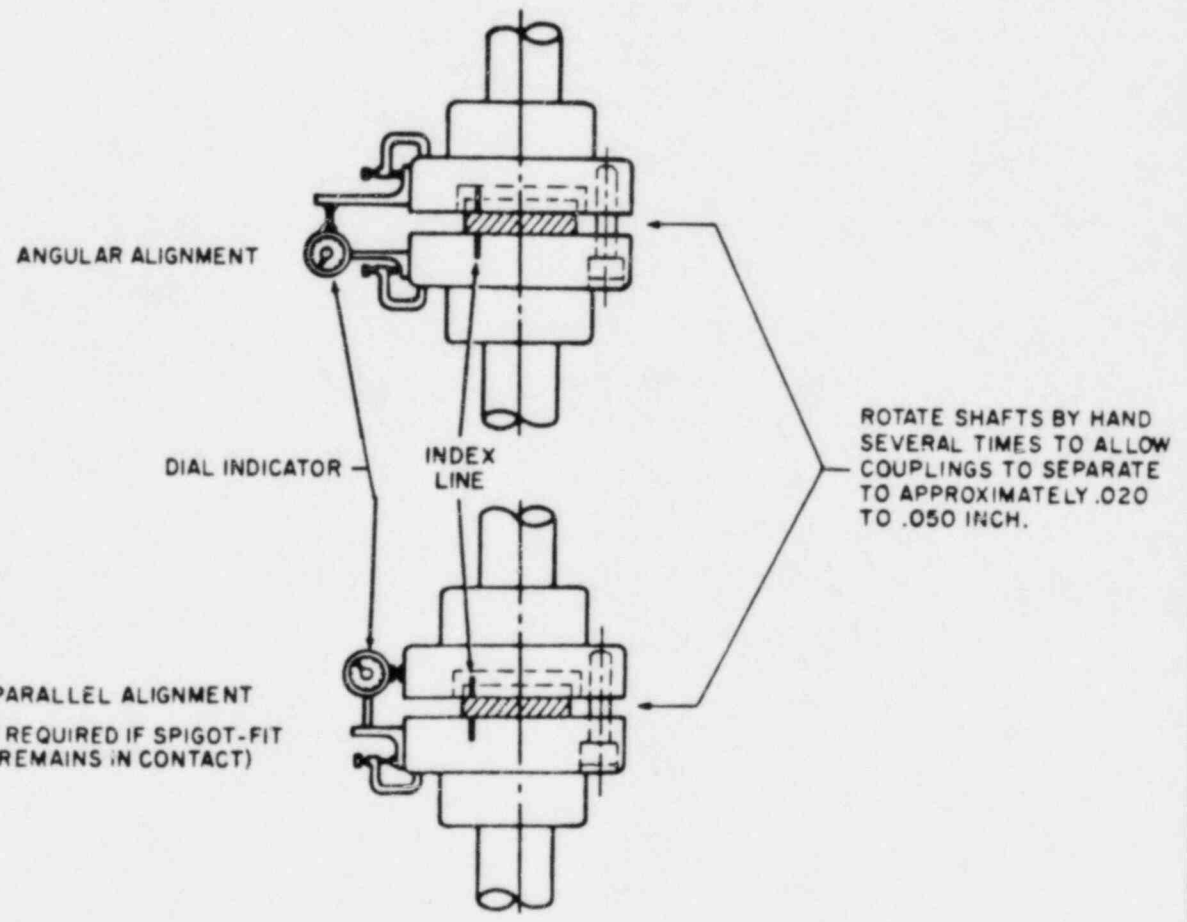


FIG. 2-1 TEST ALIGNMENT WITH DIAL INDICATOR (SOLID COUPLING)

2698

ALIGNMENT PROCEDURE

The following checking procedure applies to a unit consisting of motor, flexible coupling, and a driven component. Although applicable to all types of flexible couplings, it is primarily intended for the pin and rubber bushing type. For other types, where the procedures differ, refer to the coupling manufacturer's Installation and Maintenance Instructions. Check alignment as follows:

Disconnect the coupling halves.

Test for parallel and angular alignment with a dial indicator mounted as shown in Figure 2-1. Proceed as follows:

(1) Scribe index lines on the coupling halves (as shown) or mark where the indicator point rests.

(2) Set indicator dial to zero.

(3) Slowly turn BOTH coupling halves so that index lines remain matched, or indicator point is always on the mark.

(4) Observe dial reading to determine whether motor or driven unit needs adjustment.

(5) Acceptable parallel alignment occurs when the total indicator reading (complete turn) does not exceed 0.002 in.; acceptable angular alignment occurs when one-half of the total indicator reading does not exceed 0.001 in./ft. (Radius to dial indicator = one foot.)

Small, excess misalignment may be corrected by inserting shims between flanged faces. Such shims may also compensate for flanges being out of plane. (Fig. 2-2)

CAUTION

Shims must be notched to span the bolts only.

A GOOD SHIMMING TECHNIQUE

To avoid the possibility of twisting the flange when shimming between the flanges, minor shims should be one-half the thickness of the major shim. Shims should not penetrate deeper than the bolt hole circle and not be wider than twice the penetration distance. (Fig. 2-2)

When alignment and vibration of motor are within limits, engage drive. Run unit at minimum load possible — check for vibration — continue to increase load and check for vibration until full load is obtained.

CAUTION

Do not operate unit with excessive vibration. If shaft alignment is acceptable, and vibration exceeds the limit, investigate for other causes. See "TROUBLE". (See pg. 10)

GROUTING

Grout compensates for unevenness in the foundation and base. It distributes the weight of the unit uniformly over the foundation, and prevents the unit from shifting after mounting and alignment. It is essential that the unit be expertly grouted by use of non-shrinking grout. The mix required varies with the type of unit to be grouted, location and amount of grout. The instructions included with the non-shrinking grout package will provide the required information for the proper mix for individual applications.

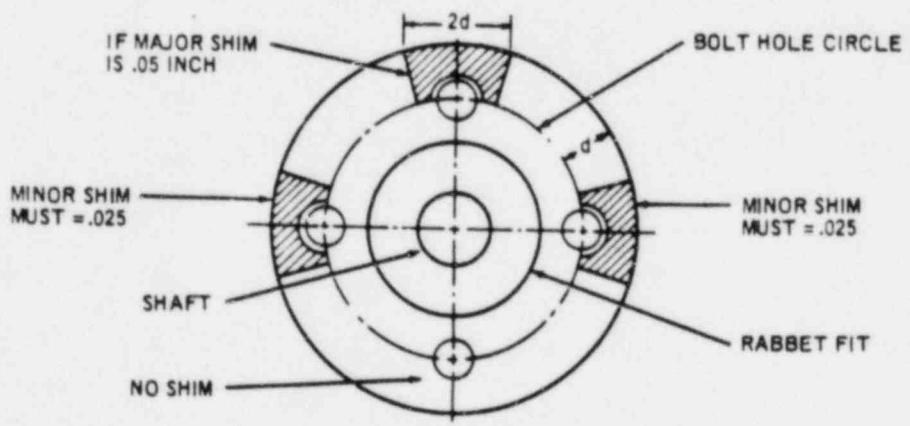


FIG. 2-2 SHIMMING

26925

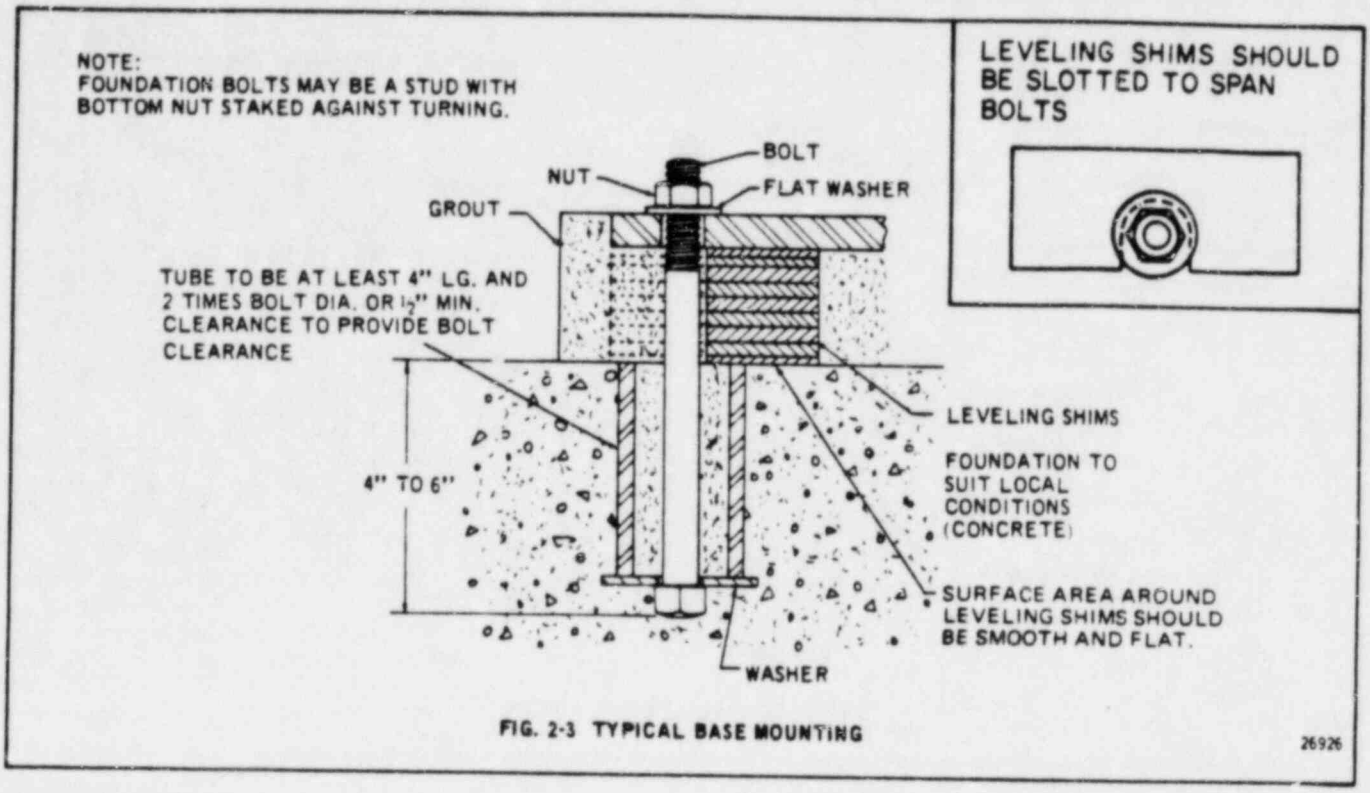


FIG. 2-3 TYPICAL BASE MOUNTING

26926

Grout the unit as follows:

(1) Build a form of plywood or thin planking around the foundation to contain the grout. Support the planking to prevent deformation.

(2) Soak the top of the concrete pad thoroughly with water before grouting. Remove all surface water before pouring.

A recommended mix of grout that is satisfactory for most applications is as follows:

> **Dry Mix.** One sack Portland Cement. Two parts well graded, clean, dry sand. One-pound bag grout additive.

This additive is one way to counteract the plastic shrinkage and settlement of a cement-sand mix.

To make grout additive, add 2 grams of unpolished aluminum powder (Merck Co. #0770, or equivalent, available at local pharmacists) to 1 lb. of clean dry flint sand (50 mesh screen passing 25% preferred). Mix thoroughly and seal in a plastic bag. Keep additive dry until ready for use.

NOTE: The effect of the aluminum powder is lost if the mix is allowed to stand, uncast, for 45 minutes after adding water to the dry mix.

(3) Pour the grout through the openings in the base. While pouring, tamp liberally in order to fill all cavities and prevent air pockets. The grout thickness under the base must be a minimum of 1 inch. In order to prevent the base from shifting, fill under the base-plate at least 4 inches in from all four edges. Take care that grout will not interfere with motor or driven unit mounting bolts, to allow shifting as necessary.

NOTE: If pouring and tamping the grout will trap air in some places, temporarily place small diameter tubes (thick-walled rubber hose) to provide venting. Remove the tubes after grout has filled the cavity, before pouring the remainder.

(4) After the grout has thoroughly hardened retighten the foundation bolts.

(5) Check the alignment after the foundation bolts are tightened.

Approximately fourteen days after the grout has been poured or when the grout has thoroughly dried, apply an oil base paint to the exposed edges of the grout to prevent air and moisture from coming in contact with the grout.

(6) After grout has thoroughly cured, tap on top of base to be sure grout has adhered. If vibration occurs, check base with vibration analyzer. If indication warrants, pumping epoxy grout through the base plate will eliminate voids and adhere base to original grout.

EXTREME SERVICE

If motor application is abnormal (high temperature, extreme vibration, etc.), consult Norwood Plant for special instructions for installation.

OPERATION

WARNING

Do not operate this equipment in excess of the values given on nameplate or contrary to the instructions contained in this manual.

The equipment (or a prototype) has been shop tested and found satisfactory for the conditions for which it was sold; but operating in excess of these conditions can cause stresses and strains beyond design limitations.

Failure to heed this warning may result in equipment damage and possible personal injury.

INITIAL START

After installation is completed, but before motor is put in regular service, make an initial start as follows:

Check that motor, starting, and control device connections agree with wiring diagrams.

Check that voltage, phase, and frequency of line circuit (power supply) agree with motor nameplate.

If motor has been in storage, either before or after installation, refer to storage instructions to prepare for service.

Check motor service record and tags accompanying motor to be certain bearings have been properly lubricated. (When shipped from the factory, ball bearings have been lubricated to give 6 months satisfactory service.)

If possible, remove external load (disconnect drive) and turn shaft by hand to insure free rotation. This may have been done during installation procedure; if so, and conditions have not changed since, this check may not be necessary.

Start motor at no load long enough to check rotation and to be certain that no unusual condition exists. Listen and feel for excessive noise, vibration, clicking, or pounding. If present, de-energize motor immediately. Carefully observe for unusual conditions as motor coasts to a stop. Investigate the cause and correct before putting motor in service.

CAUTION

Repeated trial starts can over-heat the motor. Starting currents are several times running current; heating varies as the *SQUARE* of the current. Allow time between starts so that windings cool.

When checks are satisfactory to this point, operate at lowest load possible and look for any unusual condition. Increase load slowly to maximum, checking unit for satisfactory operation.

NORMAL OPERATION

Start the motor in accordance with standard instructions for the starting equipment used. Sometimes the load should be reduced to the minimum, particularly for reduced voltage starting, and/or high inertia connected loads.

VOLTAGE REGULATION

Motors will operate successfully under the following conditions of voltage and frequency variation; but not necessarily in accordance with the standards established for operation under rated conditions:

(1) If the variation in voltage does not exceed 10% above or below normal, with all phases balanced.

(2) If the variation in frequency does not exceed 5% above or below normal.

(3) If the sum of the voltage and frequency variations does not exceed 10% above or below normal (provided the frequency variation does not exceed 5%).

TROUBLE SHOOTING

Between regular maintenance inspections, be alert for signs of motor trouble. Common symptoms are listed in the TROUBLE table. Correct any trouble immediately and AVOID COSTLY REPAIR AND DOWN TIME.

TROUBLE SHOOTING

SYMPTOM	POSSIBLE CAUSES	CURE
Motor won't start.	Usually line trouble — single-phasing at starter.	De-energize and correct! Check source of power supply. (Don't check with motor energized!) Check overloads, controls, and fuses. Check voltage and compare with rating plate.
	Improper connection.	Check connections with diagram.
	Load too heavy.	Disconnect motor to see if it starts without load. Reduce load — or replace motor with unit of greater capacity.
Excessive hum.	High voltage.	Check input voltage and for proper connections.
Regular clicking.	Foreign matter in air gap.	Take out rotor; remove matter.
Rapid knocking.	Bad bearing, dirt in grease.	Replace bearing; renew grease.
Motor overheating. (Check with thermometer or thermocouple; don't depend on hand). See pg. 11 maintenance.	Overload.	Measure load; compare with nameplate rating. Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with unit of greater capacity.
	Single phase.	Check current, all phases.
	Dirt in motor.	Check air flow at ventilation ducts. Blow out motor. Use solvent on wound section if necessary.
	Unbalanced voltage.	Check voltage, all phases.
	Rotor rubbing on stator.	1) Check alignment. 2) Clean air gap. 3) Check and replace bearings, if necessary.
	Open stator windings.	Disconnect motor from load. Check idle amps balance in all three phases. Check stator resistance in all three phases for balance.
	Over voltage, or under voltage.	Check voltage and compare to rating plate.
	Ground.	Locate with test lamp or megger and repair.
	Improper connections.	Recheck connections.

(Continued)

TROUBLE SHOOTING (CONTD.)

SYMPTOM	POSSIBLE CAUSES	CURE
Bearing over-heating.	Misalignment.	Check mounting and flange alignment.
	Excessive end thrust.	Reduce thrust from drive or machine.
	Too much grease (ball or roller bearing).	Relieve supply to point set by manufacturer.
	Insufficient lubricant.	Add — up to point set by table.
Vibration.	Misalignment.	Re-align units.
	Twisted base or flange.	Check flange alignment and shims.
	In driven machine (disconnect motor from load and run idle).	Eliminate source in load.
	Excessive dirt on fan blades.	Clean rotating members.
	Rotor out of balance (after repair).	Balance rotor.
	Shaft bent or flange face run out.	See maintenance.
	System natural frequency. (Resonance)	Alter rigidity of base structure.

GENERAL

Routine, regular maintenance is the best assurance of trouble-free, long-life operation. It prevents costly shutdown and repairs. Two major elements of a controlled maintenance program are:

Trained personnel who KNOW the work.

Systematic records, which contain at least the following:

Complete nameplate data (Service Record).

Prints (Wiring diagrams, certified outline, sectional view).

Parts list (see rear of this section).

Stock of essential parts.

List of spare units in storage.

Alignment data (departures from perfect alignment, allowance for high temperature).

Results of regular inspection (Service Record).

Repairs (Service Record).

Lubrication data:

Method of application.

Types of grease for wet, dry, hot, or adverse locations.

Stock of greases.

Maintenance cycle by locations (Some require more frequent lubrication).

Record for each unit (Service Record).

PREVENTIVE MAINTENANCE

Several of the more important items of good maintenance are discussed in the following paragraphs. Others should be added when adverse or unusual conditions exist.

Inspection. Each machine should be inspected at regular intervals. The frequency and thoroughness will depend on the amount of operation, nature of service, and the environment. Inspect for:

CLEANLINESS. The exterior should be kept free of oil, dust, dirt, water, and chemicals. For a fan-cooled machine it is particularly important to keep the air intake opening free of foreign material. Do not block air outlet.

MOISTURE. On non-explosion proof TEFC motors, a removable plug permits removal of any accumulated moisture. Drain regularly.

NOTE: If equipment is operated intermittently in very damp locations, it should be protected by space heaters. To retard corrosion, grease all machined fits when the unit is reassembled after a maintenance check.

LOADING. Guard against improper loading. Overloading causes overheating and, overheating will shortened insulation life. A winding subjected to a 10° temperature rise above the maximum limit for its class will have its insulation life halved.

While somewhat less serious, underloading a motor is improper. It does lower the power factor which results in higher power cost. Any motor consistently underloaded should be replaced by one of lower power rating.

TEMPERATURE. Electrical apparatus operating under normal conditions become quite warm. Although some places may feel hot to the touch the unit may be within guaranteed limits. *Use a thermocouple to measure winding temperature.*

The Total Temperature — not the temperature rise, is the measure of safe operation. Investigate the operating conditions if the *Total Temperature* measured by the *Temperature Detector* placed on the winding exceeds:

230° F (110° C) for Class "B" insulation.
275° F (135° C) for Class "F" insulation.
302° F (150° C) for Class "H" insulation.

If checking total temperature by winding resistance or imbedded detector, total temperature should not exceed the following as they represent maximum insulation temperature. *If operation occurs above these temperatures, insulation life is shortened.

*266°F (130°C)	Class "B" insulation
*312°F (155°C)	Class "F" insulation
*356°F (180°C)	Class "H" insulation

LOW INSULATION RESISTANCE (see Corrective Maintenance.)

Vibration

Most problems can be detected when inspected visually. Check for:

Loose or missing parts, such as — fan blades, nuts, bolts, screws, couplings, etc.

Accumulation of dirt on fan or rotor.

Foundation construction — Base, grouting and associated equipment supporting drives. Vibration can be amplified by weak construction.

Associated equipment — Disconnect equipment to determine where the vibration is being generated.

History — When was vibration first noted? If there was a change in loading and or duty of equipment. If ambient vibration has changed.

Often, more important than the actual vibration itself, is — the *change of vibration* over a period of time.

CORRECTIVE MAINTENANCE

Two factors that usually cause corrective maintenance are electrical failure or mechanical failure. The first sign of electrical failure is usually indicated by low insulation resistance. Mechanical failures are usually preceded by excessive bearing noise and heat.

Low Insulation Resistance

Factors that usually cause low insulation readings are:

(1) Dirty windings (oil, dust, grease, salt, etc.).

(2) Excessive moisture.

(3) Mechanically damaged insulation.

(4) Heat deterioration.

Factors three and four require extensive repairs by a competent service shop. Dirty windings can be cleaned and moisture laden windings can be dried.

Cleaning

Clean the motor, inside and outside, regularly. Actual conditions existing around the motor dictate the frequency of cleaning operations. Use the following procedures as they apply:

Wipe off — dust, dirt, oil, water, etc. from external surfaces of the machine. These materials can work into, or be carried into, the windings and may cause over heating or insulation breakdown.

Remove dirt, dust, other debris from ventilating air inlet. Do not permit such matter to accumulate near the inlet. Do not operate motor with air outlet blocked. Clean open motors internally by blowing with clean, dry compressed air at 40 to 60 psi. If the conditions warrant, use a vacuum cleaner.

When dirt and dust are solidly packed, or windings are coated with oil or greasy grime, disassemble the motor and clean with solvent. Use only high-flash naptha, mineral spirits, or Stoddard solvent. Wipe with solvent dampened cloth, or use suitable soft bristle brush. DO NOT SOAK. Oven dry (150° F) solvent cleaned windings thoroughly before reassembly.

Windings of SUPER-SEAL® (encapsulated stator) motors may be rinsed or sprayed with solvent, and immediately wiped dry with a cloth. These windings may be cleaned with water and a fugitive detergent (ammonium oleate), or common household detergents. Rinse with clean, clear water to remove all detergent. Hot water or low-pressure steam may be used. Wipe excess water from metal surfaces and oven dry at 200° F.

After solvent cleaning and drying windings, check the insulation resistance.

WARNING

EXPLOSION-PROOF MOTORS:
These motors are constructed to comply with the U L Label Service Procedure Manual. When reassembling a motor that has the Underwriters' label, it is imperative that:

(1) The original fits and tolerances be maintained.

(2) *All* plugs and hardware be securely fastened.

(3) Any part replacements are accurate duplicates of the original.

(4) Motor enclosure must be verified by Underwriters Laboratories and if approved a licensed service shop will relabel the motor.

To violate any of the above will invalidate the significance of this label.

Insulation Resistance

Check insulation resistance periodically.

A hand cranked megger, not over 500 volts, is the most convenient and safest device to use.

CAUTION

Semi-conductors, small transformers, voltage regulators and other devices that may be injured by the high voltage, must not be in the circuit.

The standards of the Institute of Electrical and Electronic Engineers (IEEE) No. 43 is an excellent reference for the testing of insulation resistance. Very briefly, the publication recommends that stator winding insulation resistance, (at 75° C) measured with 500 volts D.C. — after one minute, should not be less than;

$$\frac{\text{Rated Voltage} + 1000}{1000} = \text{Resistance in Megohms}$$

This formula is satisfactory for most checks.

Allis Chalmers reprint of publication 43 is 05R7728.

DRYING INSULATION

If the megger reading is less than satisfactory, and the cause is excessive moisture in the windings; dry the windings by applying heat from:

(1) A warm air oven.

(2) Electric strip heaters.

(3) Circulating currents through the coils.

The heat should be applied slowly so the desired temperature will not be obtained in less than six hours.

TABLE 5-1

INSULATION DRYING TEMPERATURES*			
CLASS "A"	CLASS "B"	CLASS "F"*	CLASS "H"*
167° F	200° F	245° F	275° F
75° C	94° C	118° C	135° C

*Class "F" and "H" Insulated Units should be baked at 70% specified temperature (to avoid steam inside winding) for about six hours, before temperature is raised to drying temperature.

Insulation resistance should be measured before the heat is applied, and every six to eight hours thereafter.

NOTE: Insulation resistance will decrease as the machine warms up; but will begin to increase shortly as the dryout continues.

A uniform temperature must be maintained in the machine to obtain constant resistance readings. When the megger readings reach a constant value, the drying out process is complete and may be discontinued. If readings are not satisfactory (high enough), check for other causes.

WARM AIR OVEN DRYING

(1) Remove bearing housings.

(2) Remove rotor.

Bake in oven at temperatures specified in Table 5-1 and follow procedures described for drying insulation.

STRIP HEATER DRYING

(1) Remove bearing housings.

(2) Remove rotor.

(3) Direct a fan on stator to carry away the moisture.

(4) Attach temperature indicators to winding and apply heat as specified in Table 5-1. Follow procedures described for drying insulation.

CAUTION

Temperatures must be carefully controlled. Avoid hot spots. Do not use radiant type heat such that some parts become scorched before remote parts reach desired temperature.

CIRCULATING CURRENT DRYING

(1) Remove bearing housings.

(2) CENTER the rotor in the stator core.

(3) WEDGE fiber strips into the lower part of the air gap, so that rotor is not touching stator.

(4) Direct fan on unit to blow away excessive moisture.

(5) Attach temperature indicators to windings and follow the procedures prescribed for drying insulation. Do not exceed the drying temperatures in the table.

(6) Apply a controlled current of the same number of phases, and the same, or less than rated frequency to the windings. The voltage used should not be more than 10% of normal, nor should it cause more than 60% of normal full load current to pass through the windings.

CAUTION

Insulation resistance will decrease as the machine warms up; but will begin to increase as the drying process continues.

When the insulation resistance has reached one-half of the minimum value determined by the formula, a voltage of 15% of normal may be applied.

NOTE: For more detailed information about insulation maintenance, see factory instructions 05X7391.

BEARINGS

Long life of bearings is assured only by maintaining proper alignment, and good lubrication at all times. Some factors that can cause excessive bearing noise and heat are:

(1) Incorrect alignment of solid couplings.

(2) Incorrect alignment of flexible couplings.

(3) Excessive, or wrong direction of thrust.

(4) Improper greasing.

Bearing Lubricants — Grease: Prior to shipment, motor bearings are lubricated with the proper amount and grade of grease to provide six months of satisfactory service under normal operation and conditions. It is good practice, however, to check bearings of newly installed motors for proper lubrication.

For best results, grease should be compounded from a lithium soap base and a good grade of petroleum oil.

It should be of No. 2 consistency for double-shielded, No. 3 consistency for open or single-shielded bearings, and stabilized against oxidation. Operating temperature range should be from −15° to +250° F for Class B insulation, and to +300° F for Class "F" and "H". Most leading oil companies have special bearing greases that are satisfactory.

For specific recommendations, consult the factory.

BEARING RELUBRICATION

The frequency of relubricating bearings and the amount added each time, depends on two factors — speed and service. As a guide the following is recommended.

SPEED (RPM)	RELUBRICATING FREQUENCY*
3600	6 Months (4,000 Hours)
1800 or Less	12 Months (8,000 Hours)

*Operating environment may dictate more frequent lubrication.

NOTE: A common mistake is daily lubrication of bearings. As well as being wrong, it is a dangerous practice, particularly when grease is added without removing the drain plug. The excess grease must go somewhere and usually it is forced into and through the inner bearing cap and is then thrown into the windings. Proper lubrication is desired, but some under-lubrication is less dangerous than over-lubrication.

Relubricate bearings with the proper grade of grease as follows:

(1) Stop the motor and lock out the switch.

(2) Thoroughly clean off and remove grease inlet plug, drain pipe and plug from the outer bearing caps.

NOTE: Drain pipes do not always permit satisfactory escape for displaced grease. It is a good practice to remove drain pipes, if practical, and visually check the drain outlet for grease.

(3) Add grease to inlet with hand gun until small amount of new grease is forced out drain. Catch used grease in suitable container.

NOTE: For vertical shaft motors, it is wise to check the inner cap of the top bearing for grease slumping through the bearing and filling the inner cap grease reservoir. Since it is necessary to remove the housing, this check is best done during periodic shut down inspections.

(4) Remove excess grease from parts and replace inlet plug.

(5) Replace cleaned drain pipe and run unit at least one hour to expell any excess grease.

(6) Replace drain plug.

(7) Put unit back in operation.

CAUTION

Avoid adding lubricant to bearings while unit is running.

If it is mandatory to add grease while the unit is running, the following instructions must be followed carefully.

The correct amount of grease must be predetermined. The object is to avoid overgreasing. Since a bearing acts as a pump when running, the initial measurements must be made with the unit at a stand still.

(1) Stop the unit, lock out the switch and remove inlet pipe plug and outlet drain pipe, as previously described.

(2) Add small, *measured amounts* of grease to inlet until it is evident that new grease is entering the drain opening.

(3) Insert the inlet pipe plug; run the unit one hour to expel excessive grease.

(4) Replace clean drain pipe and plug.

Subsequent regreasings with the unit running, the grease added should be not more than ⅔ the amount needed to make the grease come out the drain when the unit was stationary.

BEARING REPLACEMENT

Replacement bearings may be of a different manufacturer; but must be equal to the originals used in the motor. When ordering bearings specify as follows:

(1) Identifying numerals and manufacturer stamp on the bearing (number is also on motor name plate).

(2) Bearing Tolerance Class, *i.e.* (A.B.E.C.-1) Annular Bearing Engineers' Committee — Tolerance Class One.

(3) Electric motor quality.

(4) Internal Radial Clearance, *i.e.* (A.F.B.M.A.-3) Anti-Friction Bearing Manufacturers Association, Clearance Class Three.

CAUTION

Never use A.F.B.M.A.-0 Bearings on **enclosed** motors with Class "F" or "H" insulation.

For angular contact type bearings, replacements must be equivalent in angle of contact. Following is an interchangeability table:

MRC	SKF	New Departure	Fafnir
7300 P	7300 G	30300	7300 PW

TO REPLACE BEARINGS

(1) Remove bolts holding bearing housings to yoke. If motor has stationary inner end caps, remove bolts holding end caps to housings.

(2) Remove end housings.

(3) Remove snap ring in front of bearing.

(4) Use bearing puller and exert force only on inner race to remove bearing from shaft.

NOTE: Protect the shaft end with a cap (Fig. 5-1). If bearing is to be reused make certain the puller applies pressure against the inner bearing race only. If puller will not hook the bearing inner race, fabricate a split bushing and install it between the bearing and the puller hooks.

(5) Check shaft diameter for proper size with micrometer. Clean or replace inner bearing cap and slide cap onto shaft.

(6) Heat the new bearing in an oven (200° F.).While it is hot, slide the bearing onto shaft — make certain that the inner race makes a firm even contact with shaft shoulder.

CAUTION

Do not subject bearing to impact.

(7) Let bearing cool — pack bearing caps per table (5-2) with the proper grade of grease.

(8) Reassemble end caps and end housings.

When repacking bearings, consult the accompanying table for the proper amount of lubricant. Pack all open bearings full between balls or rollers, but remove excess grease from the outside of the retainers. Full packing of a cap or bearing housing cavity should be done with a grease gun.

GREASE REPACKING TABLE 5-2

Type of Bearing	Operating Position	Front or Top		Rear or Bottom	
		Outer Cap	Inner Cap	Inner Cap	Outer Cap
Double Shielded	Vertical	Full	None	⅔ Full	Full
Open Deep Groove	Vertical	⅔ Full	⅓ Full	⅔ Full	Full
Angular Contact	Vertical	⅔ Full	⅓ Full	⅔ Full	Full

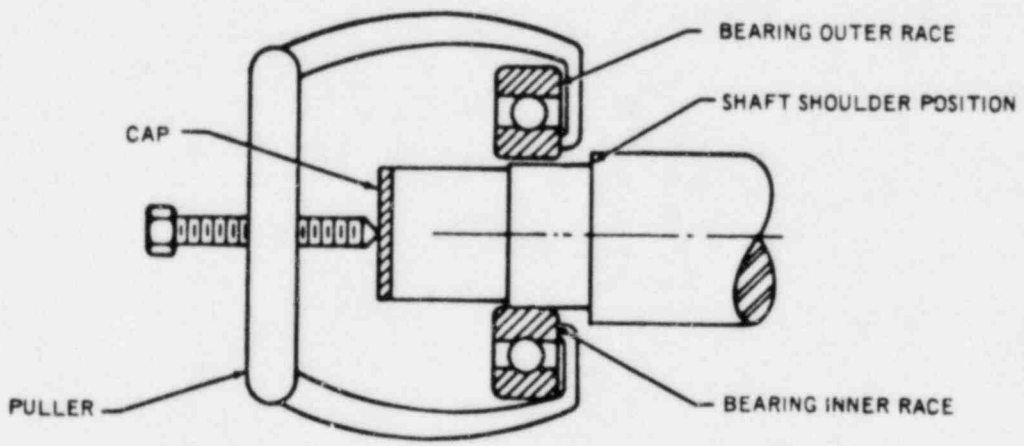


FIG. 5-1 REMOVING BEARING

26914

WARNING

EXPLOSION-PROOF MOTORS:
These motors are constructed to comply with the U L Label Service Procedure Manual. When reassembling a motor that has the Underwriters' label, it is imperative that:

(1) The original fits and tolerances be maintained.

(2) *All* plugs and hardware be securely fastened.

(3) Any part replacements are accurate duplicates of the original.

To violate any of the above will invalidate the significance of this label.

SHAFT OR FLANGE FACE RUNOUT

Because inspection of flange faces, eccentricity and shaft runout, is rigorously enforced at the factory, vibrations caused by this alignment problem are rare and usually if shaft runout, face runout, or eccentricity are excessive; the equipment has been mistreated in some way.

The NEMA method for checking shaft and flange faces is as follows:

NOTE: On ball-bearing motors, it is recommended that the test be made with the shaft vertical to minimize the effect of bearing clearances.

SHAFT RUNOUT

The shaft runout is measured with the indicator stationary with respect to the motor and with its point at the end of the finished surface of the shaft. See Fig. 5-2 for typical fixture.

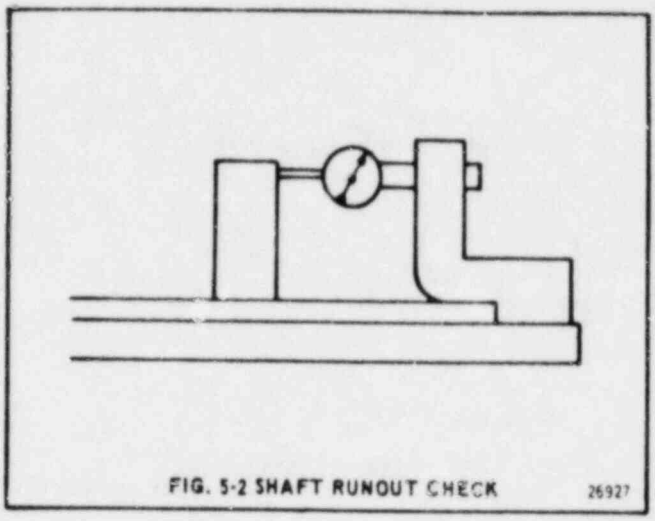


FIG. 5-2 SHAFT RUNOUT CHECK 26927

Read the maximum and minimum values on the indicator as the shaft is rotated slowly through 360 degrees. The difference between the readings shall not exceed:

.002 inch — frame 140 thru 280
.003 inch — frame 320 thru 445

ECCENTRICITY AND FACE RUNOUT OF MOUNTING SURFACES

The eccentricity and face runout of the mounting surfaces is measured with indicators mounted on the shaft extension. The point of the eccentricity indicator shall be at approximately the middle of the rabbet surface, and the point of the face runout indicator shall be at approximately the outer diameter of the mounting face. See Fig. 5-3 for typical fixture.

Read the maximum and minimum values on the indicators as the shaft is rotated slowly through 360 degrees. The difference between the readings shall not exceed:

.004 inch for 140 thru 280 frame
.007 inch for 320 thru 445 frame

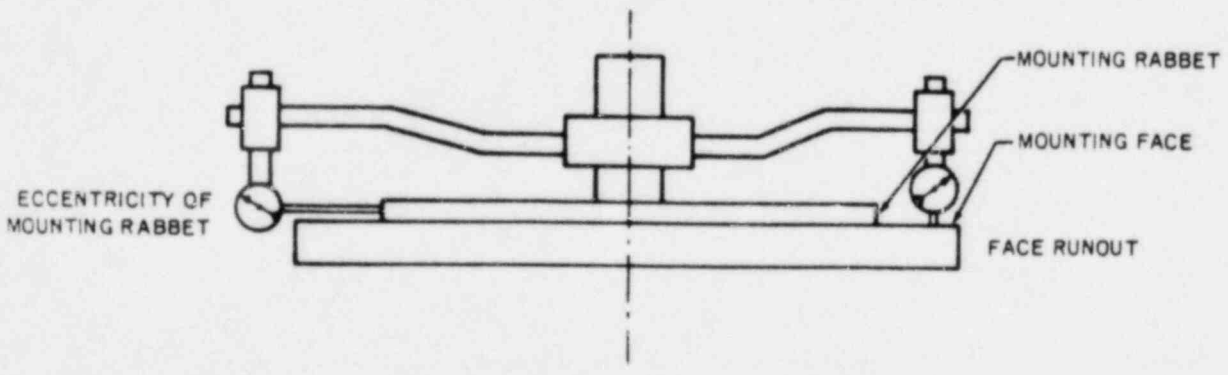


FIG. 5-3 ECCENTRICITY AND FACE RUNOUT CHECK 26928

SQUIRREL-CAGE INDUCTION AND *SYNDUCTION*® MOTORS

Item	Description of Part	Recommended Minimum Stock			
		Number of Units in Operation			
		1 to 4	5 to 9	10 to 20[1]	10 to 20
1	Motor Complete	0	0	0	1
2	Stator Coils with Winding Supplies[2]	1 Set	1 Set	2 Sets	1 Set
3	Bearings	1 Set	2 Sets	2 Sets	1 Set
4	Oil Rings (where used)	1 Set	1 Set	2 Sets	1 Set
5	End Cap (Anti-friction Bearings)	1 Set	1 Set	2 Sets	1 Set

Synduction is an Allis-Chalmers trademark. [1]This column to be used when complete machine is not stocked.
[2]This does not apply for motors with POXEAL® encapsulated-stator, in which case one complete stator is recommended

IDENTIFICATION

All units have an identification (name) plate affixed to the frame (Fig 6-1). All the necessary information pertaining to the machine can be found on this plate. Permanent records are kept by the factory and filed by:

(1) Serial number.

(2) Type and frame size.

(3) Horsepower and speed.

(4) Model number

It is important when ordering spare parts or refering to your machine, to record as much data from this plate as possible.

PARTS IDENTIFICATION

The drawings in this book are of the standard design. Most of the parts should be easy to identify, if however, there is some deviation from your actual machine, consult the factory or the drawings supplied with your unit.

Order these and other parts, as required, from Allis-Chalmers, 400-440 Frames, 4620 Forest Ave., Norwood, Ohio 45212, 140-360 Frames, 1400 Dineen Drive, Little Rock, Arkansas 72206, or through the nearest sales office. Give the identifying information from the name plate (Fig. 6-1).

NOTE: IF MOTOR HAS MORE THAN THREE LEADS, THE CONNECTION DIAGRAMS ARE USUALLY STAMPED ON THE NAME PLATE OR ON A SEPARATE CONNECTION PLATE

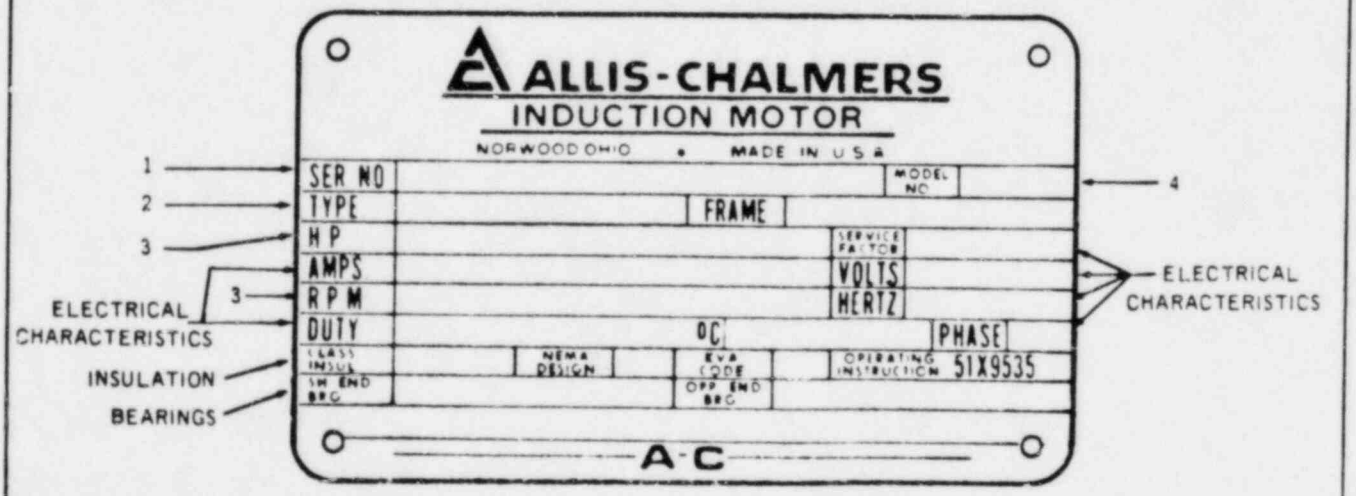
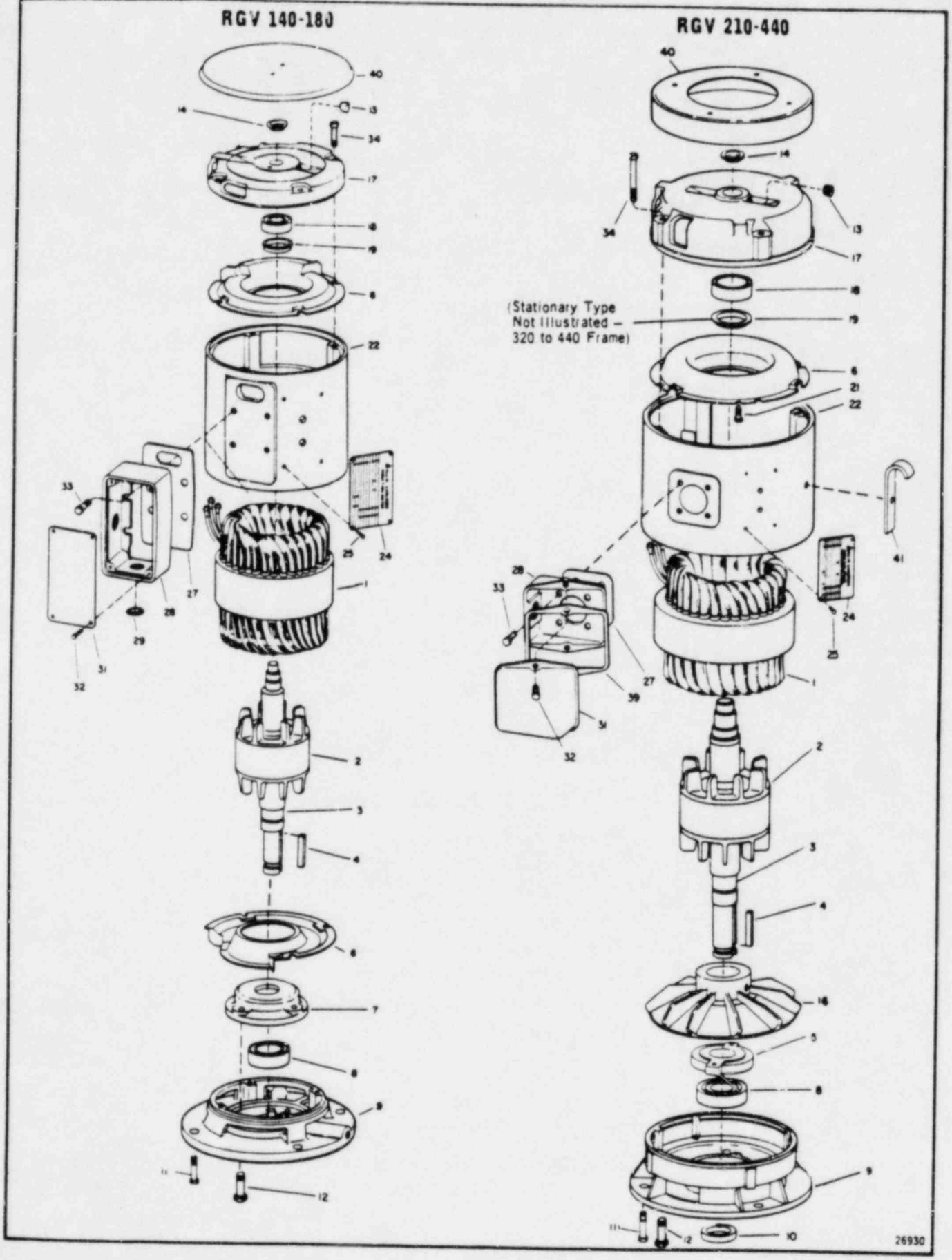


FIG. 6-1 IDENTIFICATION PLATE

26929

EXPLODED VIEW

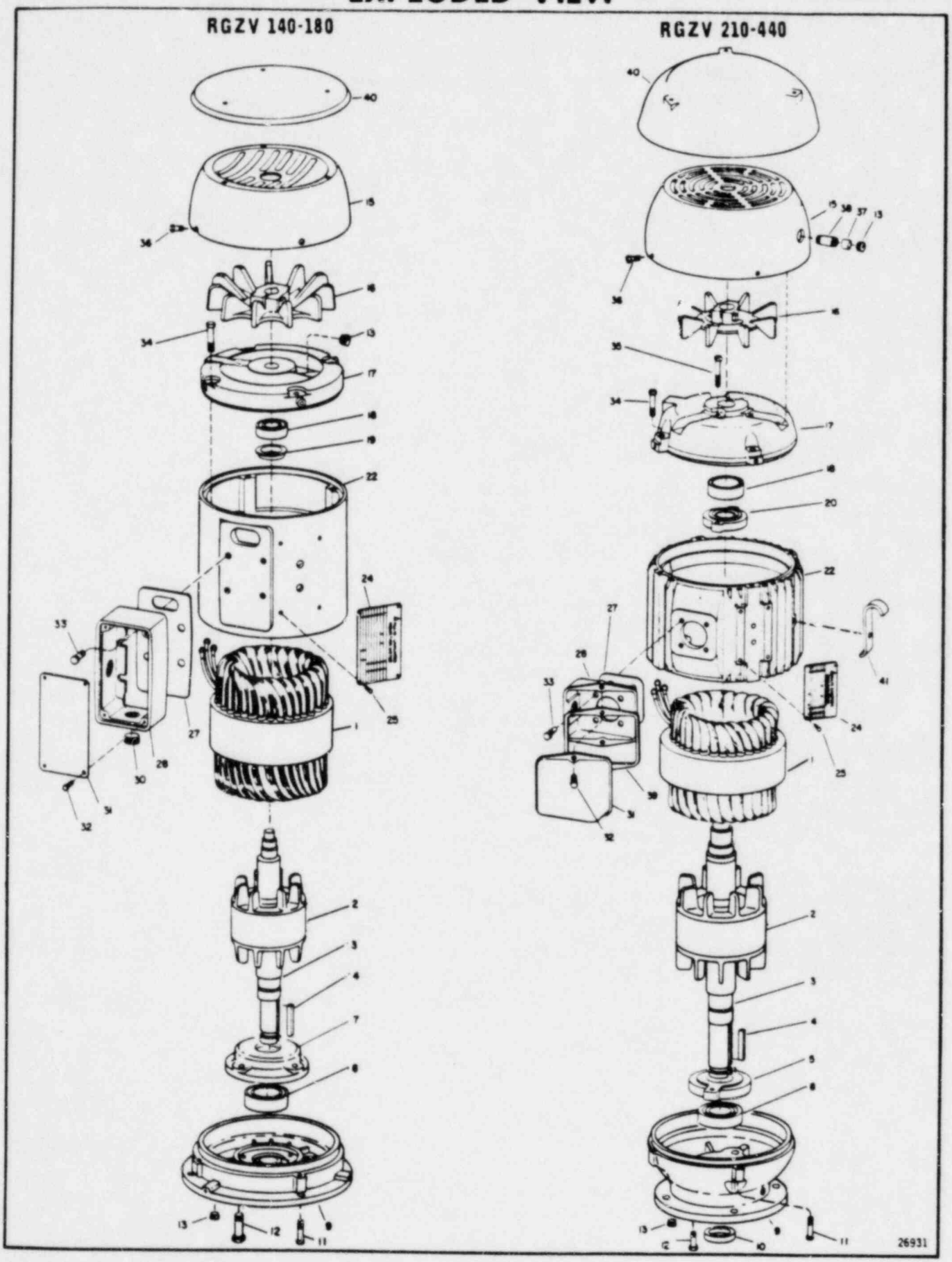


PARTS LIST

KEY NO.	CATALOG NO.	PART NAME
1	71000	Stator Assembly
2	70520	Rotor Core
3	70510	Shaft, Rotor
4	70660	Key, Square
5	72014	Cap, End - Rear
6	72320	Deflector, Air
7	72014	Cap, End - Rear
8	72054	Bearing - Rear
9	72004	Housing, Bearing - Rear
10	72330	Seal, Shaft
11	72220	Bolt, Hex Head (Rear Bearing Housing)
12	72220	Bolt, Hex Head (Rear End Cap)
13	72270	Plug, Pipe
14	72040	Plug, End Cap
15*	72090	Bowl, Fan and Grid
16	72080	Fan (210 – 250 Round Frame Only)
17	72003	Housing, Bearing - Front
18	72053	Bearing - Front
19	72013	Cap, End - Front
20	72013	Cap, End - Front (Stationary Type Not Illustrated - 320 to 440 Frame)
21	72220	Bolt, Hex Head (Front Air Deflector)
22	71010	Yoke Stator (Typical 210-320 yoke shown)
23*	72210	Eyebolt, Lifting
24	72340	Plate, Rating
25	72220	Pin, Escutcheon
26*	72220	Bolt, Hex Head (Air Deflector - Rear)
27	70930	Gasket (Conduit Box to Yoke)
28	70900	Box Conduit
29	70960	Plug - Conduit Box
30*	72270	Plug, Pipe Conduit Box
31	70910	Cover, Conduit Box
32	72220	Bolt, Hex Head (Conduit Box Cover)
33	72220	Bolt, Hex Head (Conduit Box)
34	72220	Bolt, Hex Head (Front Bearing Housing)
35	72220	Bolt, Hex Head (Front End Cap, Not Illustrated)
36*	72220	Bolt, Hex Head (Fan Bowl)
37*	72260	Coupling Pipe
38*	72250	Nipple Pipe
39	70930	Gasket, Cond. Box Parting
40	72120	Drip Cover
41	72210	Lift Hook

*Not Required for Type RGV

EXPLODED VIEW



PARTS LIST

KEY NO.	CATALOG NO.	PART NAME
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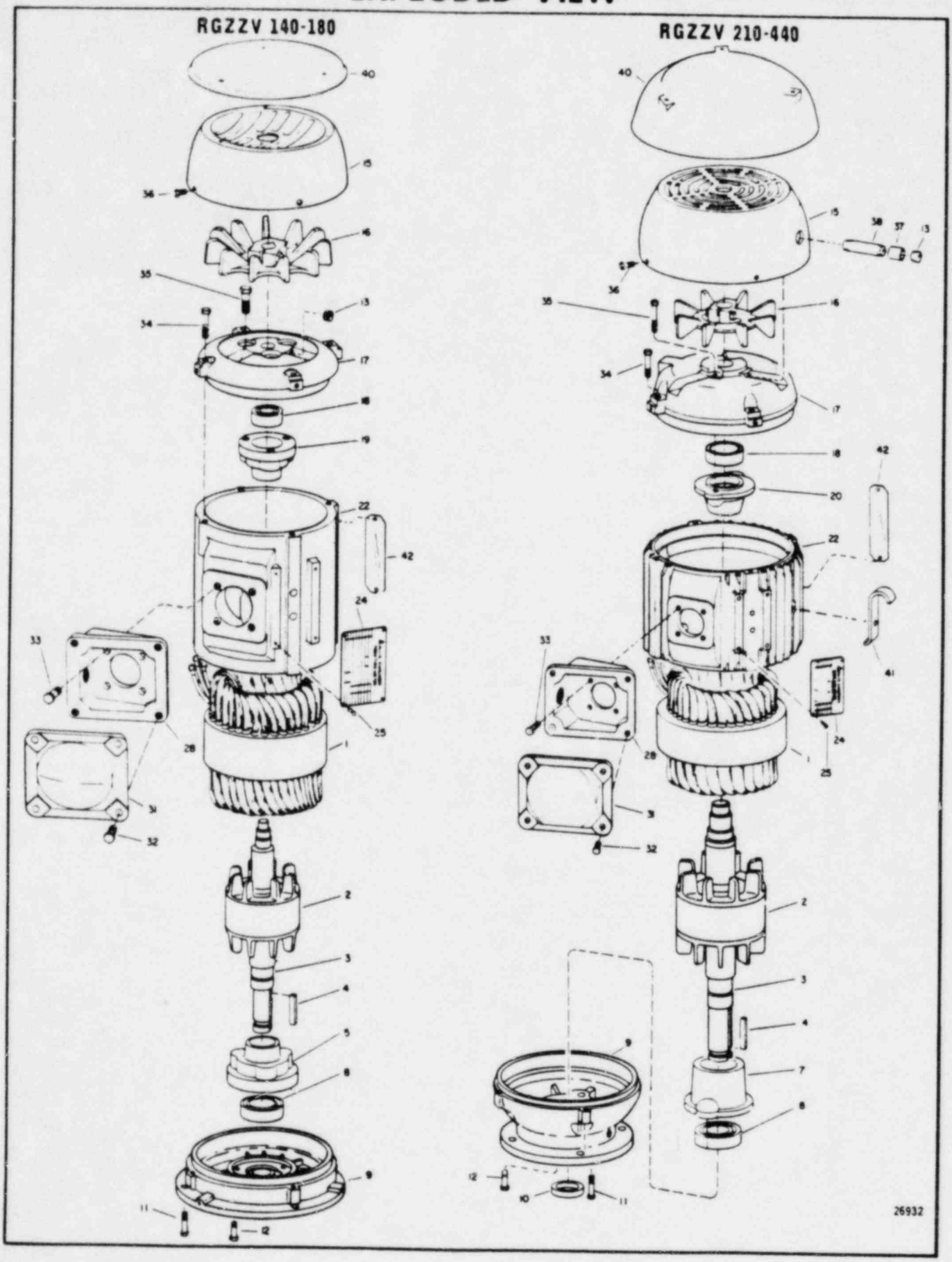
2	70520	Rotor Core
3	70510	Shaft, Rotor
4	70660	Key, Square
5	72014	Cap, End - Rear
6*	72320	Deflector, Air
7	72014	Cap, End - Rear
8	72054	Bearing - Rear
9	72004	Housing, Bearing - Rear
10	72330	Seal, Shaft
11	72220	Bolt, Hex Head (Rear Bearing Housing)
12	72220	Bolt, Hex Head (End Cap)
13	72270	Plug, Pipe
14*	72040	Plug, End Cap
15	72090	Bowl, Fan and Grid
16	72080	Fan
17	72003	Housing, Bearing - Front
18	72053	Bearing - Front
19	72013	Cap, End - Front
20	72013	Cap, End - Front
21*	72220	Bolt, Hex Head (Front Air Deflector)
22	71010	Yoke Stator
23*	72210	Eyebolt, Lifting
24	72340	Plate, Rating
25	72220	Pin, Escutcheon
26*	72220	Bolt, Hex Head (Air Deflector - Rear)
27	70930	Gasket (Conduit Box to Yoke)
28	70900	Box Conduit
29*	70960	Plug - Conduit Box
30	72270	Plug, Pipe Conduit Box
31	70910	Cover, Conduit Box
32	72220	Bolt, Hex Head (Conduit Box Cover)
33	72220	Bolt, Hex Head (Conduit Box)
34	72220	Bolt, Hex Head (Front Bearing Housing)
35	72220	Bolt, Hex Head (Front End Cap)
36	72220	Bolt, Hex Head (Fan Bowl)
37	72260	Coupling Pipe
38	72250	Nipple Pipe
39	70930	Gasket, Cond. Box Parting
40	72120	Drip Cover
41	72210	Lift Hook

* Items not required for Type RGZV

EXPLODED VIEW



PARTS LIST

KEY NO.	CATALOG NO.	PART NAME
1	71000	Stator Assembly
2	70520	Rotor Core
3	70510	Shaft, Rotor
4	70660	Key, Square
5	72014	Cap, End - Rear
6*	72320	Deflector, Air
7	72014	Cap, End - Rear
8	72054	Bearing - Rear
9	72004	Housing, Bearing - Rear
10	72330	Seal, Shaft
11	72220	Bolt, Hex Head (Rear Bearing Housing)
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14*	72040	Plug, End Cap
15	72090	Bowl, Fan and Grid
16	72080	Fan
17	72003	Housing, Bearing - Front
18	72053	Bearing - Front
19	72013	Cap, End - Front
20	72013	Cap, End - Front
21*	72220	Bolt, Hex Head (Front Air Deflector)
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23*	72210	Eyebolt, Lifting
24	72340	Plate, Rating
25	72220	Pin, Escutcheon
26*	72220	Bolt, Hex Head (Air Deflector - Rear)
27*	70930	Gasket (Conduit Box to Yoke)
28	70900	Box Conduit
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32	72220	Bolt, Hex Head (Conduit Box Cover)
33	72220	Bolt, Hex Head (Conduit Box)
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35	72220	Bolt, Hex Head (Front End Cap)
36	72220	Bolt, Hex Head (Fan Bowl)
37	72260	Coupling Pipe
38	72250	Nipple Pipe
39*	70930	Gasket, Cond. Box Parting
40	72120	Drip Cover
41	72210	Lift Hook
42	-	Underwriters' Plate

* Items not required for Type RGZZV

MOTOR SERVICE RECORD (51X2285)

Serial No. _____ Horsepower _____ Type _____

Speed _____ Volts _____ Amperes _____ Phase _____ Cycles _____

Insulation Class _____ Temperature Rise _____ °C Frame Size _____

Connection Diagram - Rotor _____ Stator _____

Owner Order No. _____ Item No. _____ Date Purchased _____

MACHINE TYPE	BEARINGS	SHAFT EXTENSION
☐ Horizontal ☐ Vertical ☐ Moisture-Resistant ☐ Open Drip-Proof ☐ Super-Seal ☐ Totally-Enclosed ☐ Explosion Proof	☐ Ball ☐ Roller ☐ Sleeve Size: Front _____ Rear _____ Lubrication _____	Length _____ Diameter _____ Internal Thread _____ External Thread _____ Keyway _____

Date Installed	Location	Application

Date Repaired or Replaced	Repairs or Parts Replaced (1)	Fault	Repaired by	Total Cost

(1) Name of Part	No. Per Machine	Manufacturer's No.	Date	Quan. Repl.	Cost	Date	Quan. Repl.	Cost	Date	Quan. Repl.	Cost
Rotor											
Stator Coils											
Bearing, Front											
Rear											
Other											

INSPECTION													
Date Checked													
Bearings													
Lubrication													
Excess Heat													
Excess Noise													
Speed													
Voltage													
Amps													
Insulation													
Clean													
Alignment													
Vibration													
Temperature													

ALLIS-CHALMERS
MOTOR AND GENERATOR DIVISIONS
NORWOOD, OHIO 45212

Litho in U.S.A.

GOULDS PUMPS
VERTICAL PUMP DIVISION

Installation, Operation and Maintenance Instructions

MODEL VIT

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS (DRAWINGS AND PICTURES)

SECTION 1—INTRODUCTION

1-1 INTRODUCTION

1-2 The design, material, and workmanship incorporated in the construction of Goulds pumps makes them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps.

1-3 It is advisable that rotating components of the pump assembly be covered with a suitable rigid guard to prevent injury to personnel.

1-4 Study thoroughly Sections 1 thru 13 and carefully follow the instructions for installing and operating. Sections 14 thru 15 are answers to trouble and maintenance questions. Keep this instruction manual handy for reference. Further information can be obtained by contacting the Vertical Pump Division, Goulds Pumps, Inc., City of Industry, California or your local branch office.

WARNING

GOULDS PUMPS, INC. WILL NOT BE LIABLE FOR ANY DAMAGES OR DELAY CAUSED BY FAILURE TO COMPLY WITH THE PROVISIONS OF THIS INSTRUCTION MANUAL.

1-5 RECEIVING AND CHECKING

1-6 The pump should be carefully supported prior to unloading from the carrier. Handle all components carefully. Inspection for damage of the shipping crate should be made prior to unpacking and pump. After unpacking, visually inspect the pump, and check the following:

A. Contents of the pump assembly against shipping list.

B. All components against damage.

C. Shafting for straightness and damage should the crate be broken or show careless handling.

1-7 Any shortages or damages should be immediately called to the attention of the local freight agent of the carrier by which the shipment arrived and proper notation made on the bill. This shall prevent any controversy when claim is made and facilitate prompt and satisfactory adjustment.

1-8 MATERIALS AND EQUIPMENT REQUIRED

1-9 The material and equipment necessary for installation of the pump will vary with the size of the pump and the type of installation.

The following list of standard tools and supplies is offered only as a guide.

A. BULK MATERIAL

Anti-Galling Lubricant (such as "MOLYKOTE" DOW-CORNING)

Thread Compound

Lubrication Oil

Turbine Oil

Grease

Solvent, petroleum-base (kerosene, distillate or unleaded gasoline)

B. RIGGING EQUIPMENT

Mobile power hoist, or a traveling crane, or a derrick

Drag line and blocks

Elevator clamps, if unit is unassembled

Clevises—for use with eyebolts

Timbers—size, length and quantity as required to support long pump parts on the floor

I-Beams or timbers to support pump over installation

C. HAND TOOLS

Pipe wrenches, clean rags

Feeler gages

Set of mechanics tools, including: files, wire brush, pliers, wirecutters and pocket knife.

D. OPTIONAL TOOLS TO FACILITATE PUMP ASSEMBLY AND DISASSEMBLY

Dial indicator to assist in motor & pump alignment

Collet driver to assist in bowl assembly and disassembly.

SECTION 2—STORAGE

2-1 STORAGE

2.2 Goulds Pumps carefully preserves and protects its products for shipment. However, the effective life of the preservatives applied at the factory can vary from 3 to 18 months depending on the severity of the environment in which the equipment is stored. This section provides procedures for preparation prior to storage and maintenance during storage of Goulds pumps. These procedures are necessary to protect the precision parts of the pumps. Specific procedures for storing motors, gearheads, and engines, should be obtained from the equipment manufacturer. This section is

intended to be of general assistance to users of Goulds pumps. It shall not modify, amend and/or otherwise alter the scope of Goulds Pumps warranty responsibilities to the purchaser in any way whatsoever.

2-3 STORAGE PREPARATION

2-4 Goulds' vertical pumps require proper preparation for storage and regular maintenance during storage. The pump shall be considered in storage when it has been delivered to the job site and is waiting installation.

2-5 RECOMMENDED STORAGE PROCEDURES

A. Controlled storage facilities should be maintained at an even temperature 10° F (−12° C) or more above the dew point with relative humidity less than 50% and little or no dust. (If these requirements cannot be met the pump is to be considered in uncontrolled storage.)

B. For uncontrolled storage periods of 6 months or less, the pump is to be inspected periodically to insure that all preservatives are intact.

C. All pipe threads and flanged pipe covers are to be sealed with tape.

D. The pump must not be stored closer than six inches (15 cm) from the ground.

2-6 PREPARATIONS FOR UNCONTROLLED LONG TERM STORAGE

2-7 When applicable to the pump, storage periods over six months require the preceding uncontrolled storage procedure plus the following:

A. Inspect the lube oil and seal flush piping, and either fill the piping with rust preventative oil, or recoat the piping periodically to prevent corrosion.

B. Place 10 pounds (4.5 kg) of moisture absorbing dessicant or 5 pounds (2.3 kg) of vapor phase inhibitor crystals near the center of the pump. If the pump is assembled, place an additional one pound (0.5 kg) in the discharge nozzle securely fastened to the discharge elbow.

C. Install a moisture indicator near the perimeter of the pump. Cover the pump with 6 mil (0.15 mm) minimum thickness black plyethylene or equal and seal it with tape. Provide a small ventilation hole approximately ½ inch (12 mm) diameter.

D. Provide a roof or shed shelter to protect from direct exposure to the elements.

SECTION 3—GENERAL DESCRIPTION

3-1 GENERAL DESCRIPTION

3-2 The model VIT pump is a vertical industrial turbine type pump designed to meet wide ranges of service. The VIT pump also features capacities to 29000 GPM (6600 m^3/h), heads to 3500 feet (1065 m), and pressures to 3000 PSIG (210 kg/cm^2).

3-3 DRIVERS

3-4 Where mechanical seals are required the most common drivers supplied are solid shaft electric motors with adjustable spacer type couplings which permit replacement of the mechanical seal without disturbing the driver. Solid shaft gears are also used, occasionally.

When packing boxes are used or the unit is of the enclosed line shaft, oil lubricated type, hollow-shaft motors or gears are often used, with a separate head shaft thru the driver and connected to the pump by rigid flanged coupling or threaded or keyed type line shaft coupling, depending on the application.

3-5 DISCHARGE HEAD

3-6 The discharge head is a fabricated "L" type head. Ports are provided for connecting discharge gage, stuffing box or mechanical seal bypass return. Discharge head is designed with large hand holes for easy mechanical seal or stuffing box adjustment.

3-7 COLUMN

3-8 Flanged column construction provides positive shaft and bearing alignment, ease of assembly and disassembly. Bearings are spaced to provide vibration free operation below shaft first critical speed to insure long bearing and shaft wear. The lineshaft is supported within the column by use of bearing retainers secured to the column assembly. These retainers are separate from the column pipe for nominal pipe sizes up to and including 12" and integrally fabricated for all larger diameters.

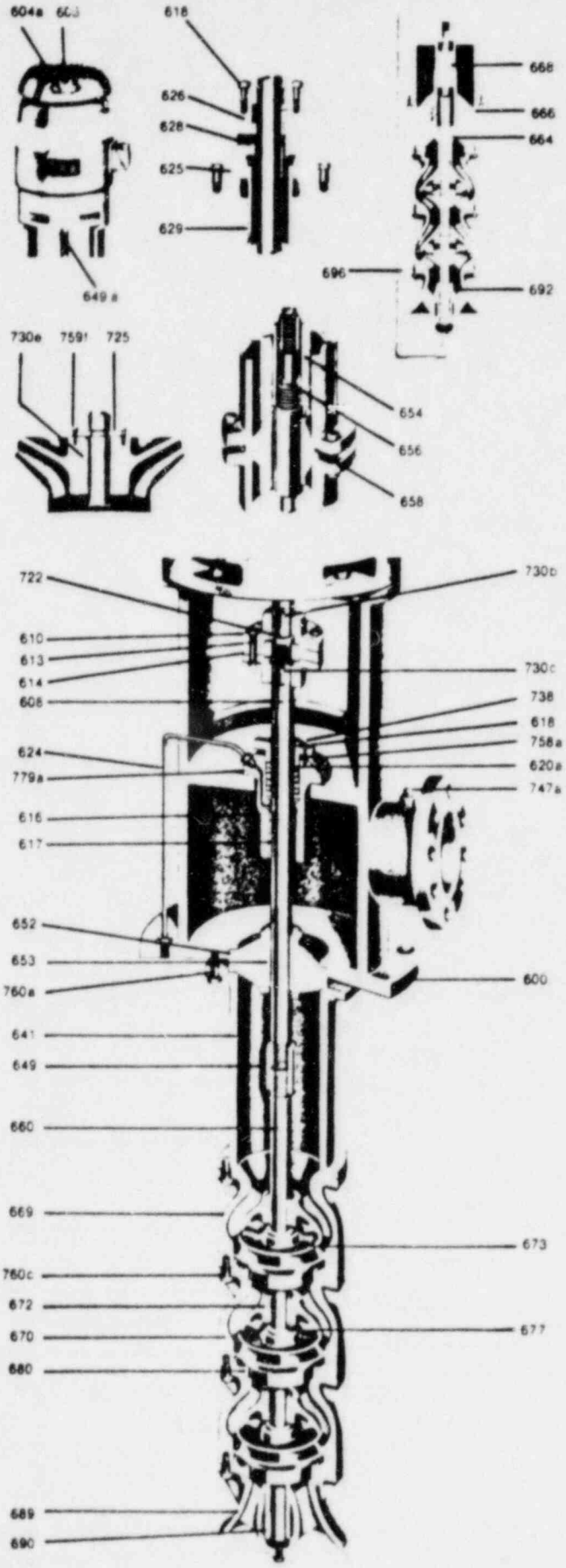
3-9 BOWL ASSEMBLY

3-10 The bowls are generally of flanged construction for accurate alignment and ease of assembly and disassembly. Impellers may be either open or enclosed, depending on design requirements. For temperatures over 180° F (82° C) and in the larger sizes, impellers are keyed to the shaft. A special first stage low NPSH impeller may be provided in certain applications.

3-11 THRUST POT

3-12 A thrust pot is utilized when the electric motor or gear is not designed to carry the pump thrust.

Sectional View



Materials of Construction and Parts List

ITEM NO	NO. REQ'D Per PUMP	PART NAME	MATERIAL CONSTRUCTION BRONZE	CI
600	1	Discharge Head	FAB STL	
604a	1 (n)	Adjusting nut	AISI C-1018	
606	1 (n)	Drive shaft	AISI C-1045	
608*	1	Headshaft	416 SS	
610	1 (k)	Upper half coupling	AISI C-1213	
613	1 (k)	Adjusting plate	AISI C-1213	
614	1 (k)	Lower half coupling	AISI C-1213	
616	1	Stuffing box	1003	
617*	1	Throttle bushing	1104	1003
618	1 (s)	Split stuffing box gland	1104	1003
620a*	1 set	Packing	Graphitized Asbestos	
624	1	Bypass pipe	SAE 1020	
625	1 (m)	Tube tension plate	1003	
626	1 (m)	Adjusting nut	1003	
628	1 (m)	Bushing nut	1104	
629	1 (m)	Tube tension nipple	ASTM STL 120	
641	(g)	Column pipe	FAB STL	
649*	1	Pump shaft coupling	416 SS	
649a	1 (n)	Headshaft coupling	416 SS	
652	(g)	Bearing retainer	AISI C-1213	
653*	(g)	Lineshaft bearing	1104	1003
654	(g) (m)	Shaft enclosing tube	ASTM STL 120	
656*	(g) (m)	Tube shaft bearing	1104	1104
658	(g e)	Tube stabilizer	1212	
660*	1	Pump Shaft	416 SS	
664*	1 (m)	Dischg. bowl throttle bushing	1104	1003
666	1 (m)	Discharge bowl w ports	1003	
668*	1 (m)	Tube adapter bushing	1104	1104
669	1 (p)	Top bowl	1003	
670	1 (a) (p)	Intermediate bowl	1003	
672*	1 (b)	Bowl bearing	1104	1003
673	1 (b) (f)	Impeller	1102	1003
677*	1 (b) (e)	Impeller taper lock	AISI C-1018	
680*	1 (b)	Bowl wear ring	1117	1003
689	1	Suction bell	1003	
690*	1	Suction bell bearing	1104	1003
692*	1	Sand collar	1104	1003
696	1 (m)	Flush line	Galv. Steel Pipe	
722	1 (k) (s)	Split ring-upper half cplg	AISI C-1213	
725*	1 (b) (f) (s)	Split ring-impeller	416 SS	
730b	1 (k)	Key motor shaft	AISI C-1213	
730c	1 (k)	Key headshaft	AISI C-1213	
730e	1 (b) (f)	Impeller key	416 SS	
738	2	Gland bolt	AISI C-1018	
747a	1	Pipe plug	ASTM A338	
758a	(g)	Capscrew-stuffing box	AISI C-1018	
759f	4 (b) (f)	Capscrew split ring collar	416 SS	
760a	(g)	Column flange bolt	AISI C-1018	
760c	(g)	Capscrew	AISI C-1018	
779a*	1	Stuffing box gasket	Vellumoid	

*Minimum recommended spare parts that should be stocked

Material Specification

Code	Specification
1003	ASTM A48 CI 30B
1102	ASTM B145-836 (SAE 40)
1104	ASTM B144-932 (SAE 660)
1117	ASTM B148-952 (SAE 68E)
1212	ASTM A216 Gr. WCB
6521	ASTM 120 Gr. B

(a) 1 each additional stage
(b) per stage
(c) optional
(e) standard through 16" Bowl size
(f) standard on 18 size and above
(g) dependent on pump length
(k) standard on VSS drive only
(m) enclosed lineshaft only
(n) standard on VHS drive only
(p) C.I. bowls through 18 are glass lined
(q) dependent upon pump size
(s) 1 set in 2 halves
(t) C.I. impellers standard on 18 and larger sizes

Figure 3-1. STANDARD VIT PUMP

SECTION 4—FOUNDATION

4-1 PREPARING THE FOUNDATION

4-2 The foundation must be rigid, level and of adequate strength to support the complete weight of the pump, plus the weight of the liquid passing through it. Concrete foundation shall have bolts with a pipe sleeve 2½ times the bolt diameter embedded in the concrete, sized and located in accordance with the dimensions given on the Pump Certified Outline Drawing. The pipe sleeve allows movement for final positioning of the foundation bolts to conform to the holes in the base plate flange.

4-3 When the pump is mounted directly on a structural steel frame, pumps shall be located directly over, or as near as possible to the main building members, beams, or walls. Mounting flange shall be bolted to the support to avoid distortion, prevent vibration, and retain proper alignment.

4-4 INSTALLATION

4-5 BASE PLATE

A. If a base plate is being bolted to a structural foundation, or the plate is not grouted to the concrete foundation, use shims for leveling the plate.

SECTION 5—PUMP INSTALLATION

5-1 PUMP INSTALLATION

5-2 Pumps 20 feet (6 m) or less in length are usually shipped assembled, with the exception of the driver, packing, mechanical seal with tubing and coupling assembly, spacer or nonspacer type. When provided refer to the Certified Pump Outline for the applicable base plate plan for locating anchor bolt holes.

5-3 INSTALLING A PARTIALLY ASSEMBLED PUMP

5-4 A. Install base plate as described in Section 4.

B. Clean the plate mounting flange and clean bottom surface of discharge head mounting flange.

C. Sling through discharge and holes or thread two eyebolts through bolt holes in flange and hoist unit into position over the foundation.

D. Lower the unit and carefully guide it so the unit does not strike sides of the base plate. Continue to lower unit until discharge head flange engages and rests firmly on the plate, then secure with capscrews provided.

E. When a lineshaft is shipped separately check shaft for straightness; average total runout should not exceed 0.010 T.I.R. (0.25 mm) for every 10 feet (3 m). Shaft must be within tolerance prior to installation.

F. Remove stuffing box (if installed) and carefully slide shaft through top column bearing retainer and thread into coupling after replacing stuffing box or seal housing. Use extreme care not to damage retainer bearing.

F. Refer to Section 6 through 16 for complete assembly, startup, maintenance, disassembly and recommended lubricants for the pump.

SECTION 6—INSTALLING THE BOWL ASSEMBLY

6-1 BOWL ASSEMBLY INSTALLATION

6-2 The following bowl installation instructions apply to pumps shipped disassembled.

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED OBJECT UNLESS THERE IS A POSITIVE SUPPORT UNDER IT, WHICH WILL PROTECT PERSONNEL SHOULD A HOIST OR SLING FAIL.

CAUTION

DO NOT ATTEMPT TO LIFT BOWL ASSEMBLY BY THE PUMPSHAFT. THIS COULD RESULT IN DAMAGING THE PUMPSHAFT.

6-3 Prior to installing the bowl assembly check that all capscrews are tight and any required integral piping is installed. Remove all accumulated dust, oil or other foreign matter from external surfaces. Install bowl assembly as follows:

A. Place two I-beam supports across the base plate opening strong enough to safely support the weight of the entire pump assembly. These I-beams should be connected by threaded rods and nuts so as to clamp them firmly against the portion to be supported. See figure 6-1.

B. Thread two eyebolts through bolt holes in the flange, and hoist into position over the foundation, (see figure 6-1).

C. Lower bowl assembly and carefully guide it so that unit does not strike sides of the plate. Continue to lower bowl assembly until bowl flange rests firmly on the supports.

D. Place a cover over the bowl assembly to prevent entrance of dirt or other foreign matter.

CAUTION

DO NOT DROP ANY FOREIGN OBJECT INTO THE BOWL ASSEMBLY. SUCH AN OBJECT CAN CAUSE SERIOUS DAMAGE TO THE PUMP AND ANY DOWNSTREAM COMPONENTS. ANY FOREIGN OBJECT DROPPED INTO THE BOWL ASSEMBLY MUST BE RETRIEVED PRIOR TO CONTINUING ASSEMBLY.

CAUTION

USE "MOLYKOTE" DOW-CORNING OR EQUAL FOR ALL GALLING MATERIAL SUCH AS 316 STAINLESS STEEL.

NOTE

SHAFT THREADS ARE LEFT HAND.

E. THREADED SHAFT COUPLING. When threaded coupling is not installed on the pumpshaft, proceed as follows:

1. Install threaded coupling onto pumpshaft screwing it on for one-half its length.

2. A fine wire inserted in the drilled hole at the center of the coupling can be used as a gage to determine when the coupling is correctly positioned on the pumpshaft. Remove the wire after installing the coupling.

F. KEYED SHAFT COUPLING. When a pump is equipped with keyed shafts assemble as follows:

1. Install bottom retainer (650) and insert key (730D) onto shaft. (See figure 6-2).

2. Lower coupling sleeve (734) onto shaft approximately one inch.

3. Insert bottom split ring (726), lower coupling sleeve until it bottoms against split ring.

4. Secure bottom retainer (650) with capscrews (759E).

5. Slide retainer (650) onto shaft away from shaft groove. Insert key (730D) onto lineshaft (646) and lower lineshaft approximately one inch. Install top split ring onto lineshaft.

6. Lower lineshaft until split ring bottoms in the groove.

7. Slide top retainer (650) downward and secure with capscrews (759E).

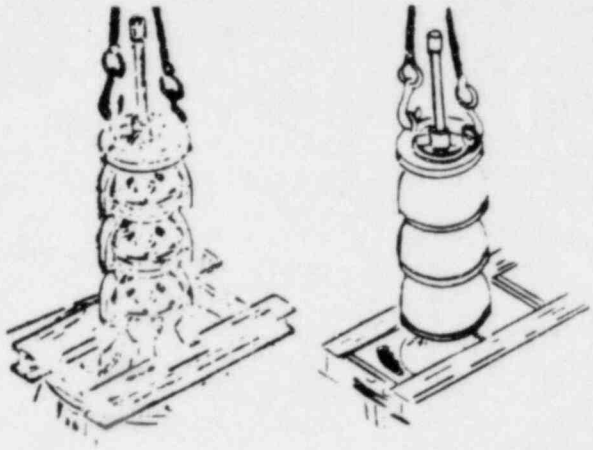


Figure 6-1. INSTALLING BOWL ASSEMBLY

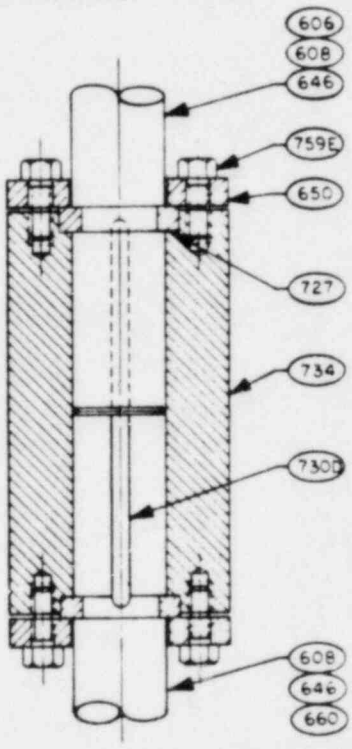


Figure 6-2. KEYED SHAFT COUPLING

SECTION 7—INSTALLING THE COLUMN

7-1 INSTALLING THE COLUMN (OPEN LINESHAFT)

7-2 When provided, see the Certified Pump Outline Drawing for the required number of column and shaft sections required.

A. Check the headshaft and lineshaft for straightness. Average total runout should not exceed 0.010 T.I.R. (0.25 mm) for every 10 feet (3 m).

B. Apply a thin film of oil to lineshaft and coupling (649) threads (if non-galling material). Start thread manually until resistance is felt. Complete the joint utilizing a pair of pipe wrenches butting the bottom of lineshaft against the top of pumpshaft

(660). Use care not to apply wrenches on bearing journal surfaces. (See figure 3-1).

CAUTION

USE "MOLYKOTE" DOW-CORNING OR EQUAL FOR ALL GALLING MATERIAL SUCH AS 316 STAINLESS STEEL.

NOTE

SHAFT THREADS ARE LEFT HAND.

C. KEYED SHAFTS—Refer to Section 6, paragraph 6-3, step F.

D. Install two eyebolts diametrically opposite in the upper flange of column (644). Attach a sling to the eyebolts and to hoist hook. Hoist column section over bowl assembly. (See figure 7-1). Lower column over lineshaft until column flange engages the discharge bowl flange register. Insert as many capscrews through both flanges as possible. Tighten capscrews gradually in diametrically opposite pairs.

E. Lift bowl and column assembly high enough to allow rotation of the I-beam supports. Install and tighten remaining capscrews.

F. Lift assembly and remove supports. Slowly lower the bowl and column assembly. Place supports on the base plate and continue to lower the assembly until the column flange comes to rest on the supports.

G. Place bearing retainer (652) with bearing (653) over lineshaft (646) and locate it in the bottom column (644) flange register (see figure 7-1).

NOTE

ON LARGER COLUMN SIZES, THE BEARING RETAINER MAY BE INTEGRAL WITH THE COLUMN.

H. Install threaded coupling (649) on protruding end of lineshaft (646), if required.

J. KEYED SHAFTS—Repeat Step C, paragraph 7-2.

K. Assemble next column section, intermediate, or top column as required, and make certain bearing retainer engages the column register, and secure with capscrews provided until all column, and lineshaft sections required for the proper pump setting have been assembled. Tighten capscrews gradually and uniformly.

NOTE

WHERE SEPARATE BEARING RETAINERS ARE USED, DO NOT OVERTIGHTEN FLANGE BOLTS IN ORDER TO MAKE FLANGE FACES MEET. FLANGE FACES ARE DESIGNED TO BE SEPARATED BY BEARING RETAINER.

SECTION 7-A—INSTALLING THE COLUMN—CLOSED LINESHAFT CONSTRUCTION

7-A 1 Installing the column when enclosed lineshaft, externally lubricated is used.

7-A 2 Proceed exactly as described in SECTION 7, Items A, B, and C.

A. Shafting and enclosing tube will usually be made up in 10' (3 m) lengths, with one odd length, generally shorter, to come out with the proper T.P.L. required by the installation. The same will apply to the column pipe. These odd lengths must go together, and are usually the top lengths unless otherwise designated. The enclosing tube, although probably made up in 10' (3 m) lengths as described, is actually composed of shorter sections screwed together over externally threaded bronze lineshaft bearings. The very top-most piece of lineshaft tubing which extends up into the discharge head, may be distinguished by its having a long, externally threaded portion.

B. Attach a small, adjustable, pipe vise type of lifting device to a 10' (3 m) tubing assembly and raise up and lower the assembly over the first length of shaft attached to the bowl assembly as described in SECTION 7, Item B. If such a device is not available, use a piece of light manila line, fastened to the tubing by a clove hitch or a double half hitch.

1. Apply "Never Seize" or some other non-hardening compound to the matching threads of the pump top screw bearing and take up tightly.

C. Lift the first length of column pipe over the tube and shaft assembly by its eyebolts as described in SECTION 7, Item D and lower it over the tube and shaft assembly and securely bolt in place as described.

D. Lift entire assembly by the column pipe eyebolts and remove the supports. Slowly lower the bowl and column assembly. Place the supports on the base plate and continue to lower the assembly until the column flange comes to rest on the supports.

E. Pour about one quart of light turbine oil into the top tubing section and screw the lineshaft bearing into the top length until it bottoms, ready to receive the next length of tubing assembly.

CAUTION

USE A LIGHT TURBINE OIL OF S.A.E. 10 OR EQUIVALENT. DO NOT USE AUTOMOTIVE OILS.

F. Install lineshaft coupling onto projecting end of shaft for half the length of the coupling and continue on with each suceeding joint in same manner until all are installed.

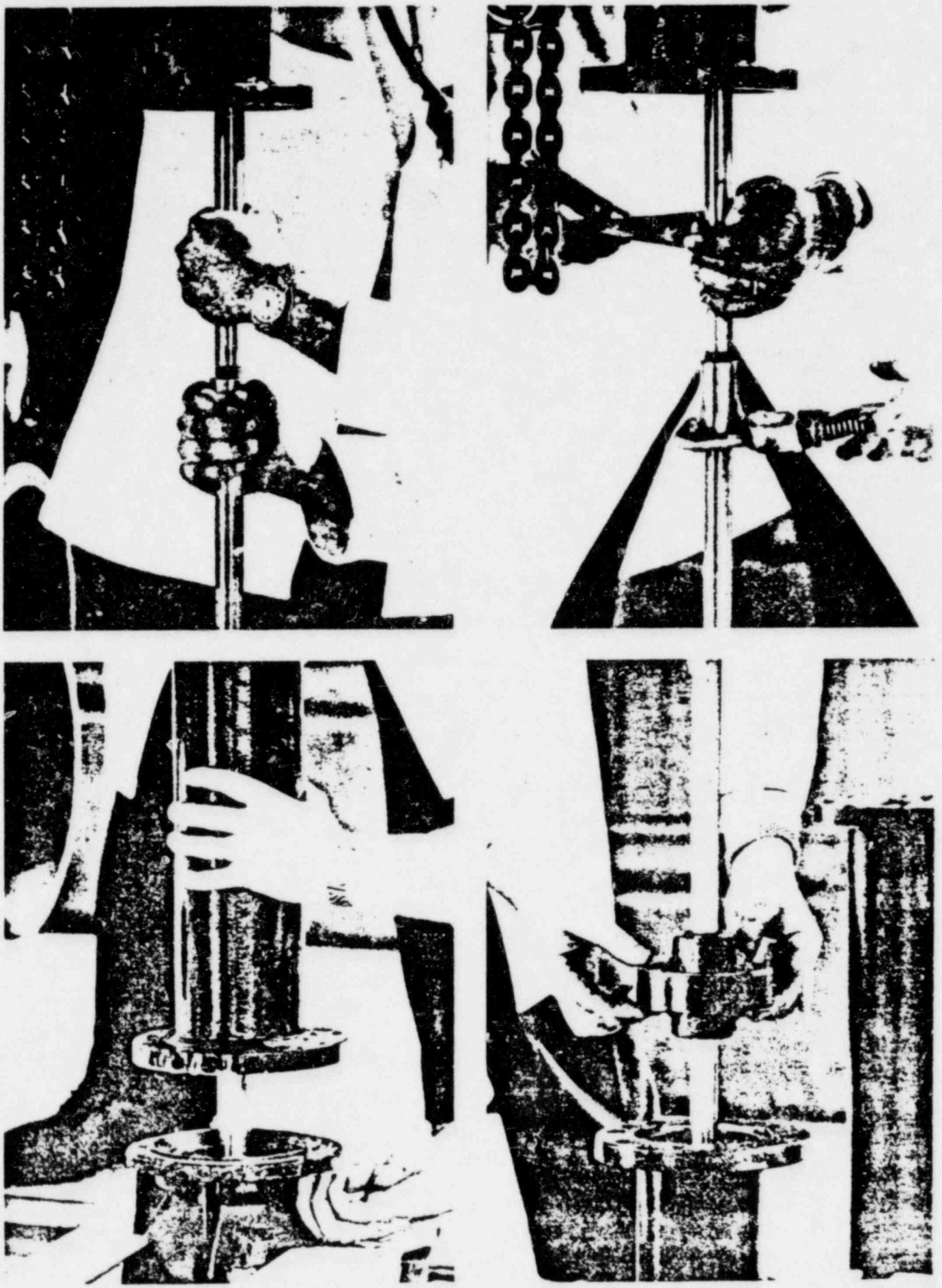


Figure 7-1. INSTALLING THE COLUMN

SECTION 8—INSTALLING THE DISCHARGE HEAD (SOLID SHAFT DRIVES)

8-1 INSTALLING THE DISCHARGE HEAD

8-2 Goulds VIT pumps are provided with an "L" type head. Install discharge head as follows:

A. If the stuffing box is assembled to the head, remove it and all attached piping. See figure 9-1 for the applicable stuffing box provided, for the pump being assembled. Remove coupling guard, if provided.

B. Remove the nuts that secure split gland (618) to stuffing box (616) and slide split gland out of the box. Capscrews that secure the split gland halves together may have to be loosened to facilitate removal of split gland. Do not remove studs from split gland.

C. When a shaft sleeve is provided, remove sleeve as follows:

1. Mark original position of sleeve on shaft to facilitate reassembly.

2. Utilizing a sharp scribe, mark position of sleeve on shaft, marking a thin line. Remove any sharp edges by polishing with a fine crocus cloth.

3. Remove setscrews and gently work sleeve down to expose setscrew seat on shaft. If area is burred, remove burrs as required to blend with shaft diameter.

4. Wipe shaft with light oil and gently work sleeve off the shaft. If shaft is threaded or keyed, use care when passing O-ring over the threaded area. Coat threads with a heavy grease, and screw or rotate sleeve over the threads, and remove sleeve.

D. When a mechanical seal is provided it is usually shipped separately. In case the seal is assembled to the discharge head, remove seal prior to installing the head. See Section 16, for removal of seal.

E. Remove coupling guard if provided. Attach a sling through windows (hand holes) or thread two eyebolts in the head driver support mounting holes diametrically opposite and hoist discharge head over the protruding headshaft.

CAUTION

DO NOT BUMP OR SCRAPE THE SHAFT PROTRUDING ABOVE THE COLUMN. THIS COULD RESULT IN BENDING OR DAMAGING THE SHAFT.

F. Orient the discharge head in the required position and lower head centering the vertical hole with the headshaft protruding above the column until the discharge head engages the bearing retainer (652) register (see figure 8-1). Install capscrews and secure discharge head to bearing retainer. Tighten capscrews gradually in diametrically opposite pairs.

G. Lift pump assembly high enough to allow rotation of the supports. Realign and lower assembly. Install and tighten remaining capscrews. Repeat rotation and tightening procedure until all capscrews are uniformaly tight.

H. Hoist bowl column, head assembly, and remove supports.

J. Lower bowl, column and head assembly until discharge head mounting flange engages base plate and secure discharge head to mounting plate.

SECTION 8-A—INSTALLING THE DISCHARGE HEAD (VHS DRIVER)

8A-1 Proceed exactly as outlined in Section 8; Items E thru J.

8A-2 INSTALLING THE TUBE TENSION PLATE

A. Lubricate tube threads and underside of tension plate flange with thread compound. Thread the tension plate (625) onto the enclosing tube nipple (629) manually until its shoulder rests on the discharge head. (See Figure 8A-2).

8A-3 TENSIONING THE ENCLOSING TUBE

A. The enclosing tube sags from its own weight as it is installed, and must be pulled tight (tensioned) to make it straight. This section describes two methods of tensioning the tube. The direct pull method is more precise and is preferred. The second method—the wrenching method—is given as an alternate.

NOTE

THE CORRECT TENSION IS EQUAL TO THE WEIGHT OF THE ENCLOSING TUBE PLUS 10%.

B. Weights per unit length for each tube size are given in Table 8A-2. Multiply by total length of the tube to determine the total weight.

8A-4 DIRECT PULL METHOD

A. The upper end of the tube may be pulled by the hoist to obtain the predetermined tension value. This requires the use of a dynamometer scale and

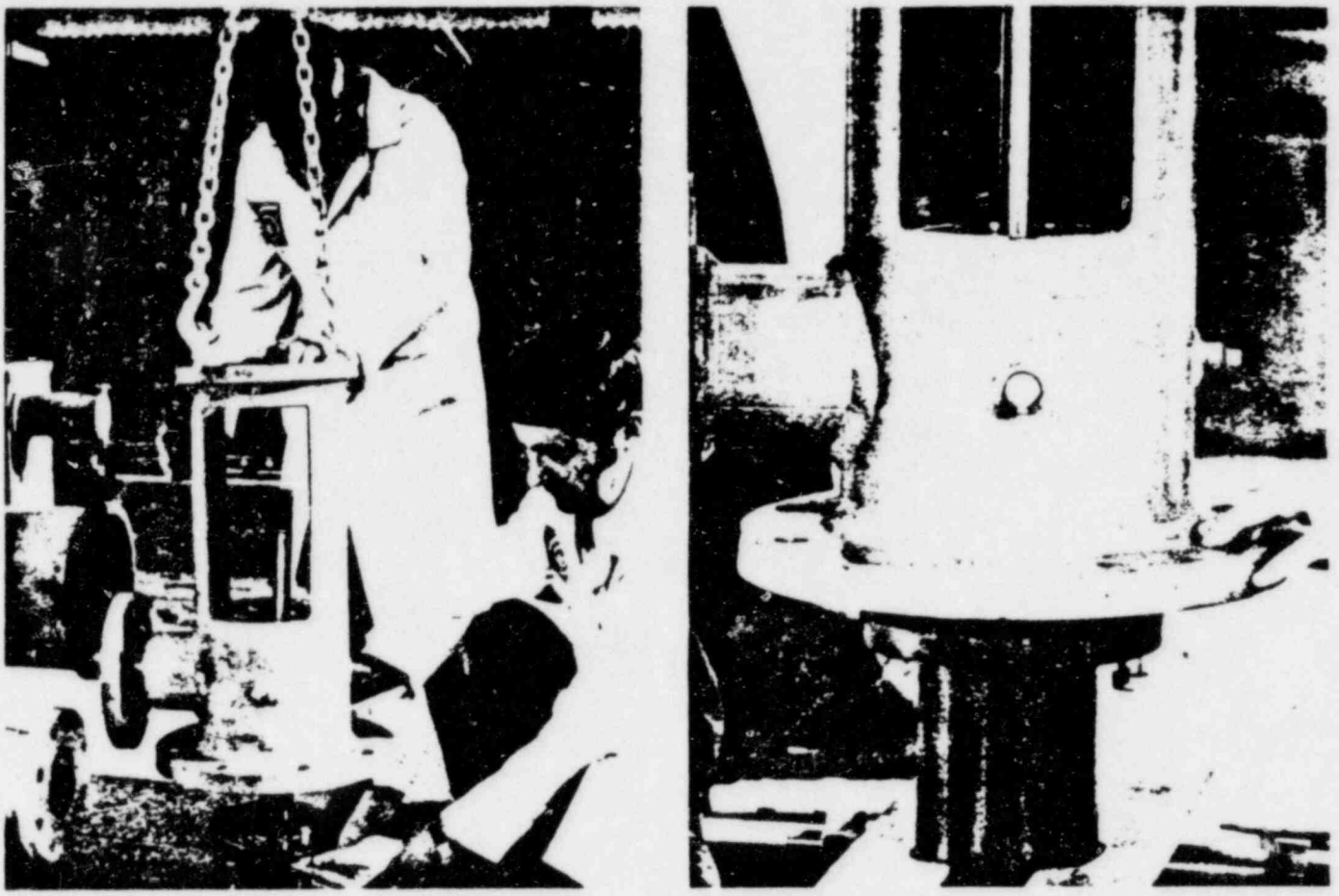


Figure 8-1. INSTALLING THE DISCHARGE HEAD

an adapter fitting to grip the tube. (TUBE TENSION ADAPTER AVAILABLE THROUGH FACTORY). With the tension plate installed manually but not tightened, thread the special fitting onto the top of the tube to full engagement. Attach the dynamometer scale to the fitting, and connect the upper end of the scale to the hoist hook. Operate the hoist hook to apply the required tension. This should pull the tension plate off the discharge head. Manually thread the tension plate to reset it. Release tension, remove dynamometer scale and special fitting.

8A-5 WRENCHING METHOD

A. If a dynamometer is not available, the tube can be tensioned by wrenching the tube tension plate. Make up a spanner wrench to straddle the projecting threaded tube end and to engage the tube tension plate capscrew holes by two lugs. Torque the tension plate to take all the slack out of the shaft tubing and induce a reasonable amount of tension by turning the tension plate *counterclockwise*. For tubing 2½" (63.5 mm) and larger, a man's full strength on a 3" (75 mm) lever arm is sufficient. For smaller sizes, less pull must be exercised.

NOTE

DO NOT TURN CLOCKWISE TO ALIGN HOLES IN TENSION PLATE AND DISCHARGE HEAD.

8A-6 INSTALLING TENSION NUT

A. Install capscrews (758F) in the tension plate. Pour one pint of oil down the oil tube.

B. Install packing in the tension plate and thread the tension nut (626), tightening it firmly against the packing.

C. If a packed type tension nut (623) is used, install packing (620C), packing gland (618) and secure with stud (739E) and nut (735B). Screw nut finger tight. Install line assembly (635) and connect to flush liquid supply (see figure 8A-8).

CAUTION

BE SURE THAT THE TOP OF THE ENCLOSING TUBE DOES NOT INTERFERE WITH THE TENSION NUT.

D. If the top of tube interferes with the tension nut, determine the distance if tube is too long or too short. Remove tension plate, raise pump assembly, unthread lock ring (639), and adjust nipple (631) (see figure 8A-2) the required distance to eliminate interference. Reinstall and relevel pump. Refer to Section 7 paragraphs J and K.

8A-7 LUBRICATION SYSTEM

A. Connect solenoid valve (if provided), oil lines, and fill the oil reservoir with oil.

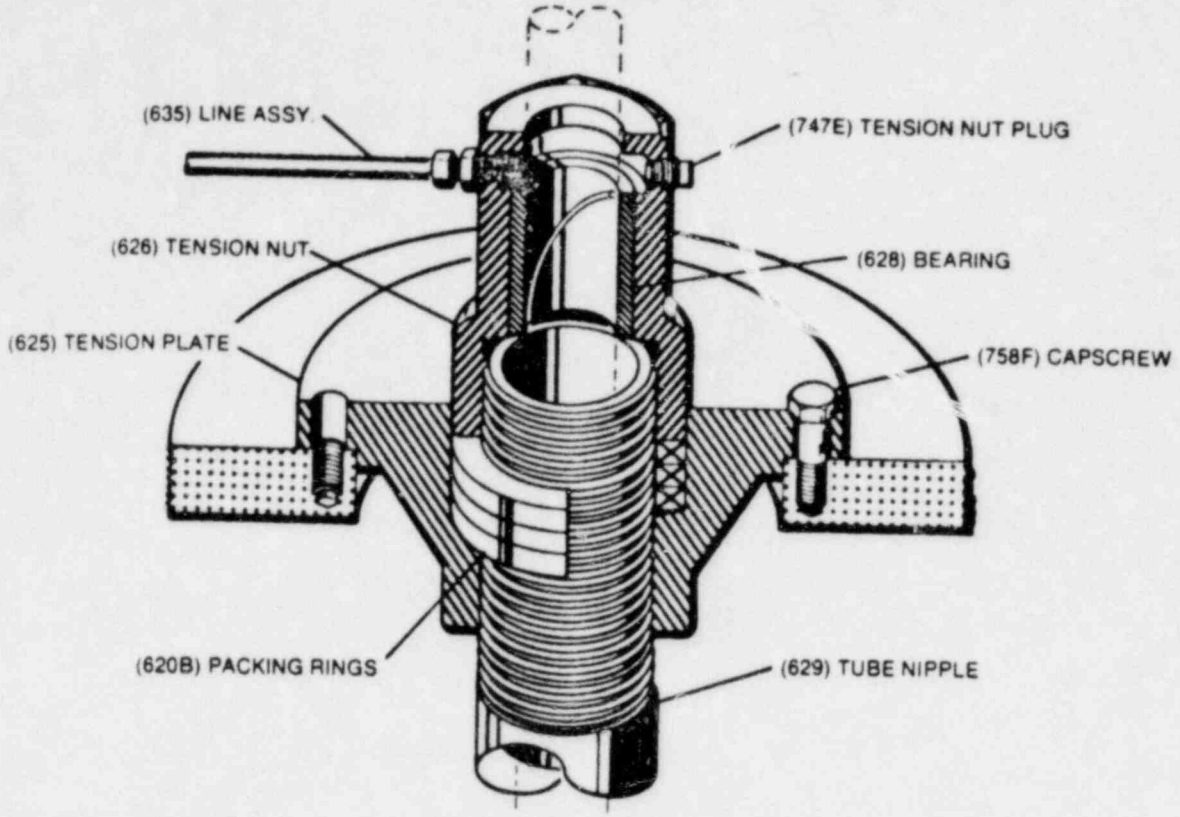


Figure 8A-2 TENSION PLATE ASSEMBLY (DRIP FEED LUBRICATION)

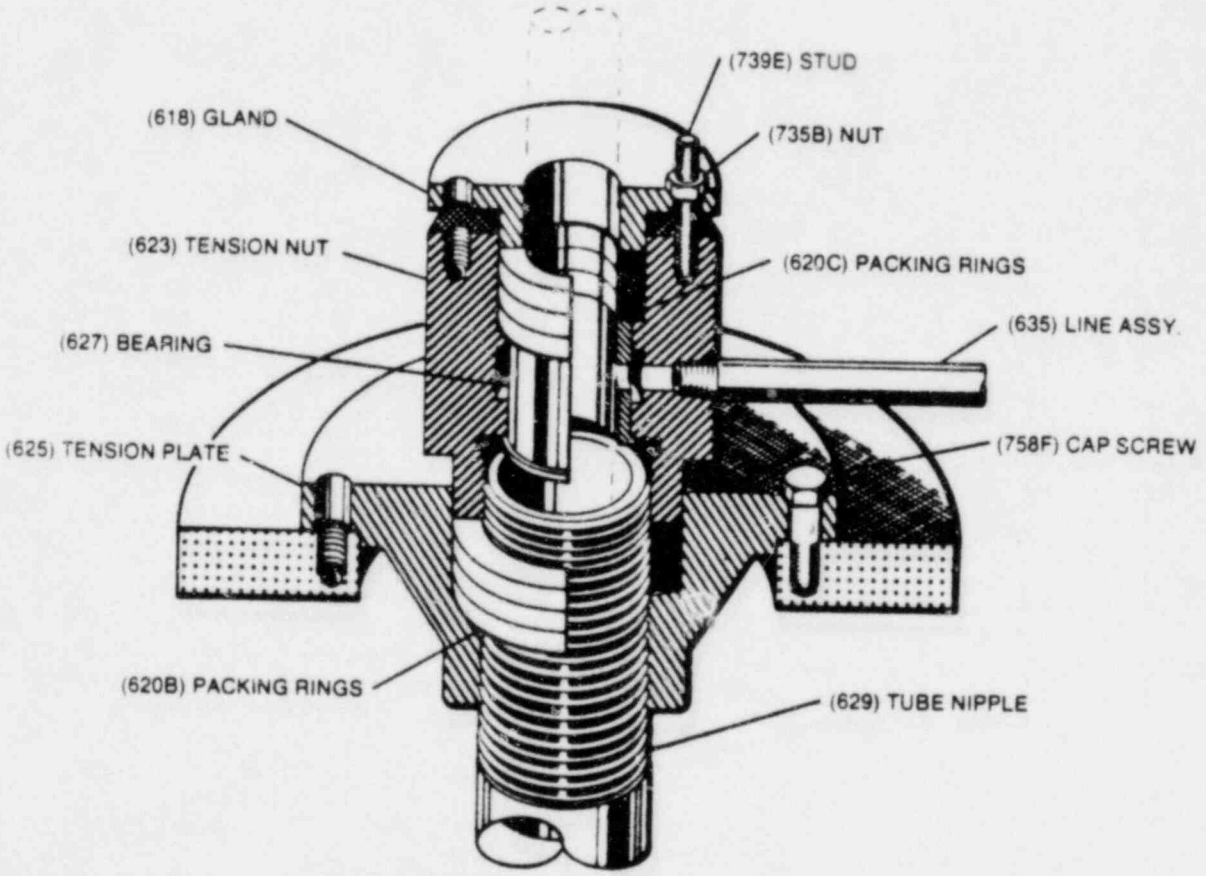


Figure 8A-8 TENSION PLATE ASSEMBLY (FLUSH LUBRICATION)

B. Check the lubricator feed and see that the oil reservoir is flowing freely. (In the case of a solenoid valve, temporary power connections are required). Set the proper drops per minute on the regulator. Table 8-2 shows recommended regulator setting.

TABLE 8-2 REGULATOR SETTING

DROPS PER MINUTE PER 100 FEET (30.48 METERS) OF SETTING	SHAFT SIZE (INCH)	SHAFT SIZE (mm)
8		19 to 25 mm
16	.75 to 1.00	30 to 50 mm
20	1.19 to 1.94	55 mm and
	2.19 and larger	larger

TABLE 8A-2
WEIGHT-PER-FOOT OF ENCLOSING TUBE

TUBE SIZE (INCH)	WEIGHT PER FOOT (LB.)
1¼	2.99
1½	3.63
2	5.02
2½	7.66
3	10.25
3½	12.50
4	14.98
5	20.78
6	28.57

SECTION 9—STUFFING BOX INSTALLATION

9-1 STUFFING BOX INSTALLATION

9-2 Assemble stuffing box in accordance to the style provided, A, B, C, or D (see figure 9-1) Caution notes apply to each individual stuffing box.

9-3 STYLE "A"—STANDARD CONSTRUCTION

A. Position gasket on discharge head. Slide stuffing box (616) down over shaft and into position on gasket. Secure stuffing box with capscrews.

B. Insert packing washer (789C) into stuffing box, if provided. (Packing washer not required on shaft sizes 2.19" (55 mm) and over.)

C. Grease the packing rings (620A) for easier installation.

D. Twist the packing ring sideways to get ring around the shaft and start the first ring into the stuffing box. When the entire ring is worked in using the fingers, tamp it down using a split wooden bushing or equal and push the packing ring hard, it must seal on the shaft and bore. Install all 6 rings in this manner. Stagger ring joints 90 degrees apart. The split gland (618) may be used as a tamper for the topmost ring.

E. Install split gland (618) and thread nuts on split gland studs and tighten with a wrench then relieve the nuts and tighten finger tight. Attach bypass line (624) to tube fitting in stuffing box.

F. Final adjustment of the stuffing box must be made at pump startup. This final adjustment applies to all stuffing box styles.

CAUTION

CHECK THAT THE SPLIT GLAND IS SQUARE IN THE STUFFING BOX. COCKING CAN CAUSE UNEVEN COMPRESSION OF PACKING AND DAMAGE TO THE SHAFT.

G. A properly packed stuffing box should be loose enough to allow shaft to be turned manually.

CAUTION

DO NOT OVER-TIGHTEN STUFFING BOX. IT CAN WEAR OUT PACKING PREMATURELY AND SERIOUSLY DAMAGE THE SHAFT.

9-4 STYLE "B"—STANDARD CONSTRUCTION WITH SHAFT SLEEVE.

9-5 Style "B" stuffing box is the same as style "A" with the exception that it has a shaft sleeve with an O-ring.

A. Lubricate O-ring (743B) in sleeve (609) and shaft threads.

B. Insert sleeve onto shaft and slowly rotate counterclockwise, simultaneously pushing inward gently until O-ring is clear of shaft threads.

C. Locate sleeve on shaft (scribe mark on shaft) or setscrew sear and secure with setscrews (774A).

D. Follow steps A through G, paragraph 9-3, for complete style "B" installation.

9-6 Style "C"

9-7 Style "C" stuffing box is provided with a shaft sleeve, O-ring, lantern ring and grease cup.

A. Follow steps A through C, paragraph 9-5, when provided with a shaft sleeve and O-ring.

B. Insert packing washer (789C) into stuffing box and install two packing rings (620A) in accordance with steps A through D, paragraph 9-3.

C. Insert lantern ring (621) into stuffing box. Be sure it is properly positioned so that it aligns with the lubrication passage in the stuffing box.

D. Install two packing rings, stagger ring joints 90 degrees apart.

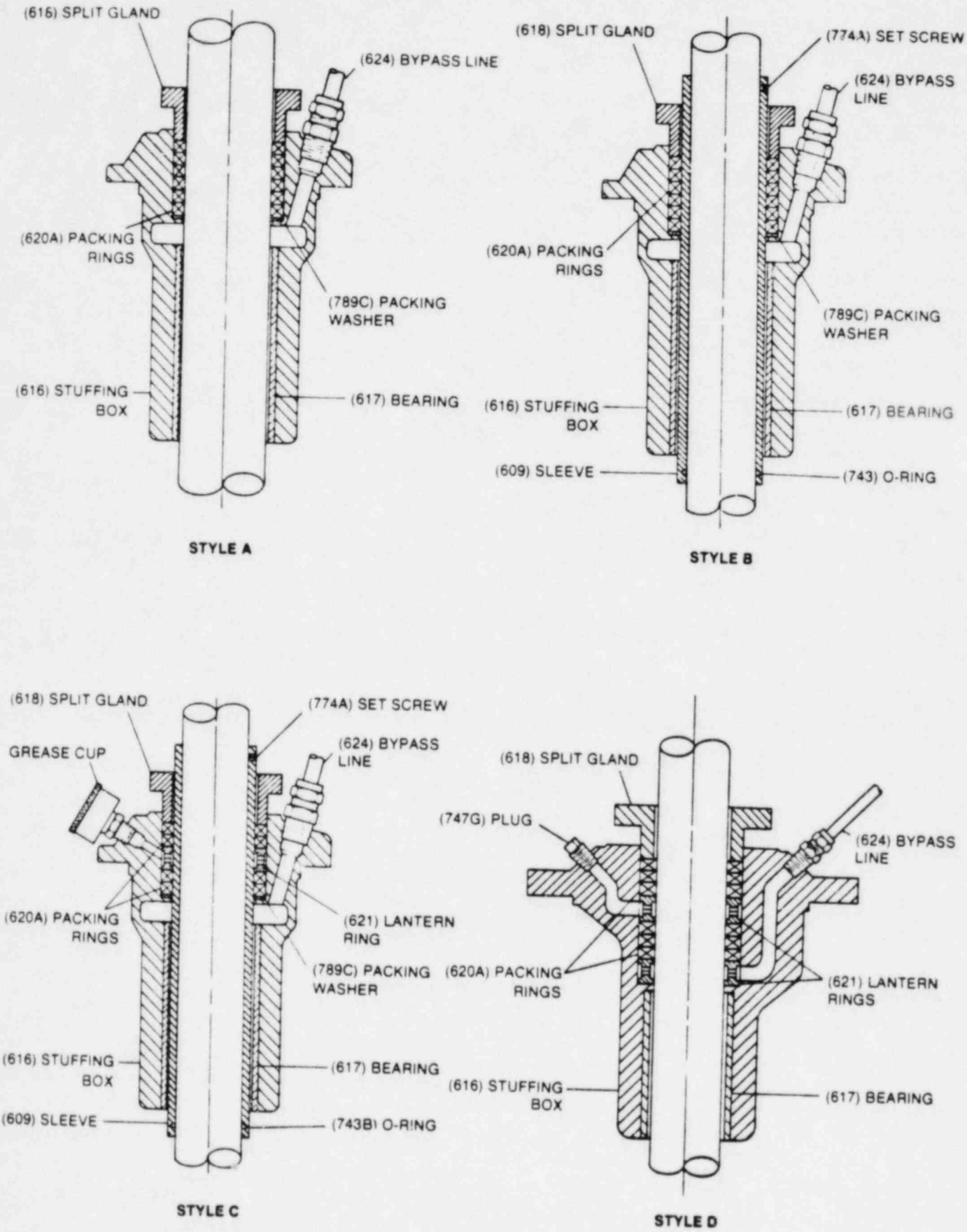


Figure 9-1. INSTALLING THE STUFFING BOX

E. Install split gland (618) and thread nuts on split gland studs and tighten with a wrench, then relieve the nuts and tighten finger tight. Attach bypass line (624) to tube fitting in stuffing box. Thread grease cup into stuffing box, if not installed.

F. Fill grease cup with a high grade of grease. If grease is not furnished, select a suitable grade from the list in Section 18.

G. After stuffing box is completely assembled, apply grease to the lantern ring by turning the grease cup cap a couple of turns.

9-8 STYLE "D"

9-9 Style "D" stuffing box is similar to style "C", with the exception that it has 6 packing rings, 2 lantern rings, and a pipe plug instead of a grease cup.

A. Follow steps A through C, paragraph 9-5, when provided with a shaft sleeve and O-ring.

B. Insert lantern ring (621) in stuffing box, follow step C, paragraph 9-7.

C. Install 3 packing ring joints 90 degrees apart. Insert other lantern ring, then install 3 packing rings.

D. Follow steps E through G, paragraph 9-3 for complete style "D" installation.

SECTION 10—MECHANICAL SEAL INSTALLATION

10-1 MECHANICAL SEAL INSTALLATION

10-2 Instruction for installing mechanical seals are provided by the seal manufacturer. Consult the seal manufacturer's instructions (furnished with the seal) for information on the type of seal used. Additionally, refer to factory furnished outline drawing and seal piping schematic on complex seal piping arrangement. The following general instructions may be used for most common seal installations, applicable to the seal provided.

10-3 INSIDE MOUNTED SEALS (See figure 10-1)

10-4 Inside mounted seals are usually shipped assembled, ready for installation.

A. Apply a thin film of oil (SAE #10 or 20) to shaft and sleeve (if provided) and O-ring.

B. Check that shaft is smooth, and free of burrs, nicks and sharp corners that could ruin the O-ring. Do this by using a strip of emery cloth 'shoeshine fashion' over shaft threads and file over the corners of the keyseat.

C. Check that all rotary unit parts of the seal fit over the shaft.

D. File threads around the keyway with a smooth mill file or emery cloth to prevent damage to O-ring or shaft packing.

E. When the seal is an O-ring type, assemble with complete unit over the shaft and ease it into position against the face of the seal box. Take care when passing the sleeve and O-ring over keyways or threads to avoid damaging O-ring.

F. If the seal is the teflon wedge ring type, remove the sleeve collar and teflon wedge ring and assemble them separately after the sleeve is in position.

G. Position seal gland on discharge head and secure with capscrews provided. Tighten capscrews gradually and uniformly.

H. On teflon wedge ring type, tighten collar on threads to seal teflon wedge around the shaft.

CAUTION

DO NOT OVERTIGHTEN CAPSCREWS ON GLAND, THIS CAN DISTORT SEAL SEAT AND CAUSE SEAL FAILURE.

J. When the seal uses half dog setscrews, remove them one at a time from the collar and spot face the shaft and tighten setscrews into position. Remove metal chips to avoid damaging seal.

DO NOT REMOVE SEAL SPACER OR ECCENTRIC WASHER, ADJUST SEAL OR TIGHTEN SETSCREWS UNTIL AFTER IMPELLERS ARE ADJUSTED.

K. Connect all seal piping as required.

L. When impellers are readjusted, seal must also be readjusted.

10-5 OUTSIDE MOUNTED SEALS. (See figure 10-1)

A. Stuffing box face must be flat, smooth and at right angles to the shaft.

B. Shaft or sleeve must be smooth, unscored, free of burrs, to form a good sealing surface for a gasket or O-ring. Sharp edges must be rounded.

C. Install seal gland assembly into position and secure with capscrews provided. Tighten capscrews gradually and uniformly.

D. Apply a thin film of oil (SAE #10 or 20) to the shaft and sleeve (if provided). Clean and oil sealing faces.

E. Install rotary unit, take care not to disengage rotary unit parts. If rotary unit parts become disengaged, installation becomes difficult.

F. Take care when installing the unit to avoid damaging the seal packing. Do not tighten setscrews or adjust seal at this time, until impellers are adjusted.

G. To adjust seal, refer to the spring gap which is stamped on the collar and shown on the assembly drawing. Tighten setscrews so that the compres-

sion ring is maintained at the same distance from the collar at all points. Before starting the pump, check to insure that the spring gap and the distance from the face of the stuffing box to the collar are the same as shown on the seal assembly drawing.

H. Install all seal piping as required.

J. If necessary to readjust impellers, reverse the preceding procedures.

CAUTION

RESET THE SEAL AFTER IMPELLERS ARE ADJUSTED.

10-6 HIGH PRESSURE SEAL (See figure 10-1)

10-7 High pressure seals are usually shipped assembled, ready for installation.

A. Check concentricity between bore of stuffing box and shaft—should not exceed 0.010 (0.25 mm) T.I.R.

B. Check that face of stuffing box is square with shaft, to within 0.010 (0.25 mm) T.I.R. Face must be smooth to form a good sealing surface for a gasket or O-ring.

C. Apply a thin film of oil (SAE#10 or 20) and slip complete seal assembly on shaft.

D. Secure gland plate to discharge head with capscrews provided. Tighten capscrews gradually and uniformly.

CAUTION

DO NOT OVERTIGHTEN CAPSCREWS ON GLAND, THIS CAN DISTORT SEAL SEAT AND CAUSE SEAL FAILURE.

DO NOT REMOVE SEAL SPACER OR ECCENTRIC WASHER, ADJUST SEAL OR TIGHTEN SETSCREWS UNTIL AFTER IMPELLERS ARE ADJUSTED.

E. Install all seal piping as required.

F. Mechanical seals on pumps with over 1200 PSI (85 kg/cm²) gage discharge or as specified by seal manufacturer are normally fitted with "backup rings." These rings are installed following seal installation, between the drive collar of the seal and bottom of flanged pump coupling, (see figure 10-2). Install backup ring as follows:

1. Screw the bottom backup ring into the top backup ring until it bottoms out.

2. Slide backup ring assembly over the shaft and position it on the seal. Adjustment of the backup ring assembly shall be completed after the spacer coupling and driver are installed.

10-8 DOUBLE SEALS. (See figure 10-2)

A. Check surfaces at the face of stuffing box and at the bottom of stuffing box to insure that they are flat and free of burrs.

B. Shaft or sleeve must be smooth, unscored, free of burrs, sharp edges to be rounded.

C. Scribe a mark on the shaft or sleeve exactly flush with face of stuffing box. This is the "reference mark" for setting the seal to the seal assembly drawing.

D. Lubricate the stuffing box bore and O.D. of inner (or lower) stationary insert with SAE #10 or 20 oil. Protect inner insert face with soft clean material, such as gasketing or sheet rubber and install into bottom of stuffing box with hand pressure only. If insert includes a holding pin, be sure pin is aligned with the slot or hole in bottom of stuffing box.

E. Carefully place gland ring and outer (or upper) stationary insert over the shaft.

CAUTION

DO NOT BUMP CARBON MEMBERS AGAINST THE SHAFT AS THEY MAY CHIP, CRACK OR BREAK.

F. Lubricate shaft or sleeve before installing any of the rotary unit parts.

G. Install seal collar or collars on the shaft or sleeve and locate collar or collars in the relation to established "reference mark" and to setting dimension given on the seal assembly drawing. Lock the collar to shaft or sleeve by tightening setscrews.

H. Install the remaining rotary unit parts on the shaft or sleeve in the proper sequence and complete the assembly of equipment.

J. Shaft packing (if provided, depending on seal type) shall be installed on the shaft or sleeve individually and with care to avoid nicks or damage that would cause seal to leak.

K. Seat the gland ring and gland gasket to face of stuffing box by tightening the nuts or bolts evenly and firmly. Be sure the gland ring is not cocked and tighten nuts or bolts just enough to seal at the gland ring gasket.

CAUTION

DO NOT OVERTIGHTEN NUTS OR BOLTS ON GLAND, CAN DISTORT SEAL SEAT AND CAUSE SEAL FAILURE.

L. Prior to making final connections of sealing liquid pressurizing lines, make sure the stuffing box and all sealing liquid lines are flushed free of dirt, scale and other particles that would be abrasive to the sealing face.

10-9 TANDEM SEALS. (See figure 10-2.)

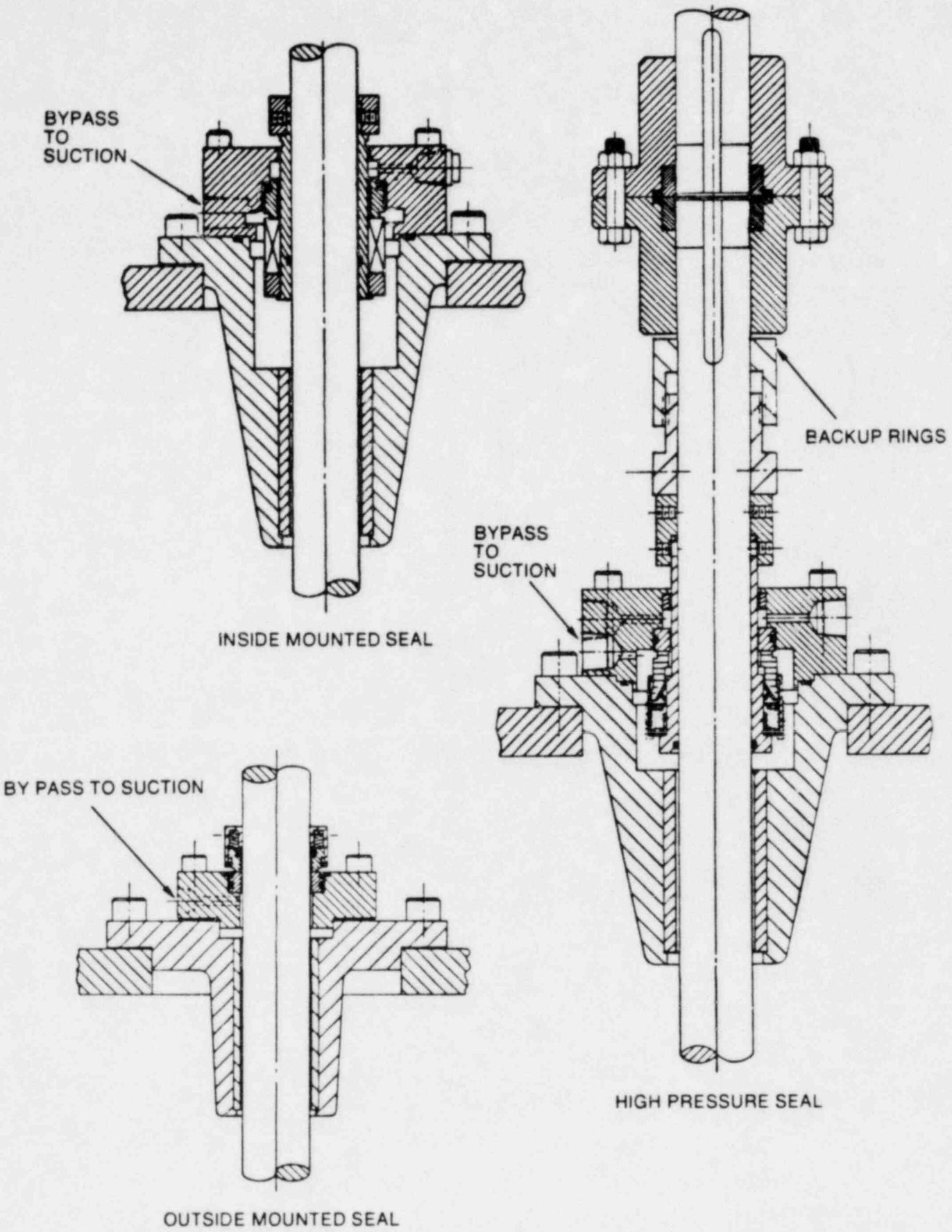
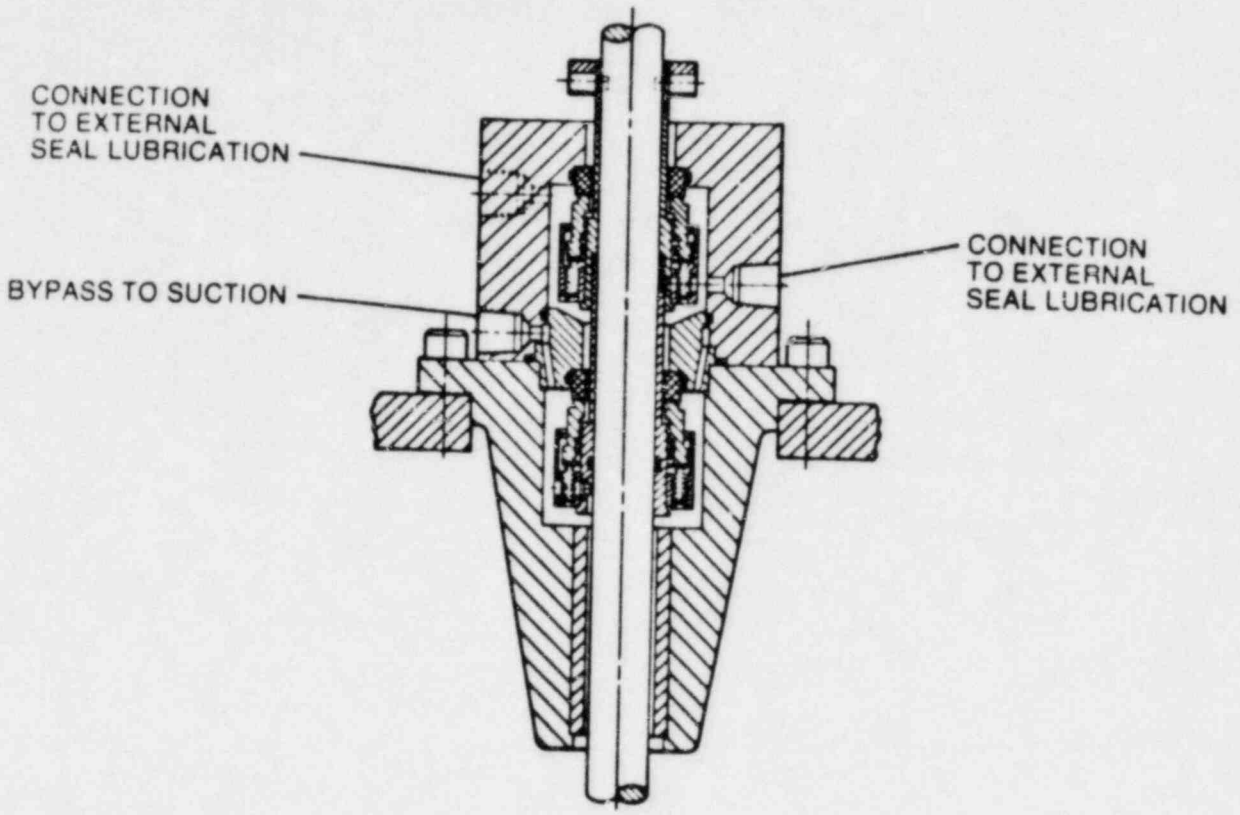
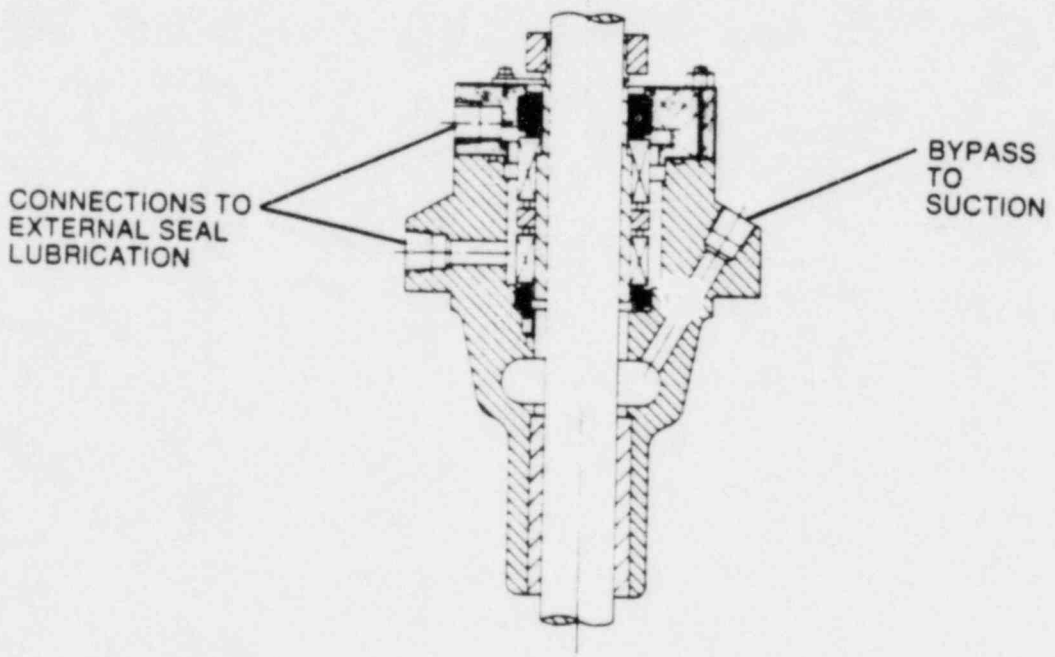


Figure 10-1. INSIDE-OUTSIDE MOUNTED AND HIGH PRESSURE SEALS



TANDEM MOUNTED SEAL



DOUBLE MOUNTED SEAL

Figure 10-2. DOUBLE AND TANDEM SEALS

SECTION 11—INSTALLING THE DRIVER (VSS)

11-1 INSTALLATION OF SOLID SHAFT DRIVER

NOTE

WHEN PUMP IS PROVIDED WITH A THRUST POT, DO NOT SECURE DRIVER TO DISCHARGE HEAD UNTIL AFTER THRUST POT AND FLEXIBLE COUPLING ARE INSTALLED. See Section 13.

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED OBJECT UNLESS THERE IS A POSITIVE SUPPORT UNDER IT, WHICH WILL PROTECT PERSONNEL SHOULD A HOIST OR SLING FAIL.

11-2 The coupling between the driveshaft and head shaft may be a nonspacer (see figure 11-1) or a spacer type (see figure 11-2). The latter is used on pumps furnished with a mechanical seal to permit servicing the seal without lifting the driver.

11-3 DRIVER SUPPORT. When a driver support is furnished, and is not installed, proceed as follows:

A. Hoist driver support, inspect the mounting surfaces, register, and clean these surfaces thoroughly.

B. Install driver support on discharge head and secure with capscrews provided.

C. Attach a sling to the lifting lugs of driver. Hoist motor, inspect the mounting surface, register, and shaft extension, and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward.

D. Orient the motor conduit box in the required position and align the mounting holes with the mating tapped holes in the discharge head. Lower the motor until the registers engage and motor rests on the discharge head. Secure motor with capscrews provided.

E. On drivers having a non-reverse ratchet or pins, manually turn the driver shaft clockwise viewed from above until the non-reverse ratchet or pins fully engage.

F. Lubricate motor bearings in accordance with instructions given on the lubrication plate attached to the motor case.

WARNING

THE MOTOR MUST NOT BE TESTED FOR DIRECTION OF ROTATION WHEN COUPLED TO THE PUMP. IF PUMP SHOULD ROTATE IN THE WRONG DIRECTION, SERIOUS DAMAGE TO THE PUMP AND DRIVER AND SERIOUS INJURY TO NEARBY PERSONNEL COULD RESULT.

G. Make temporary electrical connections according to tagged leads or diagram attached to the motor. Motor must rotate counterclockwise when viewed from above. See arrow on pump name plate. If driver does not rotate counterclockwise, change motor rotation by interchanging any two leads, for three phases only. For single phase, see motor manufacturer's instructions.

H. MOTOR SHAFT END PLAY ADJUSTMENT—Motor shaft end play if required shall be checked with a dial indicator prior to connecting pump coupling to solid shaft motor. Consult the applicable motor manufacturer's instruction manual for detail information on motor shaft end play.

J. COUPLING INSTALLATION. (See figure 11-1 or 11-2)

1. Apply a thin film of oil on headshaft key (730C) and insert key into headshaft keyseat.
2. Gently low pump hub (614) over headshaft.
3. Thread adjusting plate (613) flush with top of headshaft.
4. Apply a thin film of oil to key (730B) and insert it into the driver shaft keyseat. Place the driver hub (610) over the driveshaft and key sliding it up the shaft until annular groove is exposed. Install split ring (722) in the groove and slide driver hub down over the split ring to capture it.
5. Install spacer (612) and secure to driver hub (610) with capscrews (759B) and nuts (735C).

11-4 IMPELLER ADJUSTMENT. Impeller adjustment is identical for motors and right angle gear drives. Adjustment is accomplished by turning adjusting plate (613). (See figure 11-1 or 11-2)

NOTE

1. **MECHANICAL SEAL, WHEN PROVIDED, MUST NOT BE SECURED TO THE SHAFT PRIOR TO IMPELLER ADJUSTMENT (OPEN OR ENCLOSED IMPELLERS). SHAFT MUST MOVE UP OR DOWN WITHIN THE SEAL ASSEMBLY.**
2. **FOR PUMPS HANDLING LIQUIDS BETWEEN −50 TO 200° F (−45 to 90° C), IMPELLER ADJUSTMENT CAN BE MADE UNDER AMBIENT CONDITIONS. FOR LIQUID TEMPERATURES IN EXCESS OF THIS RANGE, IT IS RECOMMENDED THAT IMPELLER ADJUSTMENT BE MADE AFTER THE PUMP SURFACE TEMPERATURE HAS REACHED AN EQUILIBRIUM WHEN CHARGED WITH THE PUMPAGE. IN THOSE CASES, WHERE THIS IS NOT FEASIBLE DUE TO SAFETY CONSIDERATIONS, REFER TO FACTORY FOR SPECIFIC INSTRUCTIONS.**
3. **WHEN A THRUST POT IS USED, IMPELLER ADJUSTMENT IS ACCOMPLISHED WITH THE POT'S ADJUSTING NUT AND A DIAL INDICATOR.**

A. OPEN IMPELLERS

1. With the impellers at the bottom, turn adjusting plate (613), figure 11-3, towards driver hub (610) or spacer (612). Obtain 0.015 inch (0.38 mm) clear-

ance between adjusting plate and driver hub or spacer for the first 10 feet (3 m) of column. Add 0.010 (0.25 mm) for each additional 10 feet (3 m) of column. EXAMPLE: Total pump length 50 feet (15.24 METERS)—set impellers at 0.055 inch (1.4 mm).

2. After impeller adjustment, align adjusting plate (613) with pump hub (614), and tightly draw coupling flanges together. This raises impellers amount of clearance between flanges. (See figure 11-3).

3. Set seal after impeller adjustment. Securely tighten all setscrews in the collar. Remove the spacer between the gland plate and collar. Retain spacer for future resetting of seal.

NOTE

WHEN IMPELLERS ARE RESET, THE SEAL MUST ALSO BE RESET.

B. ENCLOSED IMPELLERS

1. For enclosed impellers obtain .19" (4.8 mm) clearance between adjusting plate and driver hub or spacer.

2. After impeller adjustment, align adjusting plate (613) with pump hub (614) and spacer (612), insert capscrews (759D) or (759C) and tightly draw coupling flanges together (see figure 11-3).

3. To set seal, follow step 3, open impellers.

11-5 INSTALLATION OF SOLID SHAFT RIGHT ANGLE GEAR DRIVE.

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED OBJECT UNLESS THERE IS A POSITIVE SUPPORT UNDER IT, WHICH WILL PROTECT PERSONNEL SHOULD A HOIST OR SLING FAIL.

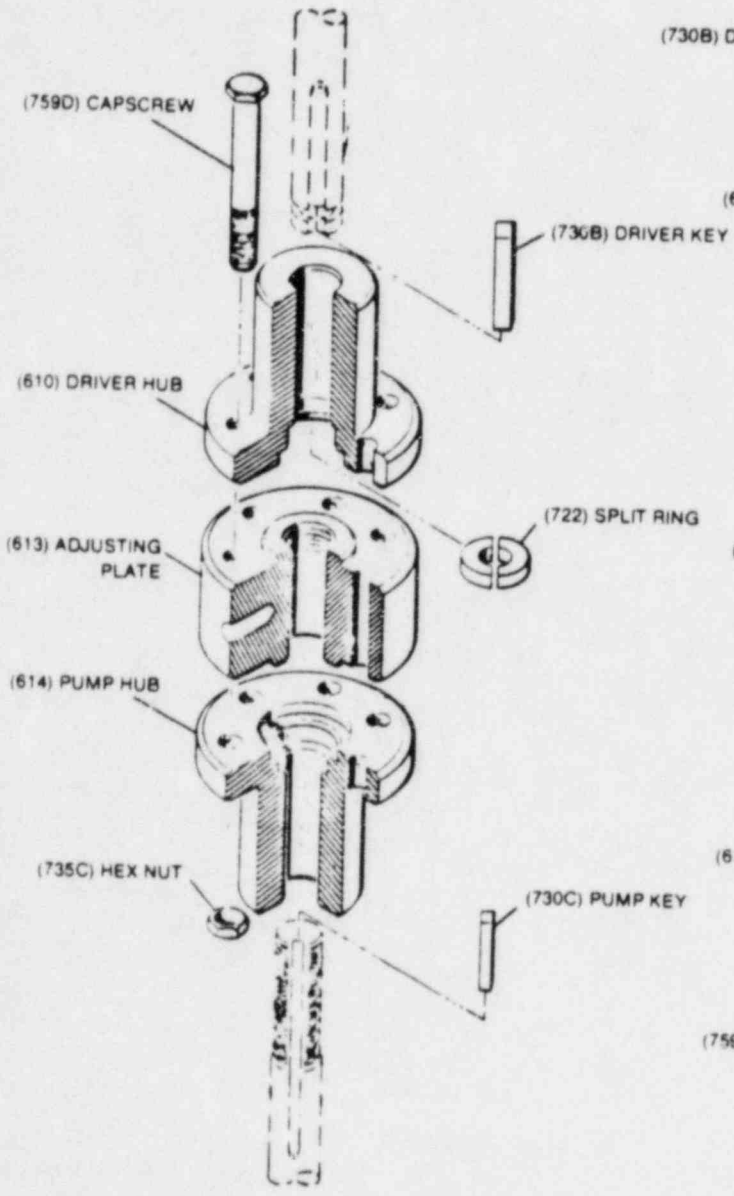


Figure 11-1. FLANGED ADJUSTABLE COUPLING

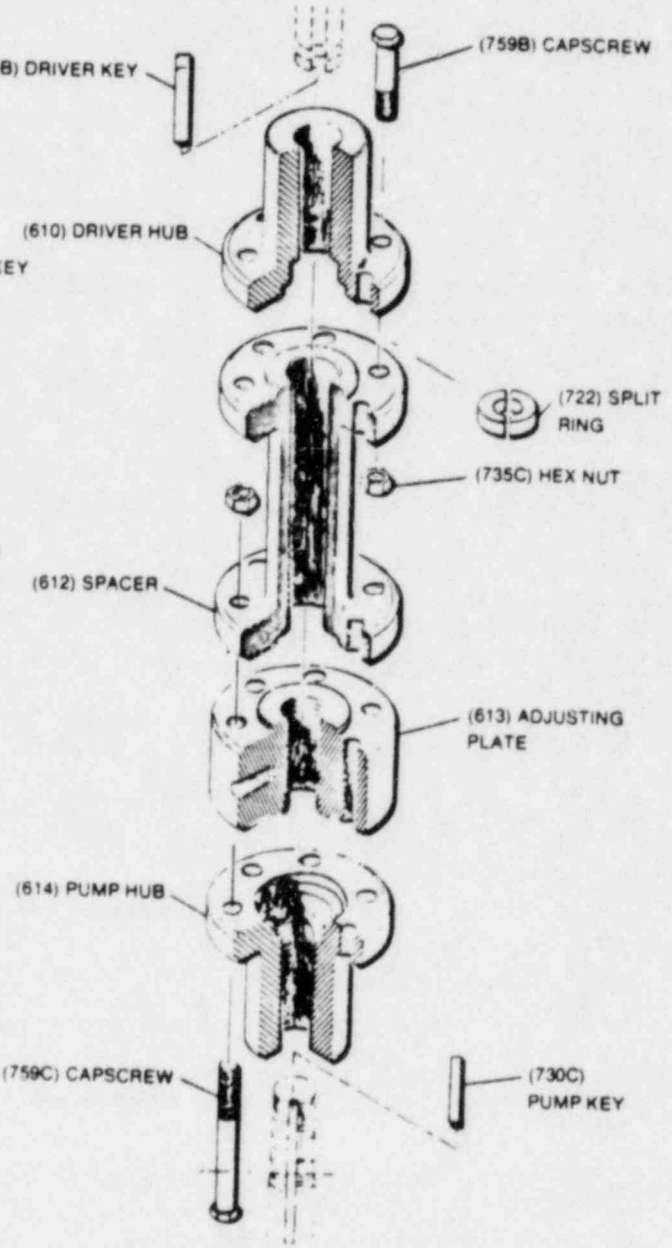


Figure 11-2. FLANGED ADJUSTABLE COUPLING WITH SPACER

11-6 The coupling shown between the driveshaft and headshaft may be a nonspacer (see figure 11-1) or a spacer type (see figure 11-2). The latter is used on pumps furnished with a mechanical seal to permit servicing the seal without lifting the gear.

11-7 DRIVER SUPPORT. When a driver support is furnished, and is not installed, proceed as follows:

A. Hoist driver support, inspect mounting surfaces, register, and clean these surfaces thoroughly.

B. Install driver support on discharge head and secure with capscrews provided.

C. Attach a sling to eyebolts of gearhead. Hoist gearhead, inspect the mounting surface, register, and shaft extension, and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file cleaning thoroughly afterward.

D. Orient the gearhead with the input shaft in the required position and align the mounting holes with the mating tapped holes in the discharge head. Lower the gearhead until the registers engage and gearhead is set firmly on the discharge head and secure gearhead with capscrews provided.

E. On gearheads having non-reverse ratchet or pins, manually turn the gearhead shaft clockwise

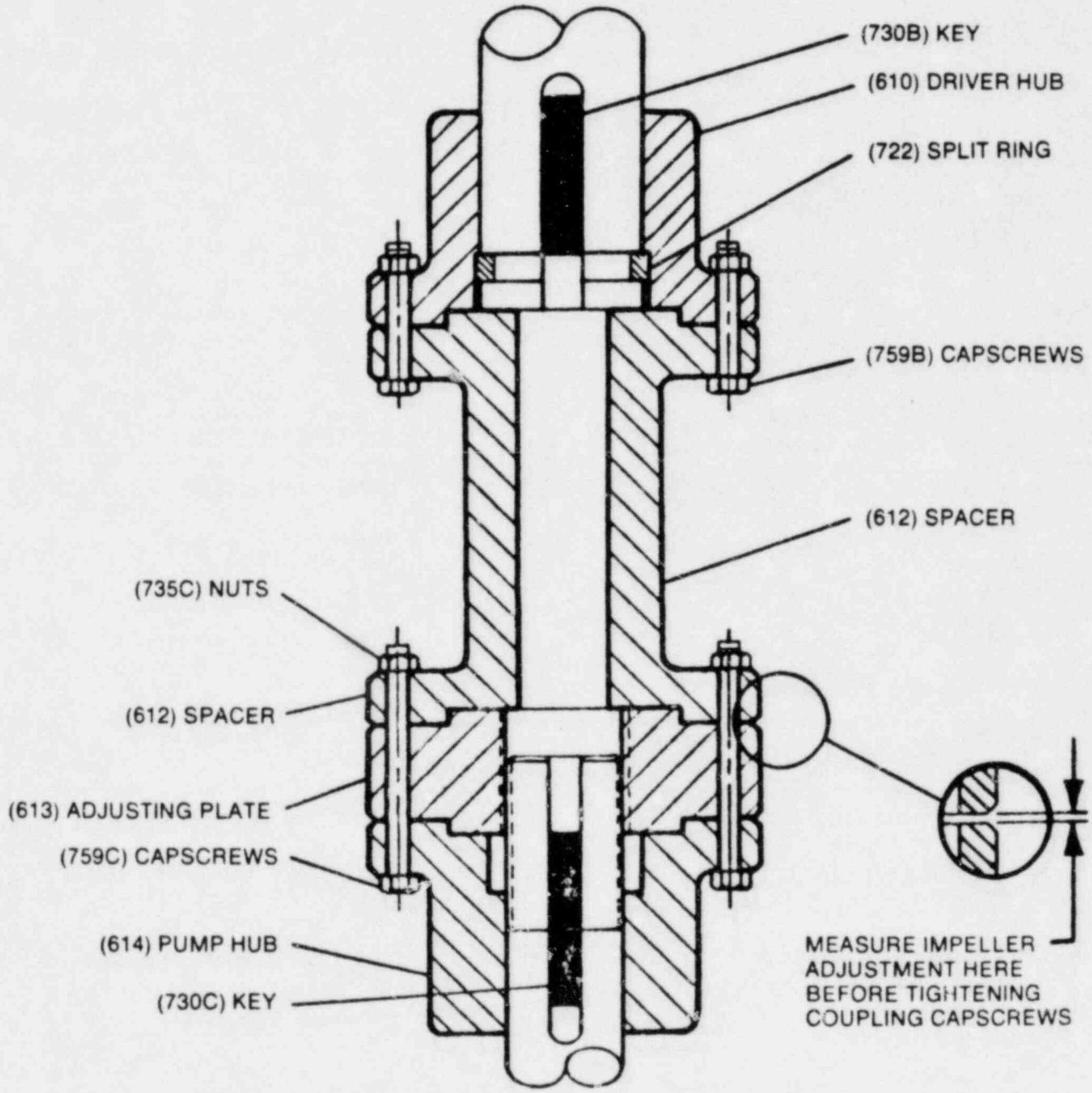


Figure 11-3. IMPELLER ADJUSTMENT

viewed from above until the non-reverse ratchet, or pins, fully engage.

NOTE

CHECK ROTATION OF THE POWER UNIT AND PUMP IN RELATION TO THAT OF THE DRIVE AS SHOWN BY ARROWS ON THE CASE. ROTATE THE DRIVE MANUALLY BEFORE APPLYING POWER. DO NOT OPERATE IN THE REVERSE DIRECTION OF THESE ARROWS.

F. Some gearheads are equipped with an oil cooling system which is supplied with cooling fluid from the pump or from an external source. Make cooling connections with tubing or rubber hose. If pump fluid is to be used, connect a length of tubing and a flow-regulating valve between the inlet on the gearhead and a pipe tap hole in the discharge gearhead. This may be used to conduct the fluid back to the sump or to any convenient drain.

CAUTION

DO NOT USE RIGID PIPE FOR THIS PURPOSE. RIGID PIPE IS SUSCEPTIBLE TO LEAKING AT THE JOINTS, DUE TO VIBRATION.

G. Fill the gearhead oil reservoir with a high grade of turbine oil. If oil is not furnished with the gearhead, select a suitable grade from the list in Section 18. Consult the manufacturer's instructions for the frequency of oil change and other data on maintenance.

H. GEARHEAD SHAFT END PLAY ADJUSTMENT—Gearhead shaft end play if required shall be checked with a dial indicator prior to connecting pump coupling to solid shaft motor. Consult the applicable gear manufacturer's instruction manual for detailed information on gearhead shaft end play.

J. COUPLING INSTALLATION. Follow instructions given in paragraph 11-3, step J, 1 through 5.

CAUTION

DO NOT USE AUTOMOTIVE OILS.

WARNING

MOVING PARTS OF THE PRIME MOVER, COUPLING DEVICE, AND GEARHEAD MUST BE COVERED WITH A SUITABLE RIGID GUARD IN COMPLIANCE WITH LOCAL REGULATIONS TO PREVENT INJURY TO PERSONNEL.

K. Type AR Rigid Flanged Coupling Assembly Procedure.

Disassemble Coupling. Be certain that all components are clean and that no foreign matter is lodged in any machined recesses or registers. Insert driver shaft key in driver shaft keyway and slide driver shaft hub onto driver shaft. Position hub such that threaded shaft end is exposed to allow mounting threaded sleeves on shaft end. If necessary for ease of assembly, temporarily secure hub in this position by means of tape, rope, or other convenient means.

Screw threaded sleeves onto the driver shaft until the sleeve extends beyond the shaft end between .06 and .09" (1.5 and 2.4 mm). This insures that the driver and pump shaft ends will not contact each other when the coupling is completely assembled.

Insert pump shaft key in pump shaft keyway and slide pump shaft hub onto pump shaft. Position hub so threaded shaft end is exposed.

Screw threaded sleeve onto pump shaft until sleeve extends beyond shaft end between .06 and .09" (1.5 and 2.4 mm).

Slide pump shaft hub toward threaded sleeve until threaded sleeve is fully seated in its register in the hub—hold hub in this position.

Insert Alignment Ring into its register in the pump shaft hub.

While holding pump shaft hub in position, slide the driver shaft hub towards pump shaft hub until the driver shaft threaded sleeve is fully seated in its register.

Insert all coupling hub capscrews and nuts and tighten *fingertight* only.

Measure the gap between the coupling hub faces. In a properly assembled coupling, this gap will be between 0.014 and 0.026 inch (0.35 and 0.66 mm) and assures proper clamping of the threaded sleeves. If the gap is not correct, disassemble the coupling and check that all parts are clean and free of foreign matter, then reassemble the coupling per instructions above.

Tighten all coupling hub capscrews.

Assemble the flexible shaft flanges on gearhead drive and engine. The prime mover must be mounted on a firm foundation in alignment with the gearhead. The driving and driven shafts shall be within plus or minus one degree parallel. Offset angle shall be one to five degrees for maximum coupling lift. Keep the lugs on flange yokes in the same position as shipped from the factory. If slip joint is moved, be sure lugs are realigned or severe unbalance may result. Consult the applicable manufacturer's instruction manual for detailed information for the prime mover and coupling or driveshaft.

When steam turbine or electric motor drives are used the instructions are essentially the same except that a Fast coupling or equivalent is generally used instead of the double universal type of drive shaft used with engine drives and no "offset" between drive and driven shafts is permitted.

11-8 IMPELLER ADJUSTMENT—OPEN OR ENCLOSED. (See figures 11-1 or 11-2). Adjustment is accomplished by turning adjusting plate (613).

1. Follow steps A and B, paragraph 11-4.

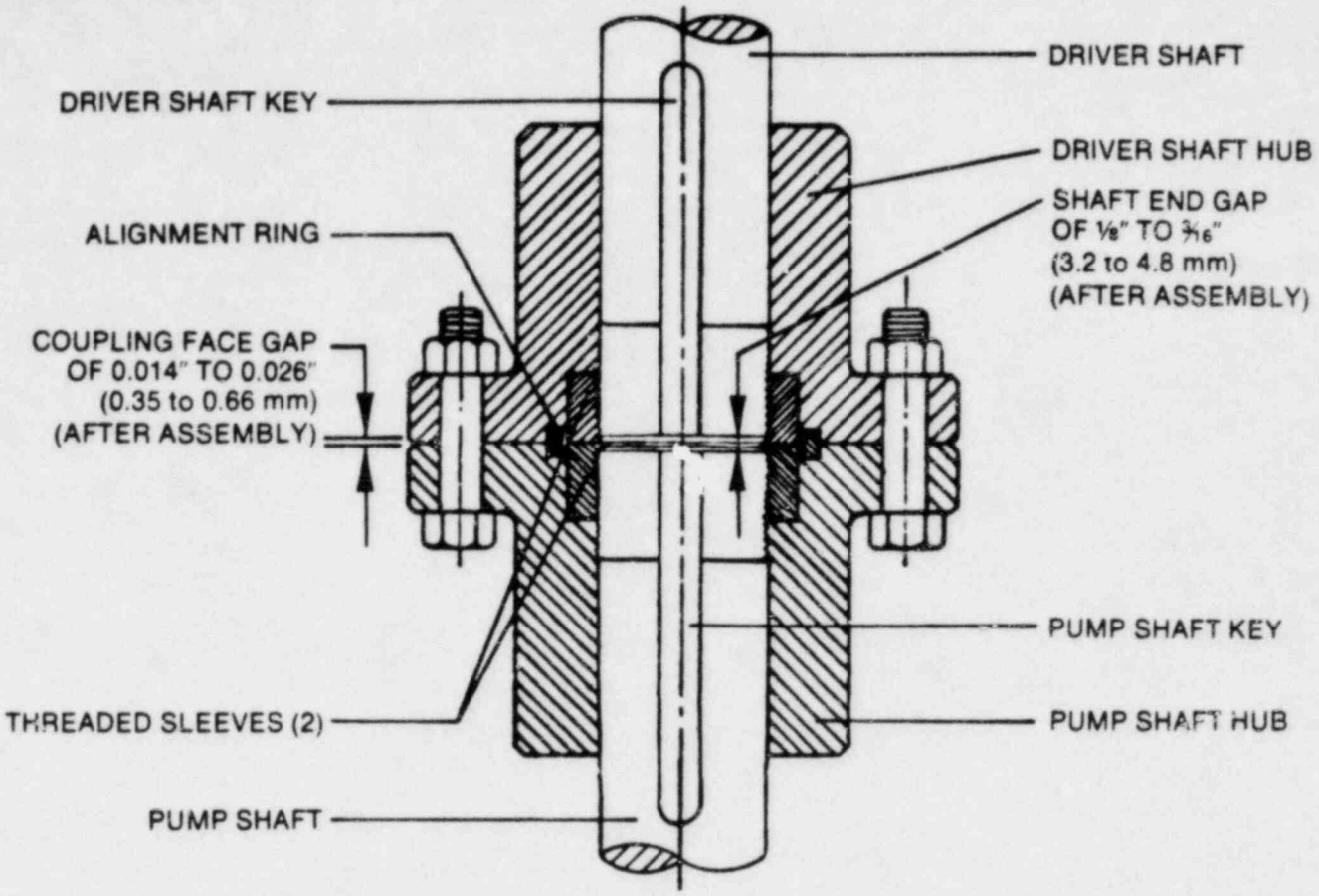


Figure 11-4. RIGID FLANGE COUPLING

SECTION 11-A—INSTALLING THE DRIVER (VHS)

This refers to either VHS Electric Motors or Hollow-Shaft Gears. A small paragraph will be devoted to combination electric motor and Right Angle drives.

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED OBJECT. "WHEN YOU ARE UNDER THE LOAD YOU ARE ON THE SPOT," AS OFT-TIMES APPEARS ON WARNING SIGNS.

11A-1 Almost invariably the head shaft projecting through the quill or hollow-shaft of the driver will be separate from the pump shaft and connected to same by either a threaded line shaft coupling, keyed line shaft coupling or rigid flanged coupling as described in SECTION 11 paragraph 11-7 J and requires no further discussion.

11A-2 In raising and installing the driver onto the discharge head, proceed exactly as in SECTION 11, PARAGRAPH 11-3, Items A, B, C and D.

11A-3 The driving mechanism of all hollow-shaft drives is shown on Fig. 11A-2 which is self explanatory. The drive shaft, you will note, extends up through the quill or hollow-shaft of the motor (or gear) drive and is held in place by an adjusting nut which not only carries all the static and hydraulic thrust of the impellers and shaft but provides the adjustment for impeller clearances.

11A-4 After lowering and orienting motor and/or gear drive as explained above, remove the drive coupling as shown in Fig. 11A-2.

1. Screw adjustment nut (604) loosely onto end of drive-shaft (606), clean thoroughly and attach a light line below the nut and lower through the motor quill shaft. Examine closely for dirt or burrs between shaft ends.

11A-5 Make up the head shaft coupling as previously described, regardless of type used, using suitable thread compounds as variously described in other parts of this manual.

11A-6 Remove lifting line and see if head shaft centers the motor quill shaft within .06" (1.5 mm). If it does not, misalignment is indicated.

11A-7 Any head shaft misalignment with driver quill shaft could be caused by a bent head shaft, burrs or foreign matter between shaft ends or any of the mounting flanges—motor to mount, mount to discharge head, discharge head to mounting plate or the plate itself could be out of level. If the latter, shimming between it and discharge head base will correct it.

11A-8 With motor in place and head shaft projecting through the motor quill shaft, connect up electrically and check motor rotation. This should be counterclockwise when looking down from the top. If opposite, instructions have been given elsewhere about how to reverse two leads and correct this.

CAUTION

NEVER CHECK MOTOR ROTATION WITH THE DRIVE COUPLING IN PLACE. THE BORE CLEARANCE BETWEEN THE DRIVE COUPLING AND PUMP SHAFT O.D. IS SO CLOSE THAT SHOULD THE MOTOR SPIN WITH THIS SHAFT STATIONARY, GALLING AND LOCKING TOGETHER IS VERY LIKELY TO TAKE PLACE.

11A-9 Install motor drive coupling inserting the ratchet pins if a non-reverse ratchet is used. Match coupling lugs with corresponding holes in motor. Pull down holding bolts evenly making sure drive coupling is properly seated in register fit.

11A-10 Fit gib head key (730A) to keyway by filing if necessary to where this is a snug but sliding fit. This key must be able to be removed by gentle leverage with a screwdriver under it.

A. Be careful that the gib head is not too high so as to hold up the adjusting nut (604) from seating on the drive coupling. If it is, cut off some of it.

B. Install adjusting nut to hand tight.

11A-11 GEAR DRIVES BY ENGINES

A. The procedure for installing a hollow-shaft gear is exactly the same as for the motor.

B. Checking pump rotation is a very simple matter. Check the arrows of rotation on the engine (they never run backward). Throw out the clutch. Take a bar and jack over the flexible drive shaft in direction of engine rotation, and note if it turns pump shaft in proper direction. Note: Engines almost invariably turn clockwise when looking toward the gear drive.

11A-12 COMBINATION ENGINE AND MOTOR DRIVES

A. On these drives the motor is invariably on top with a projecting head shaft extension.

B. Follow all procedures outlined in SECTION 11-A except that motor must be lowered over this extended head shaft and great care taken to center it exactly so as not to bump or misalign shaft while being lowered into place.

C. There are several methods of running engines without electric motors and vice versa, requiring simple adjustments to the combination drive, but they are too numerous to mention here and can be obtained from gear manufacturer's instructions included with the shipment.

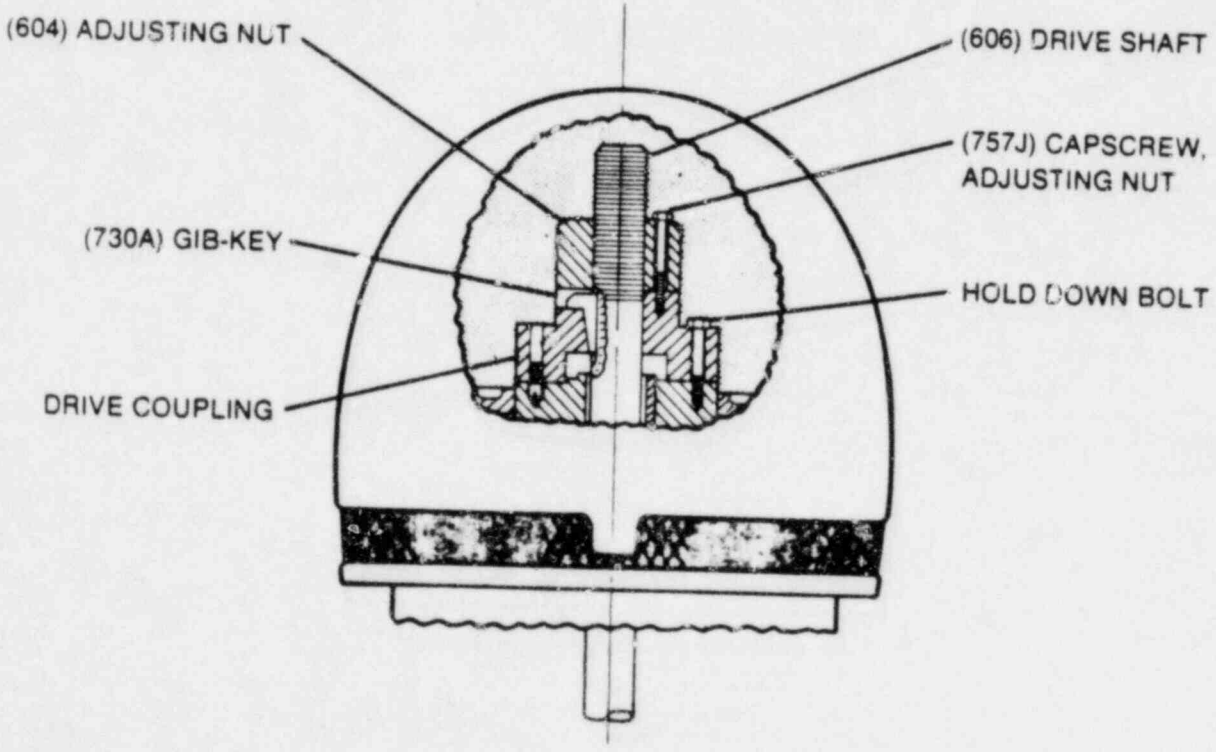


Figure 11-A2. HOLLOW SHAFT ADJUSTING NUT

11A-13 IMPELLER ADJUSTMENT FOR ALL HOLLOW-SHAFT DRIVES

NOTE: Shaft adjustment up or down is accomplished by turning the adjusting nut (604), Fig. 11A-2.

A. OPEN IMPELLERS

1. Although mechanical seals are scarcely ever provided with hollow-shaft drives they must be disengaged prior to impeller adjustment when they are.

2. With shafting all the way down and the impellers resting on their seats, turn adjusting nut (604) in a counterclockwise direction, thus lifting the shaft until the impellers *just* clear their seats and the shaft turns free by hand. This removes all deflection from the shaft.

3. Note: There are five holes in adjusting nut and only four in motor clutch.

Align hole "A" in adjusting nut and hole "C" in motor coupling (see Fig. 11A-14) or whatever similar holes are in like juxtaposition. If care is exercised this will give an initial impeller clearance of from .001" to .003" (0.02 to 0.07 mm) depending on shaft size and thread data shown in Table 11A-15.

4. Insert capscrew into hole "B," provided these are the nearest matching holes for counterclockwise rotation of adjusting nut, and turn counterclockwise until B and D line up. This gives 1/20 of one turn, the minimum possible adjustment.
1/20 of a turn = .004" (0.1 mm) on a shaft with 12 threads per inch, .005" (0.12 mm) on one with 10 threads per inch, etc. as shown on Table 11A-15.

5. Normal impeller clearance for open impellers is considered to be .015" (0.38 mm) for the first 10' (3 m) of column length and .010" (0.25 mm) additional clearance for each 10' (3 m) of length thereafter. This can be reduced in some instances where necessary but should not be attempted without consulting the factory or nearest district office, or unless some factory man is present. The impellers should never be permitted to run on their seats when running as this will gradually grind them off and reduce pump capacity.

B. CLOSED IMPELLERS:

1. The same procedure is followed as described under Paragraph A. The adjustment is not nearly as critical as for open impellers and a clearance of .12" (3.2 mm) in smaller sizes of bowls up to 8" (20.32 cm) to 3/16" (4.8 mm) in those larger is considered adequate.

TABLE 11A-15
IMPELLER VERTICAL MOVEMENT

SHAFT SIZE	THREAD	VERTICAL MOVEMENT IN 1/20 TH TURN
3/4" (19 mm)	3/4-16 LH	.003 (.76 mm)
1" (25 mm)	1-12 LH	.004 (.10 mm)
1 3/16" (30 mm)	1-12 LH	.004 (.10 mm)
1 1/2" (38 mm)	1-10 LH	.005 (.12 mm)
1 11/16" (42 mm)	1-10 LH	.005 (.12 mm)
1 15/16" (49 mm)	1-10 LH	.005 (.12 mm)
2 3/16" (55 mm)	1-10 LH	.005 (.12 mm)
2 7/16" (62 mm)	1-10 LH	.005 (.12 mm)
2 11/16" (68 mm)	1-8 LH	.006 (.15 mm)

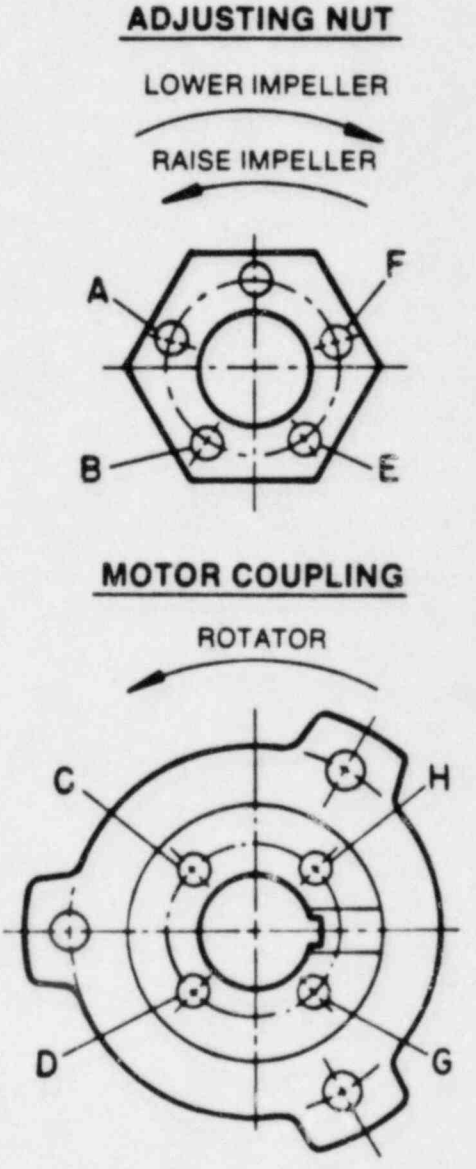


Figure 11A-14. IMPELLER ADJUSTMENT

SECTION 12—PUMP STARTUP AND OPERATION

12-1 PRE-START PROCEDURE: Consult the applicable manufacturer's instructions for detailed information for the prime mover (engine or steam turbine) coupling, drive-shaft, electric driver, gearhead or mechanical seal. When applicable to the pump and prior to startup, check the following:

A. Make sure mechanical seal is properly lubricated and all piping to seal connected. Also, check that all cooling, heating and flushing lines are operating and regulated.

B. Check alignment between pump and driver.

C. Wiring of driver.

D. Driver must rotate counterclockwise when viewed from above.

E. All connections to driver and starting device with wiring diagram.

F. Voltage, phase, and frequency on motor nameplate with line circuit.

G. Impeller adjustment.

H. Rotate shaft manually to ensure impellers are not binding.

I. Driver bearings are properly lubricated and check oil level in housing.

J. Auxiliary seal components are properly vented.

K. Discharge piping and pressure gages for proper operation.

12-2 PRIMING

12-3 The first stage must always be completely submerged. Pump must not run dry as the rotating parts within the pump may gall and seize to the stationary parts. The parts must be lubricated by the liquid being pumped.

12-4 PUMP STARTUP

A. Partially close valve in discharge line.

B. Crack open suction side valves on pressurized systems slowly. Open suction valves fully.

C. Vent system when the pump surface temperature has reached an equilibrium.

D. Start pump.

E. When pump is operating at full speed, slowly open discharge valve. If driver overheats or there is excessive vibration, stop the pump.

NOTE

IF THE IMPELLERS HAVE NOT BEEN FINALLY ADJUSTED, DUE TO EXTREME LIQUID TEMPERATURE, THEY SHOULD BE ADJUSTED PRIOR TO START-UP AND AFTER PUMP SURFACE TEMPERATURES HAVE REACHED AN EQUILIBRIUM.

F. On units with closed line shaft construction, oil lubricated, set the sight feed dripper for the number of drops per minute as directed in TABLE 12-4. REGULATOR SETTING

TABLE 12-4 REGULATOR SETTING

DROPS PER MINUTE PER 100 FEET (30 m) OF SETTING	SHAFT SIZE
8	¾ to 1" (19 mm to 25 mm)
16	1 3/16 to 1 15/16" (30 mm to 49 mm)
20	2 3/16" and larger (55 mm to larger)

12-5 STUFFING BOX

12-6 With the pump in operation, there should be some leakage at the stuffing box packing. The correct leakage is a rate which keeps the shaft and stuffing box cool (approximately one drop per second). Check the temperature of the leakage as well as the discharge head. If the pump runs hot and leakage begins to choke off, stop the pump and allow it to cool down. A few light taps with a hammer on the gland will upset the packing sufficiently to resume leakage. After pump has cooled, restart pump and follow the preceding procedure. Run pump 15 minutes, check leakage, if it exceeds two drops per second, adjust packing as described in Section 14, paragraph 14-4.

12-7 MECHANICAL SEAL

12-8 If seal leaks slightly at startup, allow a reasonable amount of time for seal to adjust itself. Liquids with good lubricating qualities normally take longer to wear in the seal than liquid with lesser qualities. When a seal starts out with a slight leak and gets progressively less with running, it is indicative of leakage across the seal faces and that continued running will eliminate this. Where leakage occurs immediately and remains constant, unaffected by running, it usually indicates secondary seal (shaft packing) damage, or seal faces are warped out of flat. Refer to Section 16 for probable cause.

SECTION 13—THRUST POT

13-1 THRUST POT INSTALLATION

13-2 If the pump unit is equipped with a thrust pot (see par. 3-12), a flexible coupling is required between the driver and the thrust-carrying pot to eliminate possible misalignment which may reduce the life of the angular contact bearings. For reliability reasons and to simplify maintenance, the bearings are oil lubricated. Normally, the bearing housing contains three heavy-duty angular-contact bearings of the MRC type 7000-P-DU series or equal. They are precision ground for mounting in series. It is possible that some housings may contain two or four bearings depending on the pump thrust load.

The manner in which the bearings are stacked in the thrust pot housing is shown in Figure 13-6. If the pump will be operating with *continuous downthrust*, the bottom bearing is to be mounted in reverse to carry possible momentary upthrust. However, if the pump will be operating with *continuous upthrust*, note that the *top* bearing is to be mounted in reverse to carry momentary downthrust. When replacing bearings, be sure that they are installed for the proper thrust conditions.

Pumps furnished with a mechanical seal are provided with a spacer coupling (located between the mechanical seal and thrust pot) to facilitate seal maintenance. Otherwise a rigid flanged (non-spacer) coupling will be furnished. Refer to paragraph 11-3, step J, 1 through 5 for spacer coupling installation prior to installing the thrust pot. Refer to Section 10 for mechanical seal installation. If a thrust pot is shipped assembled, but not installed on the pump, the thrust pot shall be installed as follows:

A. Disengage but do not remove capscrews (757Q). This will allow the shaft stub (647) to freely move upwards (but not downwards). See Figure 13-6.

B. Install coupling half (614) on pump shaft.

C. Install coupling half (610) on thrust pot shaft.

D. If a spacer coupling is furnished, install spacer (612) on pump shaft coupling half (614).

E. If the opening in the motor mounting flange (of the driver support) is large enough to pass the thrust pot, carefully lower the thrust pot through this opening and into the rabbet fit of the thrust pot mounting plate. If the opening is not large enough, remove the driver support first. To facilitate hoisting the thrust pot in place, remove two of the capscrews (760P) in cover (770)—located 180 degrees apart—and replace them with two ½"—13 N.C. x 2" long eye bolts.

F. Position the thrust pot such that, when lined up with the mounting holes, the oil level gauge (771) is located in front of either access hole in the driver support which should be 90 degrees off the discharge pipe. Bolt in place the thrust pot with cap screws (760Q) and lock washers (789B).

G. Replace the eye bolts with the original cap screws (760P) and lock washers (789B).

H. Turn adjusting nut (604B) until coupling halves (610) and (614) are about ⅛" (3 mm) apart.

I. Assemble coupling as referred to above.

J. Adjust impellers as described in paragraph 13-3 and make sure the entire rotating assembly can be turned freely by hand.

K. THRUST POT LUBRICATION. Thrust pots do not contain lubrication oil when they are shipped because if the unit is tilted too much, oil will run out through the labyrinth type weather seal in the cover (770), or it will run over the oil tube (651) which keeps the oil in the reservoir. In the latter case oil will run down the shaft. Prior to running the unit, it must be filled with oil through the oil fill opening in the cover (770) after removing the oil fill plug (747T). Reinstall the plug after the desired oil level has been obtained. It should be noted that it is more convenient to fill the unit with oil before it is installed. If the unit will not be in operation within four weeks after arrival at the place of destination, it is recommended that the unit be filled with oil until the oil runs over the oil retainer tube (651) and down the shaft (647). This will keep the ball bearings submerged in the oil and weather-protect them against corrosion attack.

After installation and prior to start-up, the excess oil must be drained to the required operational level which shall be no more than ⅛" to ¼" from the top of the oil sight gauge (771). The oil can be drained by removing the oil drain plug (747S) located at the bottom of the unit. Caution: Overfilling may result in overheating the unit. During operation the oil level may be higher. At any time gauge. If the level starts dropping, add oil to the level indicated previously. The approximate amount of oil needed to fill the thrust pot to its required level (when empty) is indicated in table 13-2.

Goulds recommends that only TURBINE TYPE OILS with a viscosity of 145 to 175 SSU (Saybolt Seconds Universal) be used. These high quality mineral oils are refined to remove unstable elements. They contain additives, including anti-oxidants, anti-foam agents for rapid separation of possible condensation, and corrosion inhibitors which adhere to the bearing surfaces and protect against rust. Use of these turbine type oils will help to prevent splashing, rusting, excessive foaming, darkening, and will assure excellent service in a wide range of operating temperatures.

CAUTION: Goulds does not recommend the use of *detergent* type oils (such as automotive oils) for lubrication of the thrust pots. Instead of allowing impurities to settle in the bottom of the oil reservoir sump, it would cause them to be suspended and to flow freely through the circulating oil system where they could cause wear to the bearings. Use only oxidation-corrosion inhibited turbine oils of the viscosity recommended above.

L. THRUST POT COOLING. The circulating oil in

the thrust pot is cooled through passing by a cooling coil (678) through which the cooling liquid is flowing. Cooling liquid may be obtained from any external source or from the pump itself. In the latter case, the pressurized liquid is tapped from the discharge head and run through 3/8" tubing to one of the cooling coil extensions protruding out of the bottom of the thrust pot. A properly sized orifice is furnished in the inlet line (at the tap connection) to provide approximately 2 GPM flow of cooling liquid through the coil. The orifice opening is determined from chart 13-7. Cooling liquid should not be tapped from the pumpage if it contains dirt as it may clog the orifice and prevent the coolant from flowing through the coil, which may result in overheating of the oil in the thrust pot. Be sure the coil, tubing and fitting materials are compatible with the cooling fluid being used.

M. BEARING REPLACEMENT. If bearing replacement becomes necessary, follow the steps outlined below.

1. Disconnect flexible coupling.
2. Disconnect and remove the driver.
3. Remove the flexible coupling.
4. Remove capscrews (757Q) from adjusting nut (604B).
5. Turn adjusting nut (604B) until impellers are resting on bowls and remove adjusting nut.
6. Remove capscrews (760P) and lock washers (789B).
7. Remove cover (770).
8. Install two eye bolts (180 degrees apart) in spindle (605) where normally capscrews (757Q) are located.
9. Carefully pull out straight the entire bearing assembly over the shaft and threading.
10. If cooling coil needs replacement, disconnect cooling inlet and outlet lines at union elbows (678B) and remove sealing connectors (678A). The coil can now be lifted out from the top of the bearing housing (794A).
11. Remove bearing lock nut (604C) and lock washer (789D).
12. Remove bearings (791B) from spindle (605).
13. Before installing new bearings, refer to cleaning and lubricating procedures in paragraph 14-5.

NOTES:

A. Be sure the new bearings are installed for the proper thrust direction. See figure 13-6.

B. To reassemble the thrust pot unit reverse above steps.

C. It is not important which cooling water connection at the bottom of the thrust pot is used for inlet or outlet.

N. FLEXIBLE COUPLING. Flexible couplings may be furnished in a variety of types and sizes depending on design requirements. Instructions for installing flexible couplings are provided by the coupling manufacturer. Alignment of the coupling is extremely important for trouble-free operation. The following general instructions may be applied for most common coupling installations.

1. Install driver, refer to Section 11.
2. Install driver key and half coupling on driver shaft. Install pump key and half coupling on pump shaft. Secure half coupling to prevent them from slipping on the shafts.
3. Check alignment by placing a straight edge vertically across coupling hubs at four points 90° apart. Shift motor as required. When the straight edge rests evenly on all four points, coupling is aligned. Check spacing between hubs at 90° intervals around the hubs.
4. Secure motor with capscrews provided.
5. Connect coupling with setscrews or capscrews furnished, for the particular make of coupling used. Recheck for misalignment.

13-3 IMPELLER ADJUSTMENT

13-4 When a thrust pot is provided, adjustment is accomplished by turning adjusting nut (604B). (See figure 13-6.)

A. OPEN IMPELLERS

1. Remove capscrew (757Q) and with impellers touching bowl faces, turn adjusting nut (604B) counterclockwise until face of adjusting nut makes contact with spindle (605).
2. Align hole "A" in adjusting nut and hole "C" in spindle. (See figure 11A-14.)
3. For pumps up to 10 feet (3 m) of column, turn adjusting nut to obtain clearance of 0.015 inch (0.38 mm). Add 0.010 inch (0.25 mm) for each additional 10 feet (3 m) of column. If pump performance is not satisfactory with the specified clearance, lower impellers as required, but do not allow impellers to drag.
4. After adjustment is complete, insert capscrew (757Q) in corresponding hole in adjusting nut, thread into spindle (605) and tighten securely. Set seal after impeller adjustment.

B. ENCLOSED IMPELLERS

1. For enclosed impellers, use 3/16 inch (4.8 mm) clearance.
2. After adjustment is complete, insert capscrew (757Q) in corresponding hole in adjusting nut, thread into spindle (605) and tighten securely. Set seal after impeller adjustment.

TABLE 13-2 THRUST POT LUBRICATION

Model 7314PD	3 Qts., 5 Oz.	3 Liters
Model 7318PD	5 Qts., 20 Oz.	5.3 Liters
Model 7324PD	13 Qts., 24 Oz.	13 Liters
Model 7330PD	22 Qts., 20 Oz.	21.5 Liters

NOTE: Use TURBINE TYPE OILS with a viscosity of 145 to 175 SSU only.

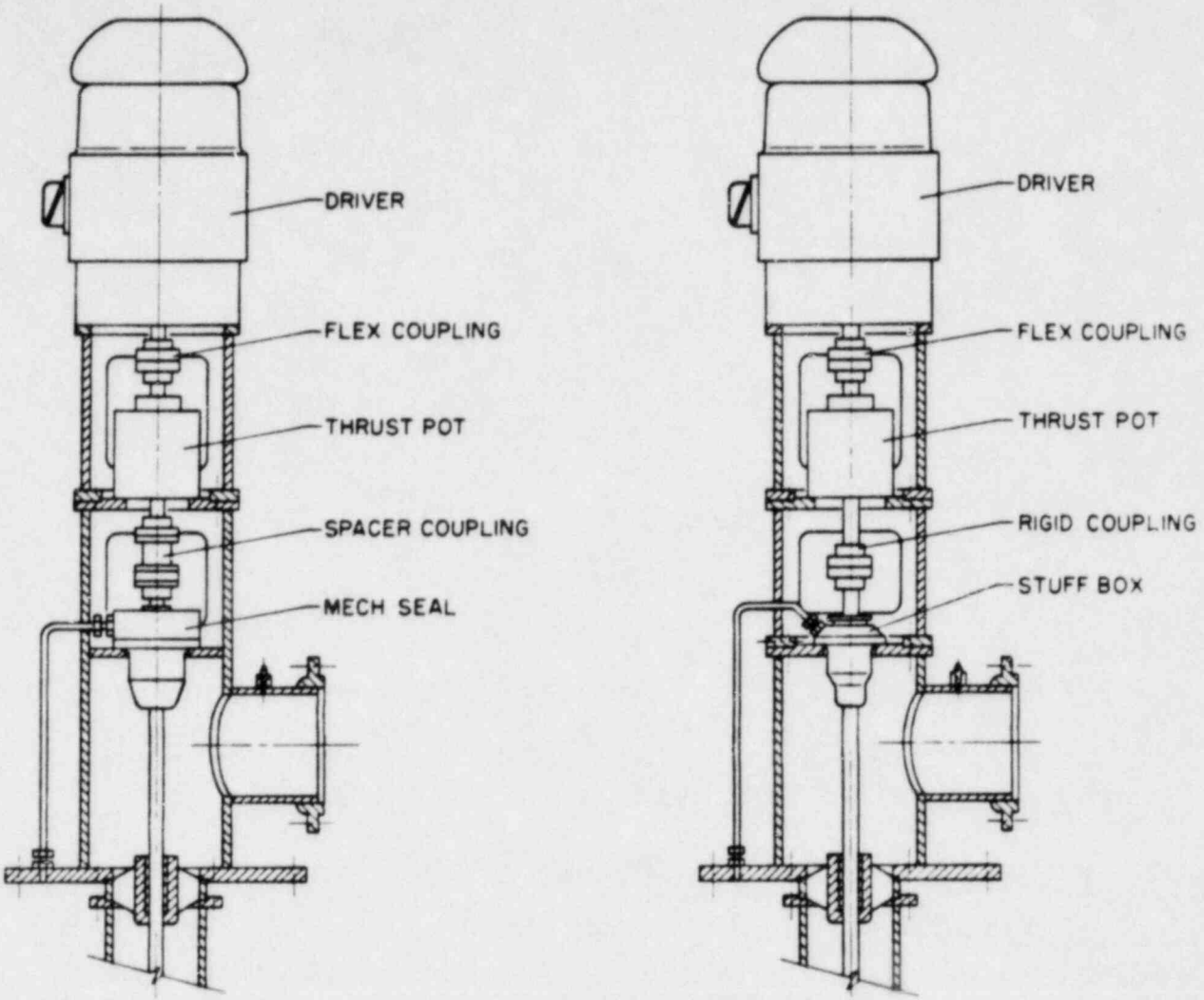
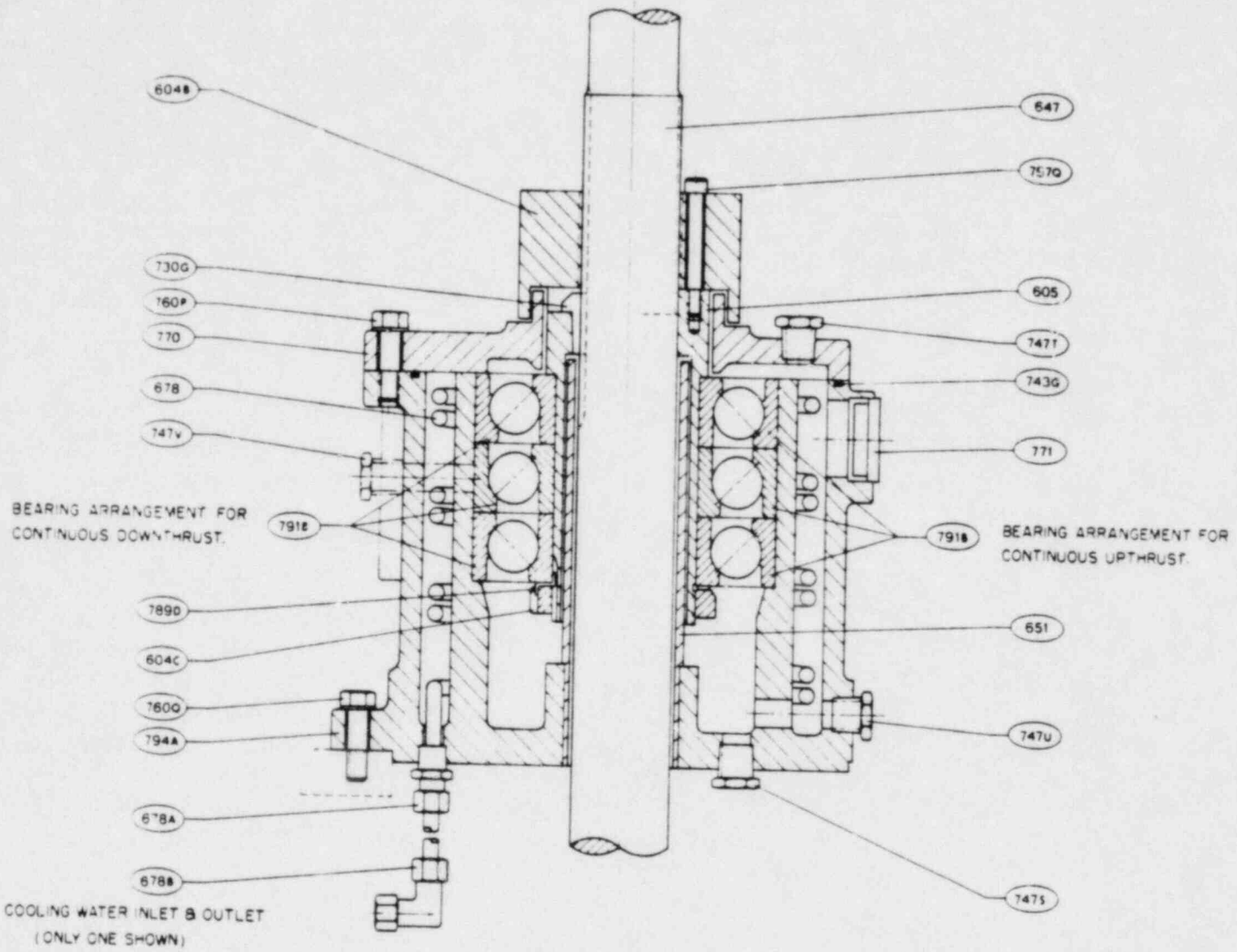


Figure 13-5. THRUST POT INSTALLATION



NO	DESCRIPTION
6048	ADJUSTING NUT
604C	LOCKNUT, BEARING
605	SPINDLE
647	SHAFT
651	OIL TUBE
678	COOLING COIL
678A	MALE CONNECTOR
6788	UNION ELBOW
730G	GIB KEY
743G	O-RING
747S	PIPE PLUG, DRAIN
747T	PIPE PLUG, FILL
747U	PIPE PLUG, ACCESS
747V	PIPE PLUG, TEMPERATURE DETECTOR
7570	SOCKET-HEAD CAP SCREW
760P	HEX HEAD CAP SCREW
760Q	HEX HEAD CAP SCREW
770	COVER
771	PORTHOLE VIEW GAUGE
7890	LOCKWASHER, BEARING
7918	BALL BEARING TRIPLEX APPLICATION
794A	HOUSING BEARING

Figure 13-6. THRUST POT BEARING ARRANGEMENT

SECTION 14—MAINTENANCE

14-1 PREVENTIVE MAINTENANCE

14-2 Preventive maintenance includes periodic inspection of oil level in thrust pots, relubrication of electric motors, gear drives and prime mover. Systematic inspection of the pump and its components should be made at regular intervals. The frequency required depends upon the operating conditions of the pump and its environment. See table 14-1 for maintenance procedures. Consult the applicable manufacturer's instructions for detailed information on maintenance for the prime mover, driveshaft, electric motors and gear drives. Any deviation in performance or operation from what is expected can be traced to some specific cause. Variances from initial performance will indicate changing system conditions, wear, or impending breakdown of the unit.

WARNING

BEFORE INITIATING MAINTENANCE PROCEDURES, DISCONNECT ALL POWER SOURCES TO THE EQUIPMENT AND ACCESSORIES AND COMPLETELY DISCHARGE ALL PARTS AND ACCESSORIES WHICH MAY RETAIN ELECTRIC CHARGE. FAILURE TO COMPLY MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

14-3 PACKING ADJUSTMENT AND REPLACEMENT

14-4 Pumps equipped with packing, shall be adjusted whenever the leakage rate exceeds two drops per second. If there is no leakage or the stuffing box overheats, do not back off gland nuts while pump is running, as this will allow the entire set of rings to move away from the bottom of the box, without relieving pressure of the packing on the shaft. Stop the pump and allow packing to cool then restart the pump. It may be necessary to repeat this procedure several times before the proper amount of liquid comes through to efficiently prevent overheating. If leakage is excessive, adjust the stuffing box as follows:

A. With the pump in operation, tighten the gland nuts one-quarter turn for each adjustment. Allow packing to equalize against the increased pressure and leakage to gradually decrease to a steady rate, before making another adjustment.

CAUTION

DO NOT OVER-TIGHTEN THE STUFFING BOX. EXCESSIVE PRESSURE CAN WEAR OUT PACKING PREMATURELY AND SERIOUSLY DAMAGE THE SHAFT.

B. With the pump shut down and when packing has been compressed to the point that the gland is about to contact the upper face of the stuffing box, remove the split gland, add one extra packing ring, and readjust. If this fails to reduce the leakage to two drops per second, remove all packing rings and replace with new rings.

C. Remove the packing with the aid of a packing hook. If a lantern ring is provided, remove it by inserting a wire hook in the slots of the ring and pull it from the packing box. Thoroughly clean the stuffing box of all foreign matter.

D. If the replacement packing is in the form of a continuous coil or rope, it must be cut into rings before installing. Tightly wrap one end of the packing material around the top shaft like one coil spring, and cut through the coil with a sharp knife. For repacking sequence, refer to Section 9.

14-5 THRUST POT LUBRICATION AND MAINTENANCE. It is good practice to flush the oil reservoir before first time operation and at the time of oil changes to remove any grit particles in the oil reservoir sump. Use the same type of oil to flush reservoir as specified for lubrication. Because of the special nature of the TURBINE OIL recommended, it is wise to keep a supply on hand. Remove drain plug (747S) before flushing. Flushing oil may be poured through oil fill opening in cover (770) after removing oil fill plug (747T). The proper *oil level when the unit is not running* shall be not more than ⅛" to ¼" from the top of the oil sight gauge (771). Overfilling may result in overheating of the unit. During operation the oil level in the sight gauge may be higher than the recommended range mentioned above. Under no circumstance is it allowed to rotate the unit when the oil in the sight gauge is not at the required level.

To avoid oxidation of the anti-friction bearings during shut-down periods lasting longer than one week, it is recommended to fill up the oil reservoir until the oil runs over the oil retainer tube (651) and down the shaft (647) so that the bearings remain completely immersed in the oil. Before start-up, do not forget to drain the excess oil to its required level.

Oil change depends on the severity of the environment. Generally speaking, when the oil in the sight gauge changes to a darkish brown color it is time for an oil change. However, for a longer bearing life, it is recommended that the oil be changed every six months. Be sure to flush the oil reservoir (see above) with each oil change. For approximate amount of oil needed, refer to table 13-2.

TABLE 14-1. PREVENTIVE MAINTENANCE PROCEDURES

PROCEDURE	TIME INTERVAL (OPERATING HOURS)
Clean dirt, oil and grease from driver and discharge head.	As required
Clean driver ventilation passage to prevent overheating.	As required
Change lubricant in gear drive.	2,000 or once a year
Change lubricant in thrust pot.	See Section 13
Tighten all loose bolts, and check for excessive vibration.	As required
If packing is grease lubricated, add as required.	100
Check that there is some leakage through stuffing box while pump is in operation. Do not tighten gland nuts unless necessary, refer to Paragraph 14-4 for tightening requirements.	As required
Maintain a liquid film of lubrication between the seal rubbing faces.	As required
Regrease motor bearings: Above 1800 RPM Below 1800 RPM	 1000 2000

SECTION 15— TROUBLESHOOTING

15-1 CORRECTIVE MAINTENANCE

15-2 Corrective maintenance procedures include troubleshooting for isolating and remedying malfunctions of the pump and its components during operation.

TABLE 15-1 TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
1. Pump does not start.	A. Electrical circuit open or not completed.	Check circuit and correct.
	B. Steam turbine not receiving steam pressure.	Make sure that turbine receives full steam pressure.
	C. Impellers binding against bowl.	Reset impeller adjustment. See Section 11, Paragraph 11-1.
	D. Low voltage supplied to electric driver.	Check whether driver wiring is correct & receives full voltage.
	E. Defective motor.	Consult factory.
2. No liquid delivered.	A. Insufficient submergence of bowl assembly.	Check for adequate submergence.
	B. Obstruction in liquid passage.	Pull pump, inspect impeller and bowl.
3. Not enough liquid delivered.	A. Speed too low.	Check if driver is directly across the line and receiving full voltage
	B. Wrong rotation.	Check for CCW rotation when viewed from above. Check engagement of motor coupling.
	C. Total pump head too high.	Check pipe friction losses. Larger piping may correct condition.
	D. Partial obstruction in liquid passages.	See Step 2-B.
	E. Cavitation.	Insufficient NPSH available.
	F. Impellers adjusted too high if semi-open construction.	See Section 11.
4. Not enough pressure.	A. Speed too low.	See step 1-B
	B. Obstruction in liquid passages.	Pull pump and inspect impeller and bowl passages.
	C. Wrong rotation.	See step 3-B.
	D. Same as F in step 3.	See step 3-F.
5. Pump works for awhile and quits.	A. Excessive horsepower required.	Use larger driver, consult factory.
	B. Pumping higher viscosity or specific gravity liquid than designed for.	Test liquid for viscosity and specific gravity.
	C. Mechanical failure of critical parts.	Check bearings and impellers for damage. Any irregularities in these parts will cause a drag on the shaft.
	D. Speed may be too high.	Check voltage on motor.
	E. Misalignment.	Realign pump and driver.

TROUBLE	PROBABLE CAUSE	REMEDY
6. Pump takes too much power.	A. Damaged impeller.	Inspect, replace if damaged.
	B. Foreign object lodged between impeller and bowl.	Remove object as required.
	C. Specific gravity higher than pump designed for.	Test liquid for viscosity and specific gravity.
	D. Viscosity too high, partial freezing of pumpage.	Check, both can cause high drag on impeller.
	E. Defective bearing.	Replace bearing, check shaft or shaft sleeve for scoring.
	F. Packing too tight.	Release gland pressure. Retighten, refer to Section 14, paragraph 14-4. Keep leakage flowing. If no leakage, check packing, sleeve or shaft.
7. Pump is noisy.	A. Cavitation	Insufficient NPSH available.
	B. Bent shaft.	Straighten as required See Section 7, Step A.
	C. Rotating parts bind, loose or broken.	Replace as required.
	D. Bearings worn out.	Replace bearings.
8. Excessive vibrations.	A. Coupling misalignment, bent shaft, impeller unbalance, worn bearings, cavitation, piping strain, and/or resonance.	Determine cause utilizing vibration frequency analyzer and/or pump disassembly. Complex problem may require factory service assistance.
	B. Motor or gear drive shaft end play maladjustment.	See Section 11.
9. Pump leaks excessively at stuffing box.	A. Defective packing.	Replace worn packing. Replace packing damaged by lack of lubrication.
	B. Wrong type of packing.	Replace packing not properly installed or run-in. Replace improper packing with correct grade for liquid being pumped.
10. Stuffing box overheating.	A. Packing too tight.	Release gland pressure. See step 6-F.
	B. Packing not lubricated.	Release gland pressure and replace all packing if burnt or damaged. Regrease packing as required.
	C. Wrong grade of packing.	Consult factory.
	D. Stuffing box improperly packed.	Repack stuffing box.
11. Packing wears too fast.	A. Shaft or shaft sleeve worn or scored.	Pull pump and remachine, or replace shaft and/or sleeve.
	B. Insufficient or no lubrication.	Repack and make sure packing is loose enough to allow some leakage.
	C. Improperly packed.	Repack properly, make sure all old packing is removed and stuffing box is clean.
	D. Wrong of packing.	Consult factory.

TROUBLE	PROBABLE CAUSE	REMEDY
12. Mechanical seal leaks steadily.	A. Faces are not flat.	Gland bolts possibly too tight, causing warpage of gland and insert, remove check and reinstall.
	B. Shaft packing nicked or chipped during installation.	Replace packing.
	C. Carbon insert cracked or face of insert or seal ring chipped during installation.	Remove, inspect and replace as required.
	D. Seal faces scored from foreign particles between faces.	Install strainer, filter or cyclone separator as required to filter out foreign particles.
13. Seal squeals during operation.	A. Inadequate amount of liquid at sealing faces.	Bypass flush line may be necessary. If one is in use it may need to be enlarged to produce more flow.
14. Carbon dust accumulating on outside of gland ring.	A. Inadequate amount of liquid at sealing faces.	Consult factory.
	B. Liquid film flashing and evaporating between seal faces and leaving residue which is grinding away the carbon.	Consult factory.
15. Seal leaks, nothing appears to be wrong.	A. Faces are not flat.	Seal faces should be replaced or relapped. Also see step 11-A.
16. Short seal life.	A. Product is abrasive, causing excessive seal face wear.	Determine source of abrasives and install bypass flushing if required to prevent abrasives from settling out or accumulating in the seal area. Install cyclone separator as required.
	B. When abrasives are forming due to the process liquid cooling and crystalizing or partially solidifying in the seal area.	Install bypass flush line to hold liquid temperature around the seal above crystalization point.
	C. Seal is running too hot.	Check for possible rubbing of some seal component along the shaft. Recirculation or bypass line may be necessary.
	D. Improper choice of seal.	Consult factory.

SECTION 16—PUMP DISASSEMBLY AND REASSEMBLY

NOTE

PUMP COMPONENTS SHOULD BE MATCH MARKED PRIOR TO DISASSEMBLY

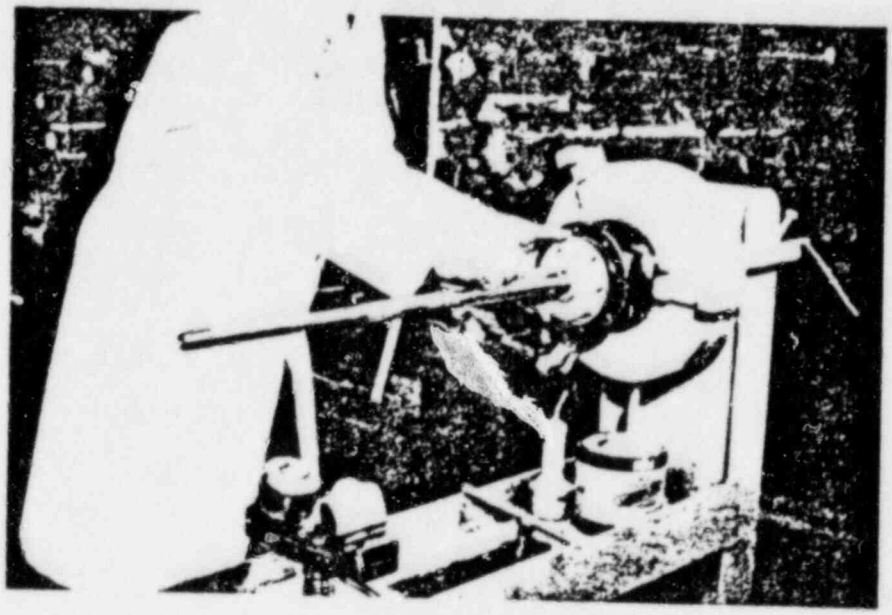
16-1 If solid shaft driver, either motor or gear is used with mechanical seals, loosen set screws fastening seal to pump shaft so pump shaft can slide up or down within the seal.

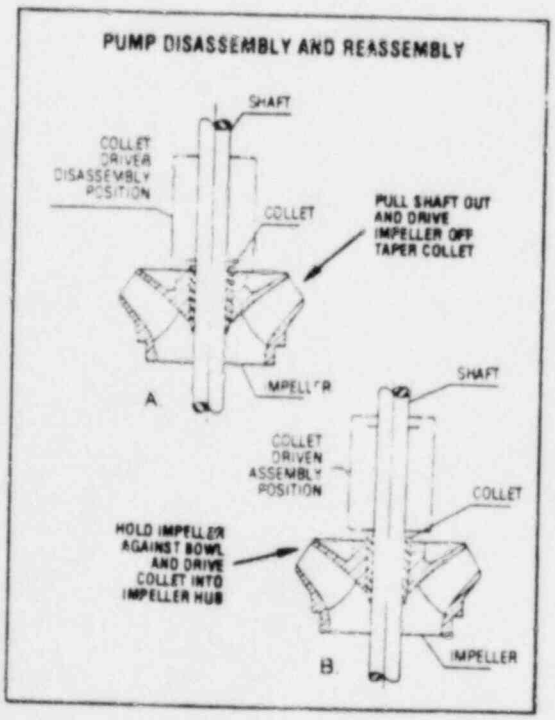
A. On pumps which are driven through a gear drive, remove the drive shaft between gear and prime mover.

B. On pumps which are electric motor driven, remove the electrical connections at the conduit box and tag electrical leads so they can be assembled the same way they were disassembled.

WARNING

BEFORE OPENING THE CONDUIT BOX OF AN ELECTRIC MOTOR, BE SURE THAT THE CURRENT TO THE MOTOR IS SHUT OFF.





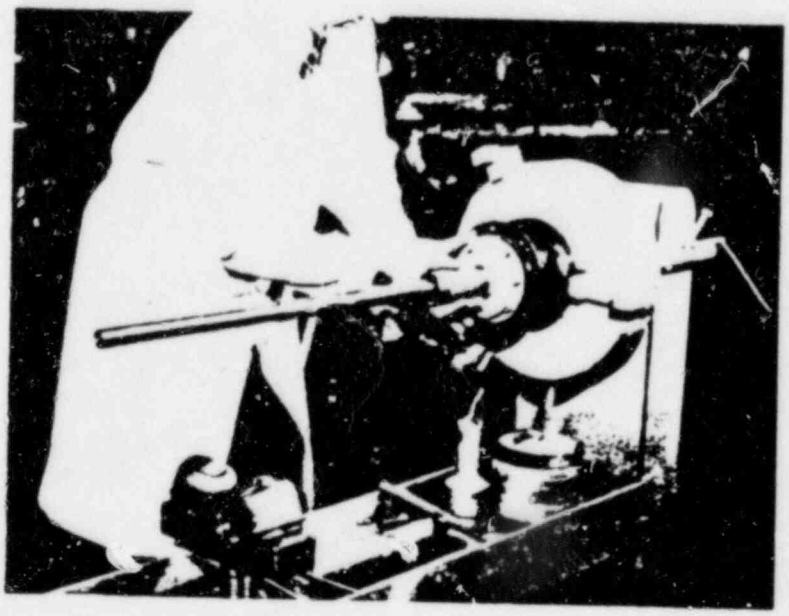


Figure 16-1. COLLET DRIVER

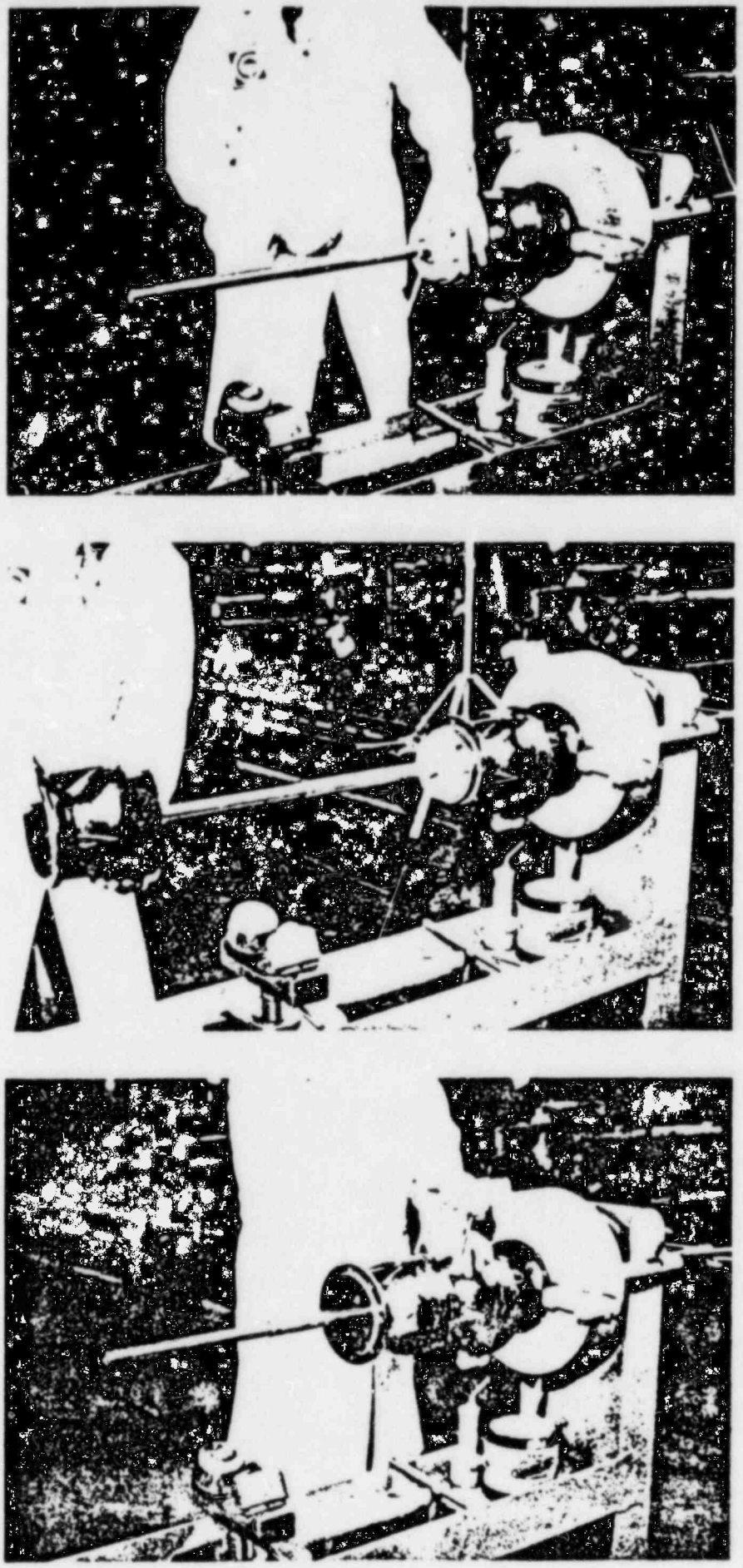


Figure 16-2. IMPELLER-KEY CONSTRUCTION

16-2 Uncouple drive from pump shaft and mounting flanges and lift off by the lifting lugs or eyebolts as furnished.

NOTE

NEVER TRY TO LIFT ENTIRE PUMP ASSEMBLY BY THE LIFTING LUGS OR EYEBOLTS FURNISHED FOR THE DRIVER ONLY.

16-3 Disconnect discharge head from discharge line. Remove all hold-down bolts and integral piping. Remove coupling packing box or mechanical seal, and proceed with disassembly down to the bowls in reverse procedure from that already described in detail for assembling the unit.

16-4 BOWL ASSEMBLY. The bowl assembly shown in figure 16-1 is composed of a suction bell, intermediate bowl, top bowl, enclosed impellers with taper collets, bearings and a barrel.

NOTE

MATCH MARK BOWL ASSEMBLY IN SEQUENCE OF DISASSEMBLY TO AID IN THE REASSEMBLY PROCEDURE.

16-5 TURBINE BOWLS. Turbine bowl impellers are secured to the shaft by either a taper collet or by standard key construction.

16-6 TAPER COLLET CONSTRUCTION. See figure 16-1.

A. Remove capscrews that secure top bowl (669) to intermediate bowl (670).

B. Slide top bowl off the pumpshaft (660).

C. Pull shaft out as far as possible and strike impeller hub utilizing a collet driver or equivalent sliding along the pumpshaft to drive the impeller off the taper collet. (See figure 16-1, A.)

D. After impeller is freed, insert a screwdriver into the taper collet to spread it. Slide taper collet and impeller off the pumpshaft.

E. Use the preceding procedures until entire turbine bowl assembly is completely disassembled.

16-7 STANDARD KEY CONSTRUCTION. (See figure 16-2)

A. Remove capscrews that secure top bowl (669) to intermediate bowl (670).

B. Slide top bowl off the pumpshaft (660), keyed impeller is now exposed.

C. Remove capscrews (759F) and split thrust ring (725) from pumpshaft.

D. Slide impeller off the pumpshaft and remove key (730E). If impeller is seized to shaft, strike impeller with a fiber mallet and drive impeller off the pumpshaft.

16-8 TURBINE BOWL—WEAR RINGS REMOVAL

A. Utilizing a diamond point chisel, cut two "V" shaped grooves on the bowl wear ring approximately 180 degrees apart. Use extreme care not to damage the wear ring seat.

B. With a chisel, or equal knock the end of one half of the ring in, and pry ring out.

C. On special materials such as chrome steel, set up the bowl in a lathe and machine the wear ring off using extreme care not to machine or damage the ring seat.

16-9 TURBINE BOWL—IMPELLER WEAR RING REMOVAL

A. Set up impeller in a lathe and machine wear ring off using extreme care not to machine or damage ring seat or impeller hub. Impeller wear ring may also be removed by following steps A and B, paragraph 16-8.

16-10 BOWL, SUCTION BELL AND RETAINER BEARING REMOVAL

A. Utilizing an arbor press and a piece of pipe or sleeve with outside diameter slightly smaller than bowl and retainer bearing housing, press the bearing off.

B. Remove suction bell bearing by setting suction bell on a lathe and machine bearing off. Suction bell bearing may also be removed by using bearing pullers and pulling bearings out.

NOTE

BOWL BEARINGS ARE PRESS FIT. DO NOT REMOVE UNLESS REPLACEMENT IS NECESSARY.

16-11 INSPECTION AND REPLACEMENT

A. Clean all pump parts thoroughly with a suitable cleaner.

B. Check bearing retainers for deformation and wear.

C. Check shafts for straightness and excessive wear on bearing surfaces. Check deflection of shafts, average total runout shall not exceed 0.010" (0.25 mm) T.I.R. for every 10 feet (3 m).

D. On pumps equipped with a mechanical seal, check that shaft or sleeve is free of pits, burrs or sharp edges to prevent cutting, or improper sealing of O-ring. Remove burrs and sharp edges by polishing with a fine crocus cloth.

E. Visually check impellers and bowls for cracks and pitting. Check all bowl bearings for excessive wear and corrosion.

F. Replace all badly worn or damaged parts with new parts. In addition, replace all gaskets and packing as required. Refer to Section 18 for spare parts list.

16-12 TURBINE BOWL AND IMPELLER WEAR RING INSTALLATION

A. Place chamfered face of bowl or impeller wear ring towards the ring seat and press into seat. Use an arbor press or equal making sure ring is flush with edge of wear ring seat.

16-13 BOWL, SUCTION BELL AND RETAINER BEARING INSTALLATION

A. Press bearing (653) into retainer (652) using an arbor press or equal. (See figure 3-1.)

B. Press bearing (690) into suction bell (689) using an arbor press or equal.

C. Press bearings (672) into intermediate bowl (670) and top bowl (669). Place the bowl with the flange downward and press bearing through chamfered side of bowl hub until bearing is flush with hub, use an arbor press or equal.

16-14 TURBINE BOWL WITH TAPER COLLET REASSEMBLY

A. For ease in reassembly apply a thin film of turbine oil to all mating and threaded parts.

B. If a pumpshaft (660) is replaced and the sand collar is not assembled to the shaft, sand collar is attached to the shaft by a shrink fit. The shaft is machined with an 0.01 inch (0.25 mm) groove to locate sand collar, place large diameter of counterbore on sand collar towards suction bell bearing. Heat sand collar until it can slip on shaft.

WARNING

WEAR PROTECTIVE GLOVES AND USE THE APPROPRIATE EYE PROTECTION TO PREVENT INJURY WHEN HANDLING HEATED PARTS.

C. When a sand collar is not furnished, use "X" dimension given in Table 16-1, to locate pump shaft with respect to bowls. EXAMPLE: For an 11A size pump, insert shaft into suction bell bearing until it bottoms out, pull shaft out and measure 2.12 inches (54 mm) from groove on shaft to suction bell hub (see figure 16-3).

D. Hold shaft in this position with washer and capscrew. Insert capscrew with washer through the threaded hole in suction bell, thread into shaft and tighten. Size of capscrew may vary between ½"-13 UNC or ⅝"-11 UNC, depending on size of pump.

E. Slide first impeller over shaft until it seats on the bowl.

F. Insert a screwdriver into taper collet (677) slot, spread it and slide it over shaft. Hold impeller against bowl and slide taper collet into hub.

G. Hold shaft with capscrew and washer against suction bell boss and drive taper collet in place with collet driver (see figure 16-1, B.). After impeller is in position on taper collet, check "X" dimension. Retighten capscrew, if required.

H. Slide intermediate bowl (670) over pump and secure to suction bell with capscrews provided.

J. Repeat preceding procedure for number of stages required.

K. Loosen capscrew and washer, check that shaft rotates freely without dragging or binding. Also check for adequate lateral end play.

16-15 STANDARD KEY CONSTRUCTION. (See figure 16-2)

A. Install key (730E) into pumpshaft keyway, slide impeller (673) over shaft and locate it on key.

B. Install split thrust ring (725) on pumpshaft groove and secure to impeller with capscrews (759F).

C. Slide intermediate bowl (670) over pumpshaft and secure to suction bell (689) with capscrews (759F).

D. Repeat preceding procedures for number of stages required.

16-16 After reassembly of bowl assembly, reassemble pump as described in Section 6 through 11. Refer to Section 12 for startup and adjusting procedures. Section 13 contains information on special applications.

TABLE 16-1 PUMP SHAFT SET-UP DIMENSIONS

PUMP SIZE	"X" DIMENSION inches	(mm)
4D	1.31	33.3
6A	1.37	34.9
6J	1.37	34.9
6D	1.37	34.9
7A	1.37	34.9
8A	1.37	34.9
8J	1.37	34.9
8D	1.37	34.9
9A	1.37	34.9
10A	1.75	44.5
10J	1.75	44.5
10D	1.75	44.5
10L	2.12	54.0
11A	2.12	54.0
12J	2.12	54.0
12D	2.25	57.2
14J	2.75	69.9
14H	2.75	69.9
14D	2.75	69.9
16D-Bell	1.75	44.5
16D-Bowl	2.75	69.9
18H	2.75	69.9
20H	.87	22.2
28T	4.50	114.3
36T	6.25	158.3

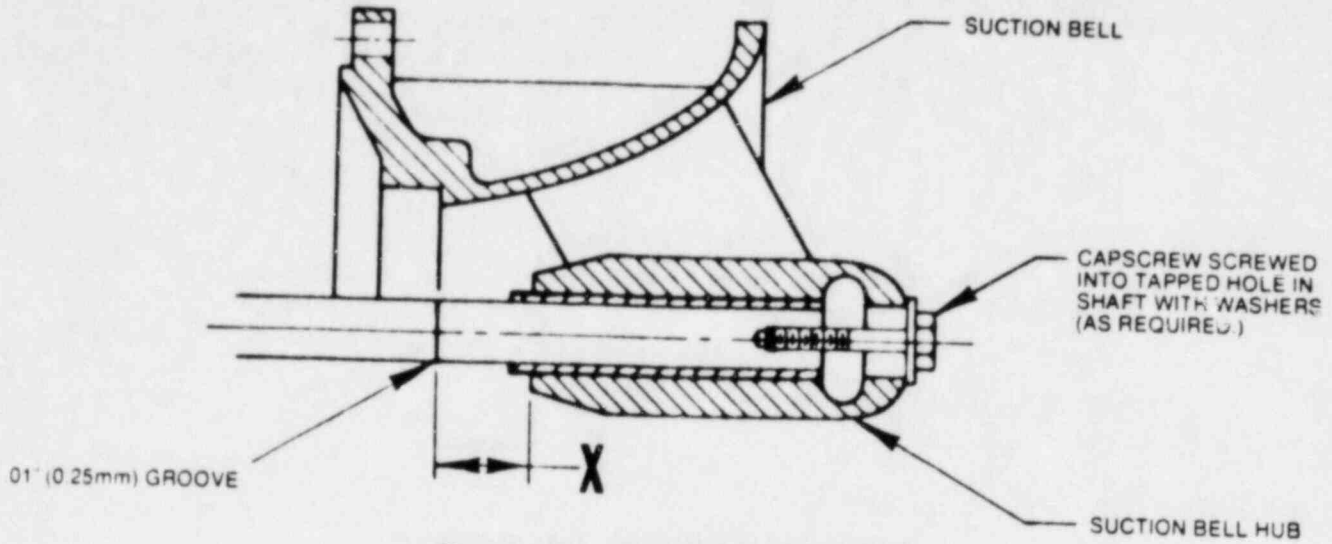
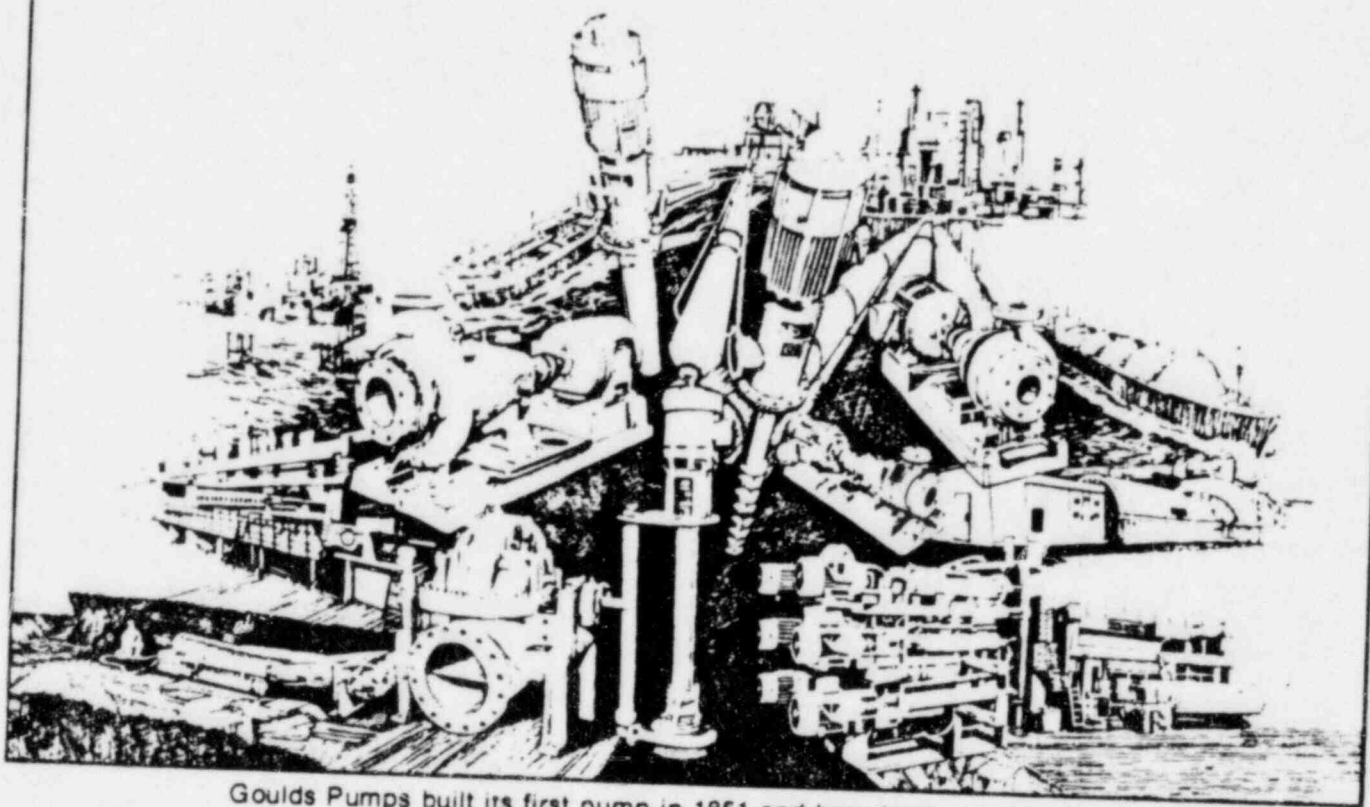


Figure 16-3. SETTING PUMP SHAFT

Pumps, and nothing but.



Goulds Pumps built its first pump in 1851 and has since grown to the largest manufacturer dealing exclusively with centrifugal pumps.

Branch Sales Offices

Atlanta—[illegible] Georgia 30329
Baton Rouge—[illegible] Louisiana 70806
Beaumont—[illegible] Texas 77702
Birmingham—[illegible] Alabama 35205
Boston—[illegible] Massachusetts 02181
Buffalo—[illegible] 14225
Charleston—[illegible] West Virginia 25177
Charlotte—[illegible] North Carolina 28209
Chicago—[illegible] 60153
Cincinnati—[illegible] 45227
Cleveland—[illegible] 44145
Dallas—[illegible] 75081
Denver—[illegible] 80150
Detroit—[illegible] 48076
Houston—[illegible] 77057
Jacksonville—[illegible] 32207
Kansas City—[illegible] 64131
Los Angeles—[illegible] 90601
Memphis—[illegible] 38157
Mobile—[illegible] 36609
Monroe—[illegible] 71201
New York—[illegible] 07006
Philadelphia—[illegible] 19073
Pittsburgh—[illegible] 15220
Portland—[illegible] 97005
St. Louis—[illegible] 63144
San Francisco—[illegible] 94546
Seattle—[illegible] 98057
Tampa—[illegible] 33617
Tulsa—[illegible] 74145
Wilmington—[illegible] 19711

Stocking Warehouses

International Sales Offices

Goulds Pumps Inc.—Export Dept. Seneca Falls, New York 13148
Goulds Pumps, Inc.—P.O. Box 3792 Kifissias Athens 36 Greece
Goulds Pumps Southeast Asia Offices—P.O. Box [illegible] Makati, P.O. 3117 Philippines
Goulds Pumps (Philippines) Inc.—P.O. Box [illegible] Commercial Center Makati, P.O. 3117 P.I.
Goulds Pumps Europa AG—Morgartenstrasse 5 CH-6003 Luzerne Switzerland
Goulds Pumps Latin American Offices—Apartado Aereo 90316 Bogota Colombia
Goulds Pumps Puerto Rico Offices—41 El Monte Mail Hato Rey Puerto Rico 00918

Manufacturing Plants

Main Plant and Headquarters—Seneca Falls, New York 13148
Vertical Pump Division—City of Industry, California 91747
Texas Division—Lubbock, Texas 79417
Bombas Goulds de Mexico S.A. de C.V.—Condor 96, Mexico 20, DF
Goulds Bombas E Equipamentos Ltda.—Brazil Plant: Santo S.P. Sales Office: S. Paulo, P.O. Box 3007
Goulds Pumps (Philippines) Inc.—P.O. Box [illegible] Commercial Center, Makati, P.O. 708, P.I.
Goulds Chemiepumpenbau—CH-4800 Zofingen, Switzerland

Manufacturing Licensees

Goulds-Allen Gwynnes Pumps Ltd.—Queens Engineering Works, Bedford, England
Bejar-Goulds Division—Bejar Sons Hermanos, Sorel, P. Quebec, Canada
Miguel Schmidt & Cia. S. R. L.—Bolivar 1458-68, Buenos Aires, Argentina
Goulds-Hidroven, Hidroven Commercial—C.A. Apartado 50.451, Caracas, Venezuela
Goulds-G-P, Drakos Pateras Pump Manufacturers Inc.—P.O. Box 24, Kifisia, Greece
Celtic Engineering Co. Ltd.—25 Great Strand Street, Dublin 1, Ireland

Pump Service Facility

Goulds-Lesourdsaay Division—Ferry and Main Streets, Newark, New Jersey 07105

GOULDS PUMPS, INC.

VERTICAL PUMP DIVISION

Main Plant and Headquarters, Seneca Falls, N.Y. 13148

Form A302-VP 2.77 Sup. 8771

Printed in U.S.A.

ALLIS-CHALMERS
NORWOOD, OHIO

PRICED RECOMMENDED SPARE PARTS

CUSTOMER: Goulds Pumps DATE: 3-8-76

CUSTOMER P. O. # 39939 A-C S.O. # EL90235

ITEM NO.	#1
HP	50
TYPE	RGV
RPM	1800
VOLTS	460
FRAME	326VP

COILS W/WINDING SUPPLIES	
STATOR & YOKE	$980.20
SHAFT END BEARING	$42.76
OPPOSITE END BEARING	$703.80

REMARKS

DELIVERY COILS: 10 to 12 weeks if copper is in stock at entry of order.

BEARINGS: 2 to 3 weeks

RECOMMENDED MINIMUM STOCK

NO, OF UNITS IN OPERATION

1 TO 4	5 TO 9	10 TO 20
1 OF EACH	1 OF EACH EXCEPT 2 EA. BEARINGS	2 OF EACH

ABOVE PRICES ARE NET EACH, PRICE IN EFFECT AT TIME OF SHIPMENT F.O.B. NORWOOD, NO FREIGHT ALL

CC:

GOULDS PUMPS
VERTICAL PUMP DIVISION

LONG TERM STORAGE/DEFERRED WARRANTY PROCEDURE

SCOPE

This procedure describes preservation, packaging, storage and inspection/refurbishment activities to be implemented in order to provide extended warranty coverage for equipment offered by this proposal.

PRESERVATION/PACKAGING

A. All exposed interior and exterior non-coated carbon steel surfaces are sprayed with water displacement rust preventative, RUST BAN 392 or equal.
B. Coat carbon steel stuffing box with crusting grease, RUST BAN 326 or equal. Cover top of stuffing box with waterproof paper and seal with waterproof tape.
C. Coat exposed carbon steel machined surfaces with firm film rust preventative, RUST BAN 373 or equal.
D. Exposed flanges are covered with hardboard flange protectors held in place by wire or clips.
E. Apply film of compatible lube oil, RUST BAN 632 or equal over the water displacement rust preventative.
F. Cover pump suction with plastic sheet and tape in place.
G. Plug all tapped openings, coating threads with thread compound.
H. Skid mounted for fork lift handling.
I. Covered with a plastic sheet open on the bottom to allow breathing.
J. NOTE: Stainless steel components shall not be painted and require no preservation.

STORAGE

Store the pump indoors in a clean, dry environment. During storage rotate shaft counter clockwise once a month and check that shaft is not in an extreme raised or lowered lateral condition.

INSPECTION/REFURBISHMENT

Prior to installation of the pump, Goulds will provide services for disassembly and inspection of the pump. Service charges for this service will be in accordance with Goulds' published service charges in effect at the time of disassembly and inspection. If any pump components or parts are deemed by Goulds Pumps to be deteriorated during storage and unfit for pump service, those parts will be replaced at prices in effect at the time of their replacement. The inspector shall be satisfied that the equipment has been stored in the above specified location and the proper attention has been given to the equipment as specified above. The inspector shall be satisfied that the equipment has not been subject to abnormal abuse.

DEFERRED WARRANTY

After completion of inpsection/refurbishment described above, the equipment warranty (as defined in Goulds Pumps, Inc. Terms and Conditions) shall be in effect for a period of twelve (12) months from pump installation and start-up. This warranty period is not to exceed eighteen (18) months from the inspection date described above.