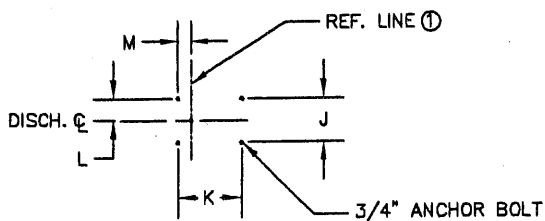
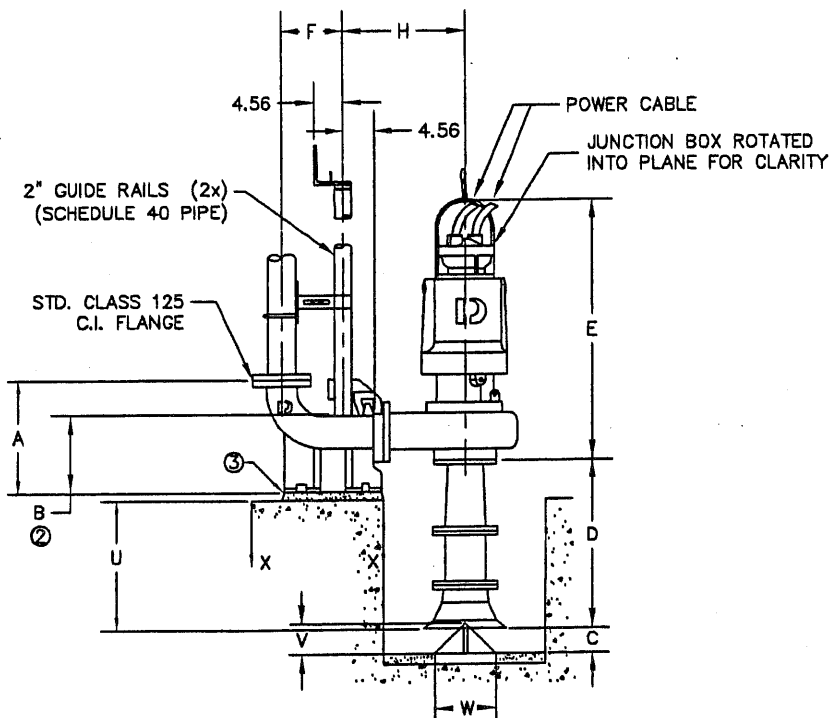
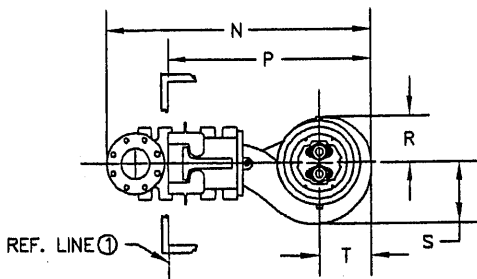


GENERAL ARRANGEMENT SERIES 2 WET PIT 4MSX12 - DOUBLE GUIDE RAIL

RIV-P-03



SECTION X-X

- NOTES:
 ① REF. LINE INDICATES INSIDE EDGE OF ACCESS FRAME.
 ② DIMENSION TO ENDS OF GUIDE RAILS.
 ③ 1 1/2" OF GROUT

ALL DIMENSIONS IN INCHES

DIMENSIONS ARE FROM DRAWINGS. CASTINGS MAY VARY SLIGHTLY. FOUNDATION BOLTS MUST NOT BE FIXED RIGIDLY UNTIL MACHINE IS IN PLACE. EXPANSION JOINTS USED IN THE DISCHARGE AND/OR SUCTION PIPING SHALL HAVE SUITABLY SIZED TIE RODS TO PREVENT THE TRANSMISSION OF EXCESSIVE HYDRAULIC FORCES TO THE PUMP. THIS PRINT IS LOANED SUBJECT TO RETURN ON DEMAND AND UNDER CONDITION THAT IT IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTERESTS. DO NOT SCALE; ADDITIONAL DIMENSIONS WILL BE FURNISHED UPON REQUEST.

	FRAME	H.P.	POLE	PH. / CYCLE / VOLTS
DRIVER	25	60	4	3 / 60 / 460

PUMP	MOTOR FRAME	DISCH. SIZE	DIMENSIONS																	PUMP WEIGHT (LBS)	BASE WEIGHT (LBS)		
			A	B	C	D	E	F	H	J	K	L	M	N	P	R	S	T	U			V	W
4MSX12	25	4	16.87	12.56	3.50	39.88	55.82	9.82	21.89	7.75	9.88	3.88	2.13	46.09	38.33	9.88	9.88	9.88	34.31	5.06	10.13	1621	90
		6	17.75	13.63	3.50	39.88	55.82	11.90	21.89	9.50	11.90	4.75	3.07	40.30	36.33	9.88	9.88	9.88	35.19	5.06	10.13	1621	112

SERIES 2 SECTIONAL

STATIONARY PARTS	
ITEM QTY.	DESCRIPTION
1	RING, WEARING, CASTING
7	HOUSING, BEARING
31	BOX, JUNCTION
33	COVER, BEARING
35	COVER, BOX, JUNCTION
37	WASHER, GLAND
63	PLATE, ADAPTER
71	GASKET, TERMINAL BOARD
73A	GASKET, TUBE, COOLING FLUID SUPPLY
73B	GASKET, BEARING HOUSING/IMPELLER COVER
89	Mechanical Seal - Secondary
89A	Mechanical Seal - Primary
89B	O-Ring, Line Bearing
119	O-Ring, Stator Housing/Bearing Housing
119C	O-Ring, Bearing Housing/Adapter Plate
119D	O-Ring, Adapter Plate/Casing
119E	O-Ring, Cover, Junction Box
119F	O-Ring, Junction Box/Stator Housing
119G	O-Ring, Cooling Jacket, Upper
119H	O-Ring, Cooling Jacket, Lower
119K	O-Ring, Stator Housing, Cooling Fluid
119L	O-Ring, Cover, Cooling Fluid Impeller, Outer
119M	O-Ring, Cover, Cooling Fluid Impeller, Inner
119N	O-Ring, Heat Exchanger, Outer
119P	O-Ring, Heat Exchanger, Inner
119S	O-Ring Washer, Cooling Fluid Fill/Avent Gland, Cable
133	SNAP RING, HEAT EXCHANGER
193D	HOUSING, STATOR
201	JACKET, COOLING
205	COVER, IMPELLER, COOLING FLUID
211	HEAT EXCHANGER
223	STATOR
229	SENSOR, MOISTURE
231	TUBE, RETURN, COOLING FLUID

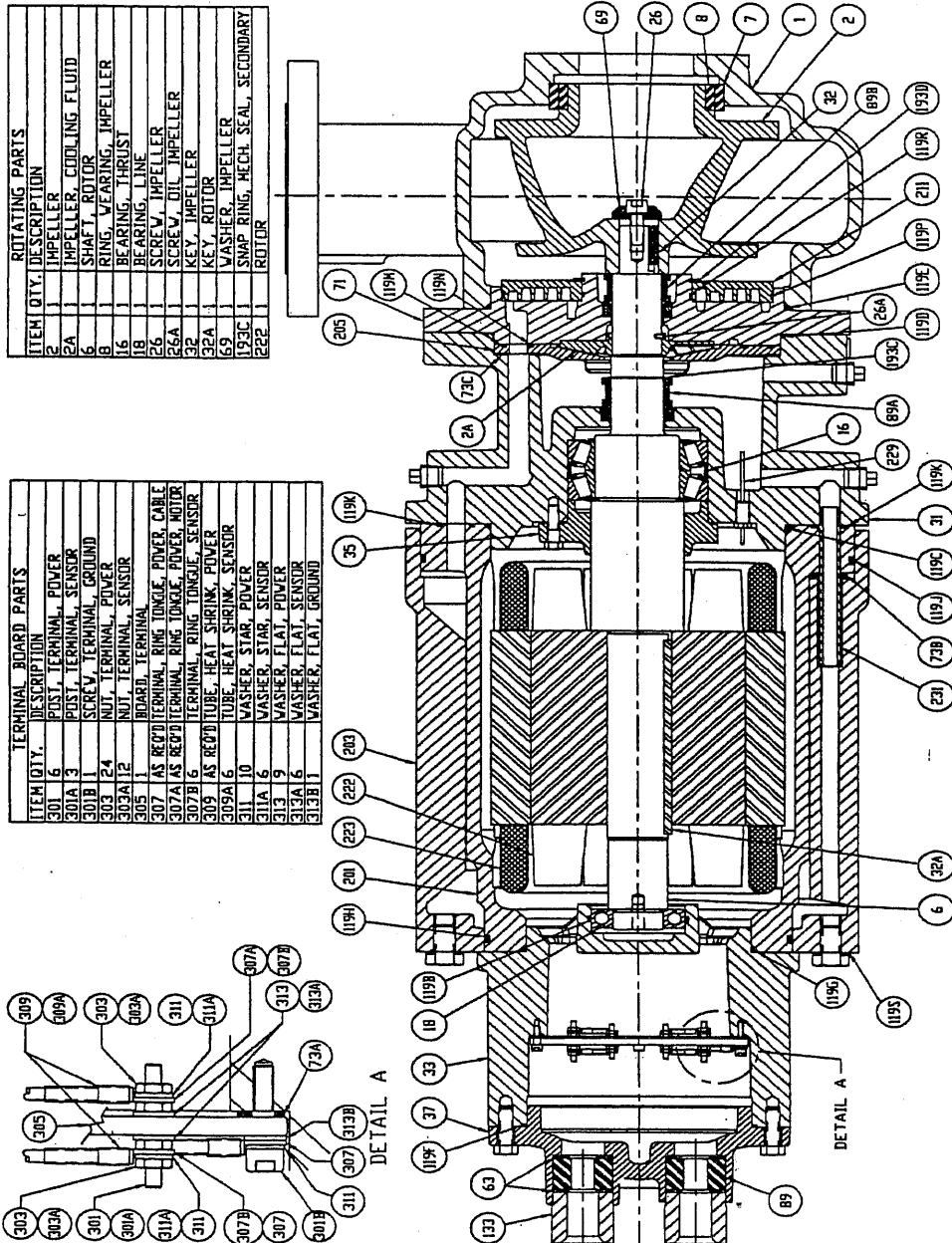
TERMINAL BOARD PARTS	
ITEM QTY.	DESCRIPTION
301	POST, TERMINAL, POWER
301A	POST, TERMINAL, SENSOR
301B	SCREW, TERMINAL, GROUND
303	NUT, TERMINAL, POWER
303A	NUT, TERMINAL, SENSOR
305	BOARD, TERMINAL
307	AS REPTERMINAL, RING TONGUE, POWER, CABLE
307A	AS REPTERMINAL, RING TONGUE, POWER, MOTOR
309	AS REPTUBE, HEAT SHRINK, POWER, MOTOR
309A	TUBE, HEAT SHRINK, SENSOR
311	WASHER, STAG, POWER
31A	WASHER, STAG, SENSOR
313	WASHER, FLAT, POWER
313A	WASHER, FLAT, SENSOR
313B	WASHER, FLAT, GROUND

ROTATING PARTS	
ITEM QTY.	DESCRIPTION
2	IMPELLER
2A	IMPELLER, COOLING FLUID
6	SHAFT, ROTOR
8	RING, WEARING, IMPELLER
16	BEARING, THRUST
18	BEARING, LINE
26	SCREW, IMPELLER
26A	SCREW, OIL IMPELLER
32	KEY, IMPELLER
69	WASHER, IMPELLER
193C	SWAP RING, MECH. SEAL, SECONDARY
222	ROTOR

STATIONARY PARTS	
ITEM QTY.	DESCRIPTION
1	RING, WEARING, CASTING
7	HOUSING, BEARING
31	BOX, JUNCTION
33	COVER, BEARING
35	COVER, BOX, JUNCTION
37	WASHER, GLAND
63	PLATE, ADAPTER
71	GASKET, TERMINAL BOARD
73A	GASKET, TUBE, COOLING FLUID SUPPLY
73B	GASKET, BEARING HOUSING/IMPELLER COVER
89	Mechanical Seal - Secondary
89A	Mechanical Seal - Primary
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119	O-Ring, Stator Housing/Bearing Housing
119C	O-Ring, Bearing Housing/Adapter Plate
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119G	O-Ring, Cooling Jacket, Upper
119H	O-Ring, Cooling Jacket, Lower
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119L	O-Ring, Cover, Cooling Fluid Impeller, Outer
119M	O-Ring, Cover, Cooling Fluid Impeller, Inner
119N	O-Ring, Heat Exchanger, Outer
119P	O-Ring, Heat Exchanger, Inner
119S	O-Ring Washer, Cooling Fluid Fill/Avent Gland, Cable
133	SNAP RING, HEAT EXCHANGER
193D	HOUSING, STATOR
201	JACKET, COOLING
205	COVER, IMPELLER, COOLING FLUID
211	HEAT EXCHANGER
223	STATOR
229	SENSOR, MOISTURE
231	TUBE, RETURN, COOLING FLUID

DUAL VOLTAGE MOTORS	
LOW	HIGH
6 5 4	6 5 4
9 8 7	9 8 7
3 2 1	3 2 1
(WXR)(G)	(WXR)(G)
THERMOSTAT RATING	
AMPS AC-VOLTS	
3.5	200
3.0	230
1.5	460
1.2	575

USE A MANUAL MOMENTARY START SWITCH ONLY



DATE	2502799	SCALE	NONE	SHEET NO.	229	PAGE	1 OF 1
BY							
CHECKED							
APPROVED							
DESIGNED							
MANUFACTURED							
D Ingersoll Dresser Pumps							
HSX SERIES II SECTIONAL							
C-000005							
SECTION B							

MOTOR MAY BE RATED FOR USE IN NFPA 70 CL. 1, DIV. 1, GROUP C&D HAZARDOUS LOCATION. SEE NAMEPLATE. MAINTENANCE ON ANY PART OF THE UNIT MUST BE PERFORMED BY AUTHORIZED INGERSOLL DRESSER SERVICE PERSONNEL. MAINTENANCE BY ANY OTHER PERSONNEL WILL NEGATE THE CERTIFICATION AND VOID THE FACTORY WARRANTY.

REV	DATE	BY	CHKD

PUMP MATERIALS OF CONSTRUCTION

COMPONENT	MATERIAL
Pump Casing	Cast Iron, ASTM A48, CL30
Casing Wear Ring	400 Series Stainless Steel, ASTM A276
Impeller	Type 316L Stainless Steel, ASTM A744
Impeller Wear Ring	400 Series Stainless Steel, ASTM A276
Suction Bell	Carbon Steel
Suction Vane or Cross	Type 316L Stainless Steel
Motor Housing	Cast Iron, ASTM A48, CL30
Cooling Jacket	Cast Iron, ASTM A48, CL30
Seal Plate	Cast Iron, ASTM A48, CL30
Bearing Plate	Cast Iron, ASTM A48, CL30
Cable Entry	Cast Iron, ASTM A48, CL30
Hardware	Type 316 Stainless Steel
Shaft	Type 416 Stainless Steel
Upper Mechanical Seal Faces	Silicon Carbide / Silicon Carbide
Lower Mechanical Seal Faces	Silicon Carbide / Silicon Carbide
Upper Bearing	Deep Groove Ball Bearing
Lower Bearings	Tapered Roller Bearings
O-rings	Buna-N
Cable Entry Grommet	Neoprene
Seal Oil	Environmentally Friendly
Power and Control Cable	UL Listed - W
Impeller Key	Type 416 Stainless Steel
Impeller Bolt	Type 316 Stainless Steel

IMPELLER INFORMATION

Number of Vanes: 2
Maximum Solid Size: 3.0"

SHOP COATING

COATING DETAILS:

Interior and exterior of the casing, exterior of the pump, interior and exterior of the discharge base will receive:

-Sherwin Williams Powder Epoxy

COATING DATA SHEETS:

Data sheets for the coatings specified above are provided on the following page.

SHOP COATING CON'T



POWDURA®

POWDER COATINGS FOR INDUSTRY

EPOXY POWDERS

Providing outstanding chemical resistance and adhesion to wide range of substrates (e.g. template phosphatized steel and glass), Powdura® Epoxy Powders are recommended for functional and decorative applications.

CHARACTERISTICS

Powdura® Epoxy Powders are designed to achieve thin films ranging from 1 – 3 mils. Higher film thickness requirements can be obtained through special techniques and processes.

TYPICAL APPLICATIONS

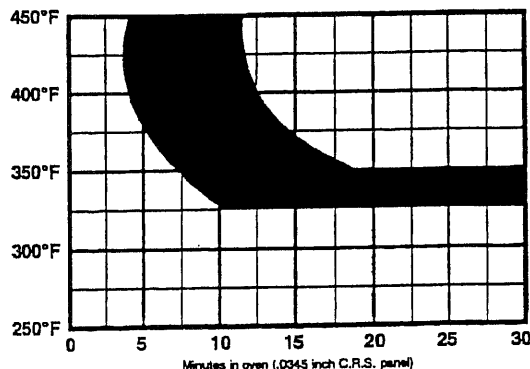
- Steel Furniture
- Refrigeration
- Hospital Equipment
- Underhood Automotive
- Shelving
- Electrical Equipment
- Instrument Casings
- Appliances

STORAGE

Powdura® Epoxy Powder should be kept in a dry and cool area at temperatures below 75°F (24°C). Shelf life ranges from 6 months to over one year. When not in use, store powder in sealed containers: fine powders are hygroscopic.

OVEN CURE TABLE

Cure schedules for Epoxy Powders will follow curve falling within shaded area shown below.



FILM CHARACTERISTICS

Property	Test Method	Result
Adhesion	Cross Hatch ASTM-D3359	Excellent
Hardness	ASTM-D3363	H Plus
Flexibility	ASTM-D1737	180°, 1/4" Conical Mandrel
Specific Gravity	ASTM-D792	1.2 to 2.0
Gloss (60%)	ASTM-D523	2% to 100%
Impact	ASTM-D2794	Up to 160 in lbs.
Salt Spray	ASTM-B117	1000 hrs. +
Humidity	ASTM-D2247	1000 hrs. +

Bonderite 1000® panels were used for all tests performed and electrostatically sprayed at 1.8 – 2.2 D.F.T. (unless otherwise noted).

HANDLING & SAFETY PRECAUTIONS

- The area adjacent to the coating operation should be properly ventilated.
- Cure ovens must be exhausted to the outside atmosphere.
- All dusts are respiratory irritants, inhalation of the dust should be avoided.
- If skin contact occurs, wash thoroughly with soap and water.
- Should eye contact occur, flush with water immediately and procure medical attention.
- To avoid static electricity build-up, properly ground all equipment.
- Provide dust collection equipment with adequate explosion venting; dust clouds of any finely divided organic material can be ignited by open flame or electrical sparks.

CAUTION! Causes eye irritation, causes skin irritation, may cause allergic skin reaction, respiratory irritant, dust may cause eye and respiratory irritation, dust may form explosive mixture in air. Avoid breathing dust. Avoid contact with eyes and prolonged or repeated contact with skin. Use protective clothing and a NIOSH approved respirator. Do not use near sparks or open flame or any type of ignition source. Wash thoroughly after handling. Use only with adequate ventilation.

- DO NOT TAKE INTERNALLY
- KEEP OUT OF THE REACH OF CHILDREN
- FOR INDUSTRIAL USE ONLY
- REFER TO MATERIAL SAFETY DATA SHEET FOR ADDITIONAL INFORMATION

MECHANICAL SEALS

UPPER SEAL (SECONDARY SEAL)

John Crane Type 2100
Shaft Size: 2.38"
Seal/Seat Matl: Silicon Carbide / Silicon Carbide
Elastomer: Buna-N
Metal Parts: 316 Stainless Steel

LOWER SEAL (PRIMARY SEAL)

John Crane Type 2100
Shaft Size: 1.88"
Seal/Seat Matl: Silicon Carbide / Silicon Carbide
Elastomer: Buna-N
Metal Parts: 316 Stainless Steel

MSX INDUCTION MOTOR DATA (Rev 1)

Motor Type: M60-4-460-EX

Shaft HP	60
RPM	1760
Voltage	460
Non Load Current (amps)	27.4
Full Load Current (amps)	72.5
Locked Rotor Current (amps)	415.0
NEMA Locked-Rotor Code Letter	F
NEMA Design Letter	B
Service Factor	1.15
Rating-Duty	40C AMB CONT
Line - Line Resistance @ 25 C	.106 Ohm

Load Characteristics at 460 Volts, 60 HZ

% Of Rated Load	Efficiency	Power Factor	Current
115% FL	93.7	83	89.94
100% FL	94.1	82	72.5
75% FL	94.1	79	56.7
50% FL	93.4	70	43.1
25% FL	89.7	49	32.1

Motor - The pump motor shall be an induction type squirrel cage design. The rotor and stator shall operate in an air-filled, watertight housing. The motor shall have a NEMA B design rating with the stator windings and leads having a Class H insulation rating (180 degree C). The motor housing shall be constructed of ASTM A48, Class 30 cast iron. The motor shall be designed for continuous duty, either submerged or unsubmerged while pumping fluids up to 40 degrees C. Motors shall be capable of handling 15 equally spaced starts per hour. All windings shall be rated for inverter duty to reduce damage caused by voltage spikes associated with variable frequency drives. Thermal switches shall be imbedded in each phase of the windings and set to open at 135 degrees C. The thermal switches shall be wired in series and be connected to the motor controls to shut down the pump during a high temperature condition. The combined service factor of the motor shall be a minimum of 1.15. The motor horsepower shall be selected such that the unit is non-overloading over the entire specified performance range. The submersible motor shall be listed by Factory Mutual as explosion proof for service in Class 1, Division 2, Group C and D hazardous locations.

11060-A. MOTOR DATA FORM:

Equipment Name Pumps

Equipment No.(s) RIV-P-01/02/03

Site Location River Side

Nameplate Markings

Mfr Flouserve Mfr Model 4MSX12 Frame 25 HP 60
 Volts 460 Phase 3 RPM 1760 Service factor 1.15
 FLA 72.5 LRA 415.0 Freq 60 Amb temp rating 40 degrees C
 Time rating Continuous Design letter B
 (NEMA MG1-10.36) (NEMA MG-1.16)
 KVA code letter F Insulation class H

The following information is required for explosionproof motors only:

- A. Approved by ^{FM}UL for installation in Class I, Div I
- B. UL frame temperature code T3C; Group C & D Atmosphere
 (NEC Tables 500-2 and 500-2(b))

The following information is required for all motors 1/2 horsepower and larger:

- A. Guaranteed minimum efficiency 93.0
 (paragraph 11060-2.04 G)
- B. Nameplate or nominal efficiency 94.1

Data Not Necessarily Marked on Nameplate

Type of enclosure Submersible/Explosion proof Enclosure material Cast Iron
 Temp rise 45 degrees C (NEMA MG1-12.41,42)
 Space heater included? Yes No; if Yes, _____ watts _____ volts
 Type of motor winding overtemperature protection, if specified: Klixon

Use the space below to provide additional information on other motor modifications, if specified:

CABLE DATA SHEET

POWER/SENSOR CABLE

CABLE TYPE	CABLE DIAMETER	CABLE LENGTH	QTY.
W	1.025"	100'	1

PURPOSE	COLOR	GAUGE
Power	Red	8
Power	Black	8
Power	White	8
Ground	Green	8
Thermal Switches	Blue	18
Thermal Switches	Orange	18
Moisture Probe	White / Black	18

POWER CABLE

CABLE TYPE	CABLE DIAMETER	CABLE LENGTH	QTY.
W	1.025"	100'	1

PURPOSE	COLOR	GAUGE
Power	Red	8
Power	Black	8
Power	White	8
Ground	Green	8



MODEL MOS-1P OVER-TEMPERATURE AND



SEAL FAILURE DETECTION RELAY

INSTALLATION AND OPERATION INSTRUCTIONS

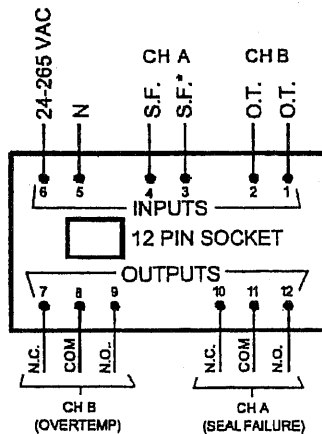
IMPORTANT

1. Measure the resistance between the probe lead wires - or the single lead and ground - using the highest resistance scale on an ohm meter. If this value (which will usually be infinity indicating an open circuit) is greater than 150K ohms, this is the proper model seal failure detector. If less than 150K ohms, the Model MOS-1PR should be used.
2. The unit should periodically be tested using the following procedure:
 - A. Press the Test push button for 5 seconds. When released, both LED's will begin to flash.
 - B. Press the Reset push-button for 5 seconds. If there is no Over-temperature or Seal Failure condition present, both LED's will extinguish.

Upon the occurrence of the first alarm condition, the proper LED will illuminate a steady alarm indication. If the alarm should clear, the LED will then begin to flash, so that the operator will know that at least one alarm occurrence has been detected, and cleared.

The over-temperature circuit requires a normally closed temperature switch in the motor while the seal failure circuit measures the resistance of oil in the seal chamber using two probes or a probe and motor ground.

A Test push button simulates both the over-temperature motor switch and low resistance in the pump seal chamber, and a Reset push button clears the alert indicators after (1) The Test push button has been depressed, or (2) An actual alert has been corrected.

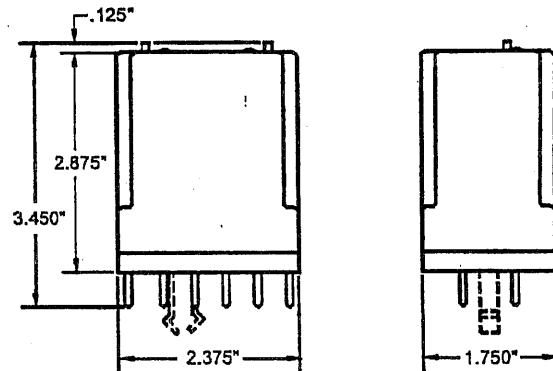


Inputs / Outputs by Pin Number

* Connection for 2 Wire Seal Fail Shown. ON 1 WIRE SEAL FAIL CIRCUITS, ATTACH PIN 3 TO COMMON GROUND POINT WITH PUMP GROUND WIRE.

SPECIFICATIONS

Input Voltage:	24-265 VAC, 50/60 Hz
Power Consumption:	2.8 Watts Max
Power to Sump:	Channel A - < 2 μ A @ 5VDC Channel B - < 25 μ A @ 12VDC
Fusing:	Control power transformer only
Relay Life:	Mechanical - 50 Million Operations Electrical - 10 Million Operations @ 5 Amps (1/6 th HP), 115VAC
Operating Temperature:	-4° F (-20° C) to +140° F (+60° C)
Seal Failure Trip Resistance:	120K Ohms (Nominal)



Inputs / Outputs by Pin Number

1. Over-temperature Output to N.C. Motor Temp. Switch (+12VDC)
2. Return From Motor Temperature Switch; Less Than 25 μ A
3. Return From Seal Failure Probe
4. Output to Seal Failure Probe; Under 6 Volts, < 2 microamps
5. Supply Neutral
6. 24-265 VAC (Nominal), 50 / 60 Hz
7. Normally Closed - Opens on High Temperature Fault
8. High Temperature Relay Common
9. Normally Open - Closes on High Temperature Fault
10. Normally Closed - Opens on Seal Failure Fault
11. Seal Failure Relay Common
12. Normally Open - Closes on Seal Failure Fault

Note: Relays are Electrically Held in Their "Normal" States

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

Multi-Tech Solutions, Inc. • P.O. Box 1264 • Conway • Arkansas 72033-1264 • Tel 501-764-1144 • Fax 501-764-1155



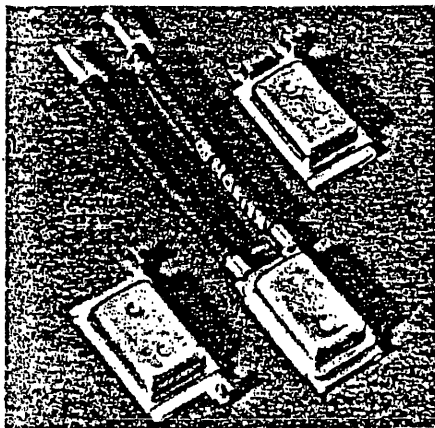
KLIXON
®

**MINIATURE
PROTECTOR**

(REV 1)

**7AM SERIES
SNAP-ACTING**

- Mini-size simplifies installation
- Temperature calibrated and checked in controlled ambients
- Positive make and break with Klixon strip disc
- Uniform repeatability in opening and closing temperatures
- Fixed differential assures lower average winding temperature; no nuisance trip-out when restarting warm motors
- Sealed steel case allows varnish impregnation and baking
- Current and temperature sensitivity for maximum design flexibility
- Wide selection of leads and Mylar™ insulating sleeves



Texas Instruments provides customer assistance in varied technical areas. Since TI does not possess full access to data concerning all of the uses and applications of customers' products, responsibility is assumed by TI neither for customer product design nor for any infringements of patents or rights of others which may result from TI assistance.

The Klixon® 7AM Protector is a miniature, lightweight thermally operated device designed to provide overheat protection for shaded pole and permanent split capacitor motors, fluorescent ballasts, solenoids, transformers and other electrically operated mechanisms.

OPERATION

The 7AM miniature, thermal protector employs the same snap-action principle as many millions of Klixon protectors presently in use. Its circuit is normally closed. The heat from the motor windings together with heat generated by the resistance of the thermal element causes the protector to snap open. When the temperature of the disc reaches its operating value which should

correspond to the maximum safe limit of the winding, the disc snaps open to interrupt the circuit. This permits maximum output while limiting the windings to a safe operating temperature. When the protector reaches the reset temperature of the thermal element, it resets automatically, re-energizing the motor windings.

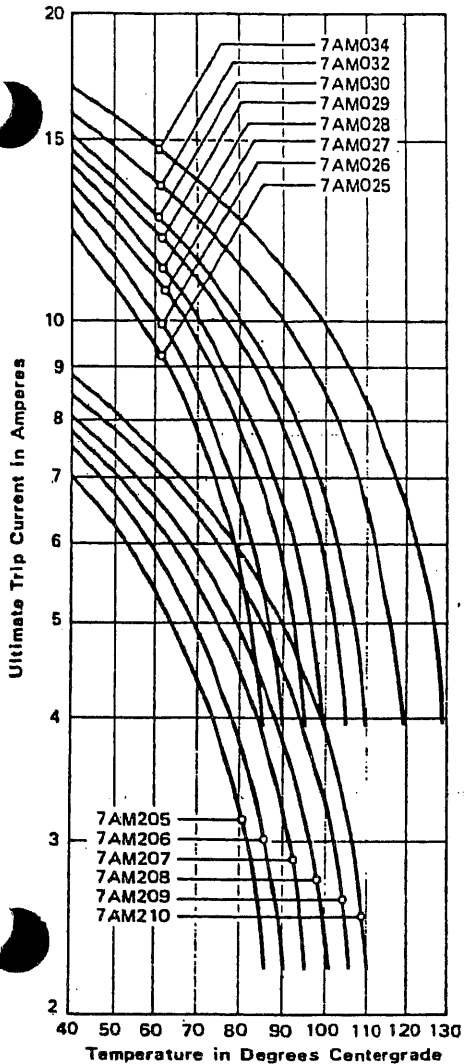
UL AND CSA APPROVALS

	Motor Protector Classed as "Component— Motor Protector devices Inherent Overheating Type"		Fluorescent Ballast Classed as "Component— Temperature—Indicating and Regulating Equipment"	
	UL Recognition Standard No. 547 Guide XEWR2 File E15962 dated 9-19-67	CSA Recognition Spec C22.2 No. 77 Guide 184-N-1390 File 11372C	UL Recognition Standard No. 935 Guide XAPX2 File E34618 dated 9-25-67	CSA Recognition † Spec C22.2 No. 74 Guide 400-E-O Class 4813 File 24458C
Operating temp °C	90°C thru 150°C		90°C thru 115°C	90°C thru 135°C
Electrical ratings Contacts	Not covered		5.5 amps-120V 1.75 amps-277V 1.00 amps-600V	4.5 amps-120V 2.5 amps-277V 1.5 amps-347V 1.25 amps-480V 1.0 amps-600V
Limited * short circuit	1000 amp circuit: 60 amp series fuse - 120V 50 amp series fuse - 240V 20 amp series fuse - 480V		200 amp circuit 20 amp series fuse - 120V and 277V	200 amp circuit 15 amp series fuse for above voltages
Group * fusing short circuit 95°C—150°C	5000 amp circuit: 125 amp series fuse - 120V and 240V 110 amp series fuse - 277V			

†For Canadian manufactured devices use file 24457C—also bulletin number 523A
*Contact factory for specific rating types covered.

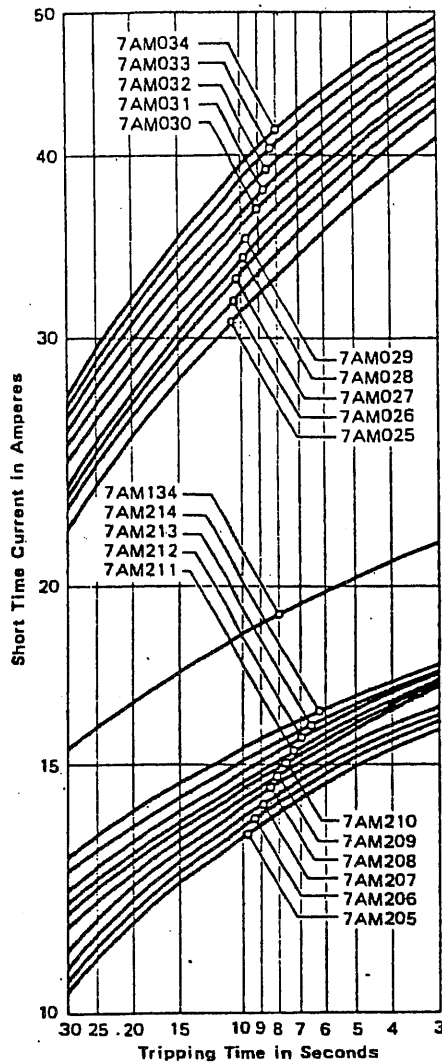
ULTIMATE TRIP CURRENT vs PROTECTOR AMBIENT TEMPERATURE

(Approximate: to be used for selecting samples only)



AVERAGE FIRST CYCLE TRIPPING TIME vs CURRENT IN 25°C AMBIENT

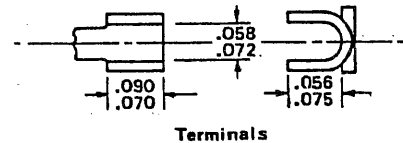
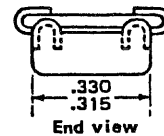
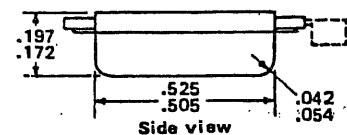
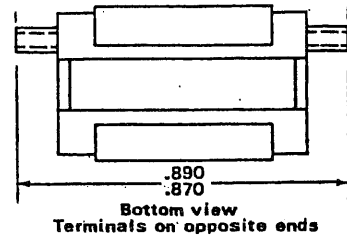
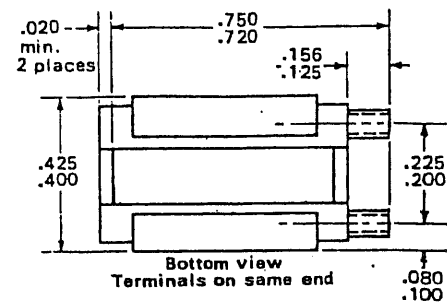
(Approximate: to be used for selecting samples only)



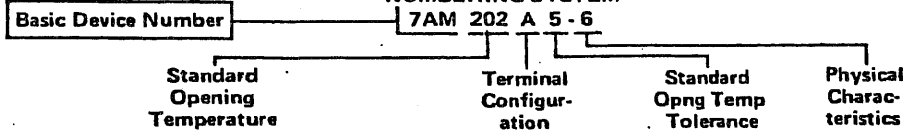
MAXIMUM CONTACT RATINGS

Devices have passed 10,000 cycles under the following conditions:

- A 16 v-dc 20 amperes
- B 115 v-ac 22 amperes
- C 227 v-ac 8 amperes
- D 600 v-ac 4 amperes



NUMBERING SYSTEM



Opng temp °C	Disc thermostat metal ohms/cm ²				Code	Terminals	Code	Tol	Code
	70	125	350	468					
75	022	062	162	262	A	Terminals on same end	5	±5°C	Assigned at factory
80	023	063	163	203			8	±8°C	
85	024	064	164	204			10	±10°C	
90	025	065	165	205					
95	026	066	166	206					
100	027	067	167	207					
105	028	068	168	208					
110	028	069	169	209					
115	030	070	170	210					
120	031	071	171	211					
125	032	072	172	212					
130	033	073	173	213					
135	034	074	174	214					
140	035	075	175	215					
145	036	076	176	216					
150	037	077	177	217					

ENGINEERING TEST SAMPLES

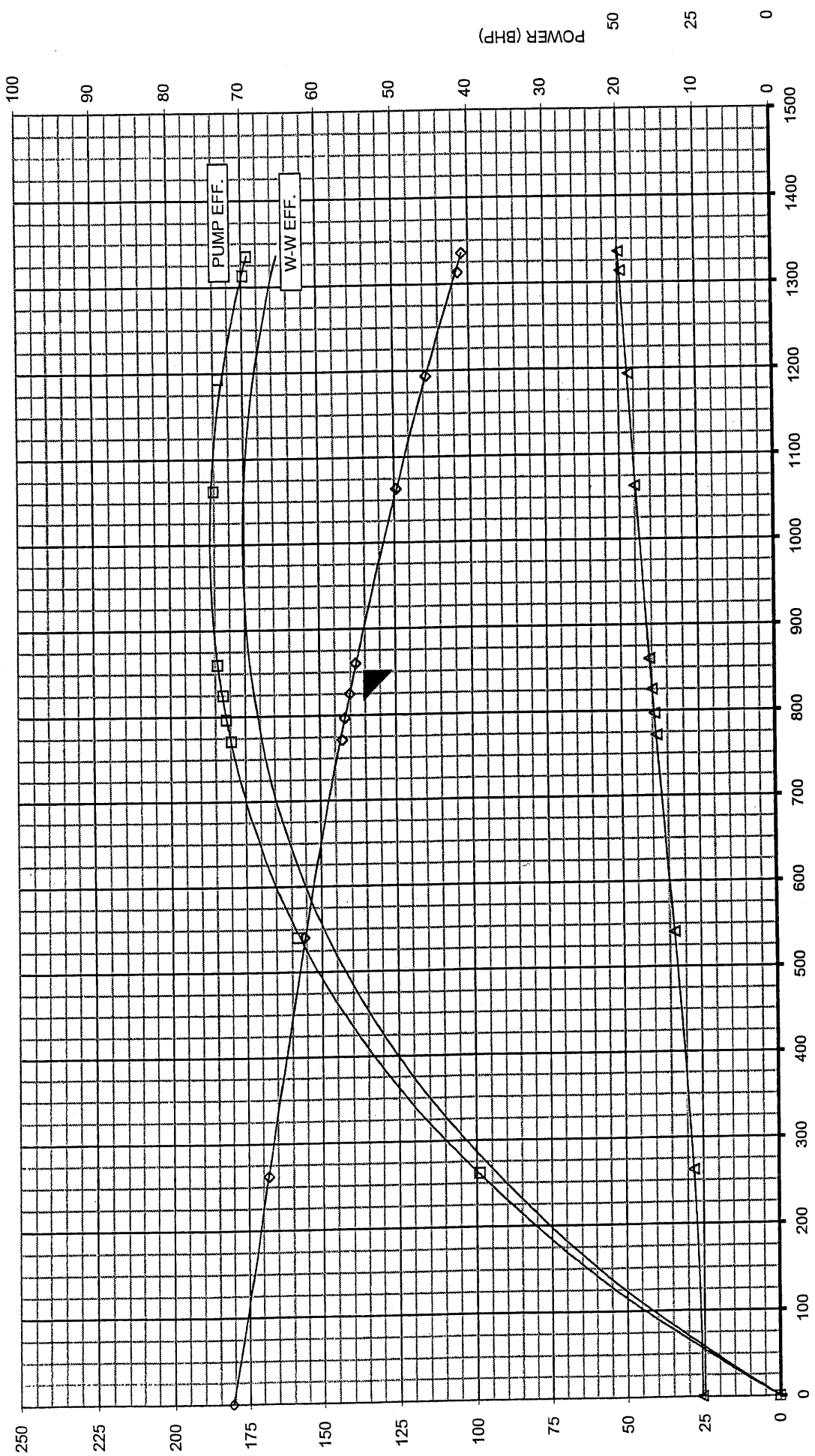
Engineering test samples are available for your particular application. The information requested below will permit selection of sample ratings.

1. Nameplate data (or oper. voltage).
2. Maximum permissible temperature.
3. Minimum continuous current to produce this temperature.
4. Stalled rotor current.
5. Protector location temperature under condition of item 2.
6. Length of time required to reach maximum permissible temperature under condition of item 3.

For further information, write or call: TEXAS INSTRUMENTS INCORPORATED MOTOR CONTROLS MARKETING ATTLEBORO, MASSACHUSETTS 02703 TELEPHONE: 617 222-2800

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TEXAS INSTRUMENTS
INCORPORATED



CAPACITY (GPM)

05M00'235 SERIAL NO.	S3669 ORDER NO.	4MSX12 MODEL	1 STAGES	MSX TEST LOOP	JOB TEST MOTOR	12 MAG FLOW METER	11/21/05 DATE TESTED	1B CURVE NO
IMPELLER DATA CAST IRON MATERIAL 12.00 DIAMETER N/A FINISH DEBURR TIP				CONDITIONS OF SERVICE 852 GPM FLOW 1 SG 136 FT HEAD 1760 RPM SPEED 77 TEMP. (F)		I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 05M002235 <i>Ret B</i>		





FLOWSERVE PUMP DIVISION
Taneytown

PERFORMANCE TEST RESULTS

ORDER NUMBER: S3669
SERIAL NUMBER: 05M002235
MODEL: 4MSX12 -1
TEST DATE: 11/21/05

DATA CORRECTED TO 1760 RPM AND 1 S.G.

FLOW GPM	HEAD FT	POWER BHP	EFFICIENCY %	NPSHA FT
0.0	180.89	25.81	0.00	38.09
262.0	168.22	28.10	39.60	38.09
540.4	155.78	33.59	63.28	38.09
771.1	142.78	38.66	71.91	38.09
796.6	141.92	39.33	72.58	38.09
824.6	140.15	40.00	72.96	38.09
860.1	138.15	40.73	73.66	38.09
1062.7	124.33	45.05	74.06	38.09
1193.7	114.14	46.93	73.32	38.09
1313.2	103.37	49.11	69.79	38.09
1335.4	102.14	49.73	69.26	38.09

structure's natural frequency may therefore differ significantly from the natural frequency of the pump alone.

In the absence of any specific information, the pump manufacturer will assume that the piping is installed rigidly and anchored close to the pump connections. It will also be assumed that the hold-down bolts are securely embedded in a concrete foundation of infinite mass and rigidity.

The system designer must give this proper consideration and must ensure that the natural frequency of the vibrating structure, as defined above, does not fall within the pump operating speed range. He must also be aware of the much lower stiffness of fabricated system structures, relative to concrete, and the problems associated with calculating stiffness of unconventional and composite structures.

Foundation bolts of the specified size should be embedded in concrete and located according to the Elevation Drawing.

Grouting

The purpose of grouting is to prevent lateral shifting of the equipment supports and not to take up irregularities in the foundation. Only non-shrinking grout with a 6000 psi (41.4 MPa) compressive strength in 72 hours should be used. Flowserve Pump Division recommends the following procedure for grouting:

1. Build a wooden form around the outside of the base to contain the grout. In some cases the form is placed tightly against the lower edge of the base and in other cases it is placed a slight distance from the edge of the pump base.
2. Saturate the top of the rough concrete foundation with water, if required, before grouting. Add grout until the entire area under the pump base is filled. A stiff wire should be used to work the grout and release any air pockets.
3. After the grout is poured, the exposed surfaces should be covered with wet burlap to effect slow curing and prevent cracking. When the grout has set (about 48 hours), remove the forms and smooth the exposed surface if desired. The grout should be allowed to cure at least 72 hours before dynamically loading.

CAUTION: IF LEVELING NUTS ARE USED ON THE FOUNDATION BOLTS TO LEVEL THE BASE, THEY MUST BE BACKED OFF AS FAR AS POSSIBLE PRIOR TO GROUTING THE BASE IN PLACE. SHIM NEAR THE FOUNDATION BOLTS, BACK OFF THE LEVELING NUTS AND TIGHTEN THE FOUNDATION BOLTS. TO DO OTHERWISE WILL SIGNIFICANTLY LOWER THE STRUCTURAL NATURAL FREQUENCY AND RESULT IN SEPARATION OF THE BASE FROM THE GROUT.

GUIDE RAIL INSTALLATION

A guide rail installation must be a double, round guide rail system; see Figure 1: Guide Rail System.

1. Install anchor bolts in the bottom of the wet well for the discharge elbow/base. Install the discharge elbow/base – see grouting instructions above. Secure the base with hex nuts and washers.
2. Cut the guide rail pipe to length. The CUSTOMER SUPPLIED guide rail pipe is galvanized or stainless steel, 2-inch round, Sch 40 pipe. Install the guide rails over the tapered plugs on the discharge elbow/base.
3. Place tapered plugs of the upper guide rail bracket in the guide rail pipes and position the upper guide rail bracket so that the guide rail pipes are plumb. Secure the upper guide rail bracket to the top of the well.

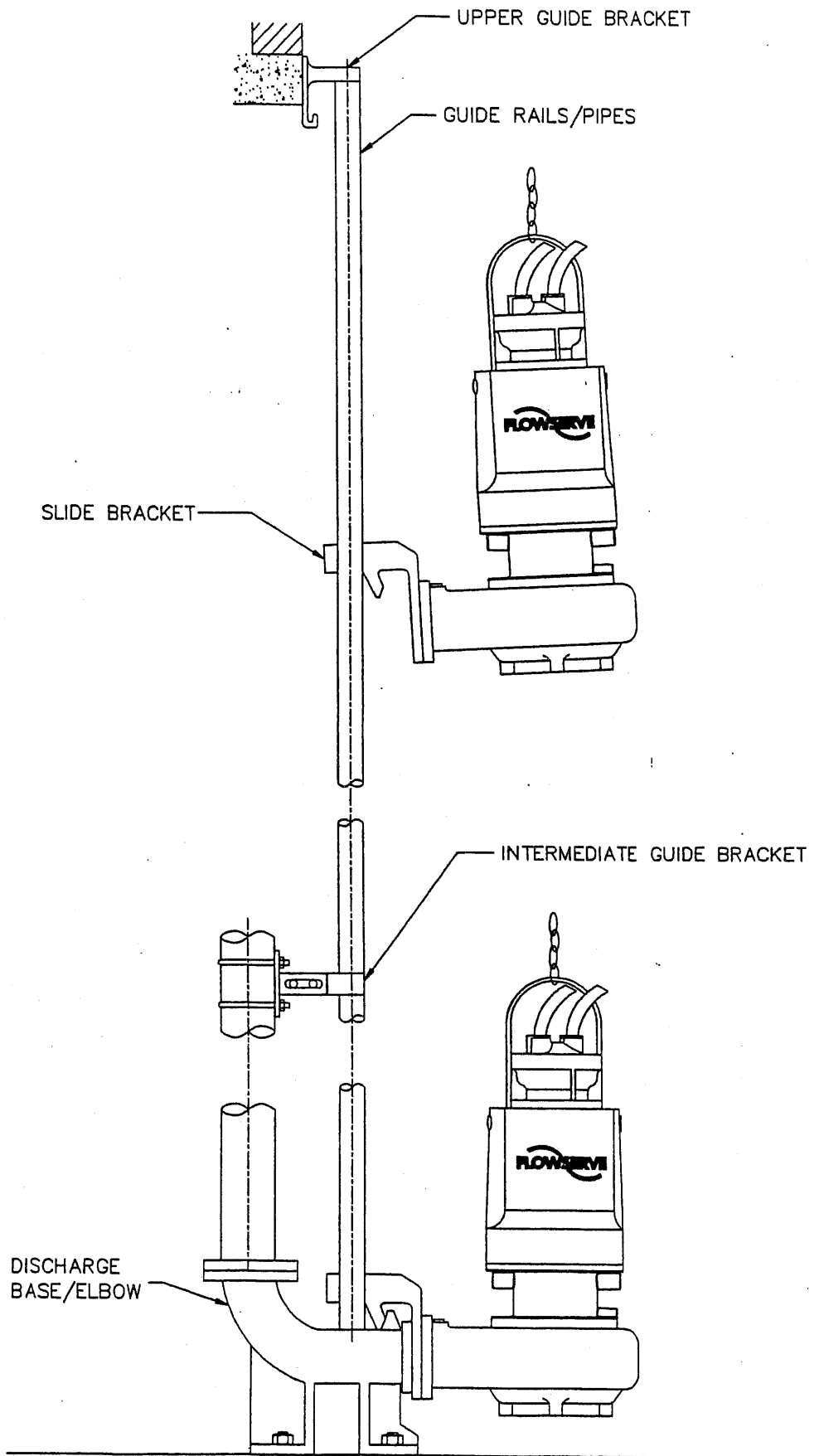


Figure 1: Guide Rail System

DRY PIT INSTALLATION

Piping Strains

Satisfactory operation cannot be maintained when the piping imposes a force on the pump. Misaligned piping flanges can spring and pull a pump out of position when their bolts are drawn up. Flanges must have flat faces and be brought squarely together before the bolts are tightened. To avoid breaking the flanges when tightening the bolting, mating pipe flanges should also have flat faces and full face gaskets should be used. Suction and discharge pipes, and associated equipment, should be supported and anchored near, but independent of the pump so that no strain will be transmitted to the pump casing.

CAUTION: PIPE COUPLINGS WHICH ARE NOT AXIALLY RIGID ARE SOMETIMES USED IN THE DISCHARGE AND/OR SUCTION PIPING TO AVOID TRANSMITTING ANY PIPING STRAINS CAUSED BY SYSTEM PRESSURE, THERMAL EXPANSION, OR PIPE MISALIGNMENT. SUCH PIPE COUPLINGS ALLOW TRANSMITTAL TO THE PUMP, A FORCE EQUAL TO THE AREA OF THE EXPANSION JOINT TIMES THE PRESSURE IN THE PIPING. THESE FORCES CAN HAVE A SIGNIFICANT MAGNITUDE AND IT IS IMPRACTICAL TO DESIGN THE PUMP CASING, SUPPORT, ETC., TO WITHSTAND THEM. CONSEQUENTLY, WHEN PIPE COUPLINGS LACK AXIAL RIGIDITY, A SUITABLE PIPE ANCHOR MUST BE INSTALLED BETWEEN IT AND THE PUMP. ALTERNATELY, ADEQUATE RESTRAINING DEVICES SHOULD BE USED AND PROPERLY ADJUSTED TO PREVENT THESE FORCES FROM BEING TRANSMITTED TO THE PUMP.

Suction Piping

Experience has shown that the major source of trouble in centrifugal pump installations, other than misalignment, is traceable to a faulty suction line. The utmost attention must be given to this portion of the installation to ensure that the pump receives hydraulically stable flow. The suction piping should be direct as possible and its length held to a minimum. If a long suction line is required, increase the pipe size to reduce friction losses. Then gradually reduce the pipe size in steps before entering the pump. The piping should be run without having high spots and should have a continual rise toward the pump. This prevents air pockets which inevitably cause trouble. Clean out all debris from the suction line and wet well prior to operating the pumps.

Care should be exercised to keep the suction piping air tight and sealed against leakage. An isolation valve is recommended in the suction line if a positive head exists above the top of the casing. Isolation valves on suction and discharge lines are recommended to facilitate future inspection and repairs.

Discharge Piping

A check valve and a gate valve are normally installed in the discharge line. The check valve is normally placed between the pump and the gate valve to protect the pump from any excessive back pressure and reverse rotation which may be caused by water running back through the pump casing during a driver or power failure. Any reverse flow through the pump or excessive back pressure should be kept to an absolute minimum. The check valve will also prevent suspended solids from accumulating in the casing and will increase wearing ring life.

Instrumentation

A compound pressure gauge should be connected to the suction and a pressure gauge connected to the discharge side of each pump. Mount the gauges at a convenient location as they are necessary for any adequate check on pump performance.