Power Unit – Electrohydraulic

Operation Manual

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Revision History

Rev	Date	Reason
B	01/26/15	Revised format
C		

Description of Change

Rev	Change
B	Combined Hydraulic and Electrical Troubleshooting, incorporated Safety Issues into other sections. Replaced Marathon manual with WEG and added Appendix B, C, D and E

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GENERAL

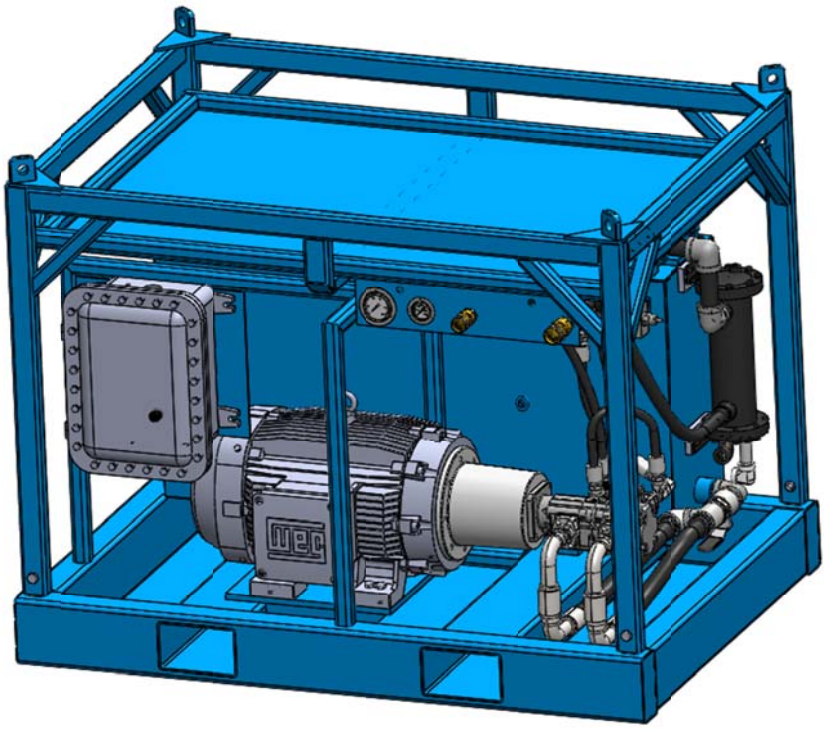


Figure 1: Power unit

Texas International Oilfield Tools (TIOT) offers a Power Unit which operates many types of hydraulic equipment. The unit is mounted on a skid for easy transport.

Large forces are involved in using this device. Operate this equipment with extreme caution

CONVENTIONS

IMPORTANT SYMBOL IDENTIFICATION	
	WARNING to Operators / Users
	CAUTION to Operators / Users
NOTE	**NOTIFICATION** to Operators / Users

Table 1

SAFETY

Texas International's equipment is used and installed in controlled rig environments involving hazardous operations and situations.

All personnel performing installation, operations, repair or maintenance on this Power Unit must have knowledge of rig procedure. All crew in the vicinity of operations should be trained on rig safety and tool operation.

SPECIFICATIONS

Item	Size			Dry Weight (lbs)	Full Weight (lbs)
	L	W	H		
Power Unit	97-1/8"	52"	60-7/16"	3159	4023

Table 2

Item	Power (hp)	Speed (rpm)	Frequency (hertz)	Voltage (3 phase)	Amperage	Features
Motor	75	1500	50	190/380	206/103	Explosion proof, Continuous duty
	100	1800	60	230/460	226/113	

Table 3

Item	Stage	Gear	Displacement	Mount	Motor Frequency (hz)	Pressure (psi)	Flow Rate (GPM)	Max operating pressure
Pump	Dual	Heavy Duty	5.10 cu in/rev	SAE C	50	2500	66	2500 psi
						1000	31	
					60	2500	79.5	
						1000	37.5	

Table 4

Item	Features	Maximum (gal)	Working (gal)	Recommended operating temp
Hydraulic Tank	Sight and temperature gauges	135	118	100 - 130 deg F
	Filtered breather			
	Top access hatch			
	Fully welded steel construction			

Table 5

Item	Features	
Return Filter	Sight gauge	Dirty element
		No element
		Operation OK
	Full flow return line	

Table 6

Item	Factory set
Relief valve - adjustable	2500 psi
Unloader valve - adjustable	1000 psi

Table 7

Standard gauges
Output Pressure 0 - 3000 psi oil filled
Tank Temperature
Tank Level
Filtration status

Table 8

Optional	Gauges	Voltmeter
		Motor Temp
		Hour Meter
		Tachometer
	Remote Start/Stop	
	Low Oil Level Shutoff	

Table 9

Item	Features
Frame	ASTM A36 steel construction
	Lift eyes on top
	Fully welded belly pan
	Full length forklift tubes
	Removable top
	Drain (plugged) 2"
Starter Station	Explosion proof
	Sealed cast aluminum

Table 10

Item	Features	Operating pressure	Max flow rate
Oil Cooler	Oil/water type	500 psi	80 GPM
	Oversized for hot climates		
	1" NPT water inlet and outlet		
	2:1 Oil to Water ratio		

Table 11

Motor	TIOT Part No.
75 HP	T1136E-50
100 HP	T1136E-60

Table 12

Do not exceed the system's rated pressure or over tighten fittings

INSTALLATION

1) Find the best location
2) place the unit, connect power, and make hydraulic connections
3) test the unit for proper operation

The electrohydraulic power unit requires a source of line or rig power capable of delivering the voltage and amperage needed.

Always ensure the unit is properly grounded

It's important to consider electric and hydraulic line losses from size, length and pressure (hydraulic) in choosing where to place the unit. The sizes of the hydraulic lines should be large enough to limit friction losses to 300 psi or less. This may mean using hoses larger than the connections on the unit. For connection instructions, see Hydraulic section page 10.

Proper hose connection is required to fully open the check valves in the hose couplings

The presence of hazardous locations should be compared with the rating of the power unit for compatibility. Ideally, the unit will be located as close as possible to the electrical power source and the equipment to be powered. Ensure power cables are placed where they won't be cut, nicked, or squeezed.

The motor develops almost 300 foot-pounds (ft/lb) of torque while running, 485 ft/lb with the rotor locked and foreign objects (i.e. loose clothing, long hair, etc.), can be drawn in - with disastrous results

NOTE

Main breaker must be off and "locked out" until all wiring and wiring inspection is done. Wiring must be performed by a qualified, licensed electrician

When properly connected, the motor rotates clockwise when looking from the pump towards the motor.

Replace the cover on the pump to motor coupling housing once rotation is verified

Transport the power unit using **only** the forklift tubes provided shown in Figure 2.

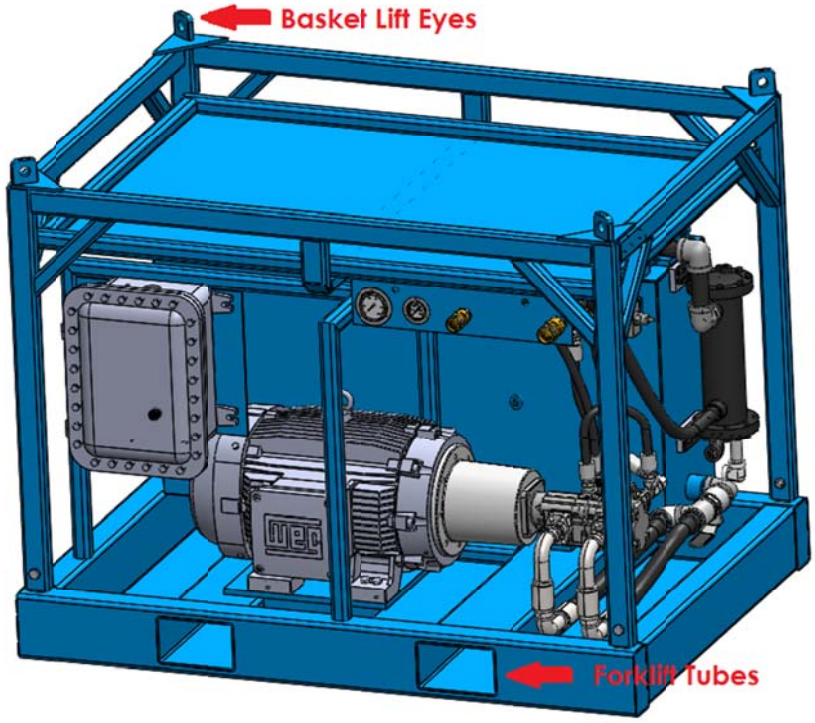


Figure 2

Use the top lift eyes to remove the top basket from the frame/skid - NOT designed for lifting entire skid

If the unit is full of hydraulic oil the center of mass is approximately in the center of the forklift tubes. If the unit is empty, the center of mass is still between the forklift tubes but biased to the motor end.

Positioning forklift forks in other positions can damage the unit and can be dangerous to personnel

Ensure the unit does not shift or move from its intended location.

HYDRAULIC

The power unit during operation heats the hydraulic fluid. If the reservoir temperature exceeds 150 degrees Fahrenheit (F), shut down the unit and let it cool. If this happens regularly, have unit repaired.

Be careful not to expose skin to hot hydraulic fluid – it can scald

Time and Temperature Relationship to Severe Burns

Water temperature		*Time for a third degree burn to occur*
155° F	68° C	1 second
148° F	64° C	2 seconds
140° F	6 0° C	5 seconds
133° F	56° C	15 seconds
127° F	52° C	1 minute
124° F	51° C	3 minutes
120° F	48°C	5 minutes
100° F	37° C	safe temperature for bathing

Figure 3*

*American Burn Association SCALD INJURY PREVENTION, Educator's Guide

The hydraulic fluid may be under pressures as high as 2500 psi. Fluid can be sprayed some distance, creating a slip hazard. If a leak occurs, shut down the power unit

immediately and repair. Hydraulic fluid can irritate the skin – for skin contact, wash and rinse the affected area. If fluid comes in eye contact, use an emergency eyewash or flush with saline solution. If not available, flush with distilled or lastly, tap water. Seek medical attention after flushing.

Avoid the hydraulic fluid spray– it can be injected through the skin at high pressures

The power unit is equipped with Snaptite 78 series quick disconnect couplings (or equivalent), one (1) inch for the supply line and one and a quarter (1-1/4) inch for the return line. These couplings contain check valves to prevent the loss of hydraulic oil during connection and disconnection.

Proper connection is required to fully open the check valves in the couplings

Connect the hoses as follows:

1. Wipe the connections clean as required to remove dirt and dust

2. Connect the one (1) inch pressure hose to the one (1) inch coupling on the unit by engaging the mating coupling halves and forcing the connectors together while rotating the threaded sleeve on the hose connector

3. Using the same method as for the one (1) inch hose, connect the one and a quarter (1-1/4) inch return hose

The motor and pump must be off (locked out) before connecting hoses

If either the pressure or return fittings are not fully tightened, the check valve will cause a restriction in the flow. This can result in overheating the fluid, poor tool operation and damage to equipment

Hoses, connections and fittings should be chosen carefully so as not to cause excessive restriction. Restriction in a hydraulic system equals pressure drop and pressure drop equals heat. Improper connection or restrictive circuits can cause a serious loss of power and will generate heat uselessly. Choose short, large inside diameter hoses whenever possible over long, skinny ones.

High temperatures decrease the useful life of the hydraulic oil, the hoses and the seals in the equipment being powered

Low hydraulic fluid level can cause overheating, or in worst cases severe damage to the pump and even the associated tools it's driving. Keep fluid up to at least the minimum on the sight gauge. Observe the filtration monitor to be sure it's operating in the green (OK) range. Change the filter if it's not.

Recommended Oils
Mobil DTE 24
Castrol Hyspin VG 32
Royal Purple Syndraulic 32
Shell Tellus 32
PetroCanada Environ AW 32
ISO viscosity grade 46*

* for warmer climates

Table 13

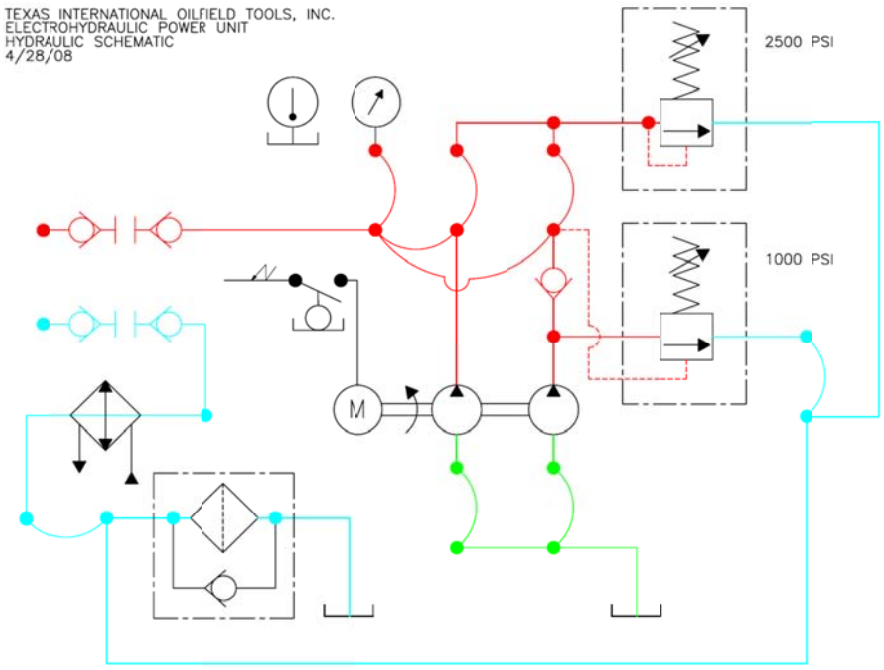


Figure 4

Color Line	Function
Red	Pressure
Aqua (blue)	Return
Green	Suction

Table 14

OPERATION

On the power unit, an electric motor drives a dual stage pump at a setting of 1500 rpm (50 hertz (hz)) or 1800 rpm (60 hz). The pump draws hydraulic fluid from the tank and delivers hydraulic fluid up to 2500 psi on the pressure line, adjustable at the unloader valve (preset at 1000 psi). The pump delivers 66 GPM at 50 hz and 79.5 GPM at 60 hz. As the line pressure decreases to 1000 psi, volume decreases to 31 or 37.5 GPM (depending on frequency). The higher volume stage of the pump is literally “unloaded” at 1000 psi, simply transferring its volume from the tank directly back to the tank through the return full flow filter with only a few psi pressure. The lower volume stage of the pump is always supplying fluid to either the output disconnect or the relief valve at system pressure. The relief valve has a maximum (factory) setting of 2500 psi. The 2500 psi setting is the maximum recommended output pressure for the standard pump. Theoretically the unit could produce 2971 psi at full motor rated output, but pump life will be shortened, possibly dramatically. See the Adjustment section on page 14 for how to change these setting.

The unit is slightly overpowered for long service life. Exceeding the factory set pressures is not recommended

For startup and shut down:

1) Push the START button on the main enclosure or on the remote start/stop switch
2) To turn the unit off, press in the STOP button

Figure 5

If the power unit shuts down prematurely, press the RESET button on the main enclosure. If this happens repeatedly, an abnormal condition exists which must be found and fixed before continuing operation

Cooling is provided on the return line with a two pass oil to water cooler (item 20 on Figure 7). The cooler is capable of removing nearly the entire horsepower rating in heat, keeping hydraulic temperatures low for safety and for system longevity and is easily achieved with a reasonable flow of cooling water. Controlling the temperature is done by manually adjusting the flow of the cooling water source while observing the thermometer.

Full filtration is equipped on the return line. The filter (item 7 on Figure 7) is mounted on the top of the tank and has a filter condition indicator mounted on the side of the filter housing. The condition indicator shows when the filter is operating properly, is bypassing (dirty filter), or is missing. Keeping the filter in good condition is strongly recommended, as dirt in the system will increase wear in the pump, valves and connected tongs or other hydraulic tools.

Hoses and fittings have JIC swivel connections, SAE flange connections, or NPT connections. A shutoff valve (Figure 7, item 12) is on the tank so it can be drained and serviced.

ADJUSTMENTS

The relief valve adjustment is shown in Figure12 - item 13. Turning the adjustment screw clockwise (in) raises the relief pressure and turning it counterclockwise lowers the relief pressure. Tools required: 5/32” Allen wrench (screw) and 9/16” wrench (locknut).

Adjustments should be made with the oil at normal operating temperature of 80 to 130 degrees F

The relief valve setting can be determined by running the unit with no equipment connected to the quick disconnects and observing the pressure reading on the panel gauge.

Do not operate the unit with equipment disconnected for over five (5) minutes. Keep temperature at or below 130 degree F

Adjusting the unloader valve (shown in Figure 7 - item 6) requires equipment NOT supplied with the power unit (a flow meter (sample shown in Figure 6), JIC plugs, caps and reducers listed below). Changing the setting from the factory setpoint of 1000 psi is not recommended. The adjustment procedure to follow is given in case of field emergency.

1. Back off the relief valve so the relief pressure is well below 1000 psi. As low as it can go is good
2. Shut down the system
3. Disconnect the high volume pump hoses to the relief valve and to the pressure outlet and plug the hoses with one (1) inch JIC plugs
4. Cap one (1) JIC outlet on the high volume pump with a one (1) inch JIC cap
5. Attach the one (1) inch to three eighth (3/8) inch JIC reducer to the other high volume pump outlet
6. Connect the gauge hose and the gauge, connecting them to the one (1) inch to the three eighth (3/8) inch JIC reducer
7. Reduce the setting on the unloader valve to minimum by turning knob counterclockwise
8. Start the system

NOTE Watch for plugged hoses – they might move

9. Adjust the unloader valve to show 1000 psi pressure on the gauge
10. Stop the system, removing all plugs, caps and test equipment and reconnect the hoses
11. Start the system and set the relief valve for 2500 psi

Figure 6

PREVENTIVE MAINTENANCE

This is a suggested PM schedule. The tool owner has the responsibility to adjust the program according to actual tool usage

For hydraulic units, disconnect lines and drain system's pressure before maintenance

Verify that the equipment to be operated is properly connected to the power unit as specified in the Hydraulic section on page 10. Be sure the equipment being operated is an 'open center' hydraulic circuit – meaning that in the neutral position the circuit has full flow from the inlet to the outlet. If not, a 'closed center' adapter must be installed.

Cracks or the appearance of damage on the hydraulic hoses or electrical cabling can indicate the need for repair, even impending failure, and requires prompt attention.

Daily – While in use

- Verify power unit is in a secure and safe location
- Inspect the hydraulic hoses for worn or scraped areas, bubbles, wrinkles or any other wear – if found, replace
- Verify power cables and hydraulic hoses are not a trip hazard and can't be pinched or cut
- Check for exposed wires/breaks in the insulation and that electrical connections are secure
- Notice the hydraulic level and ensure tank is filled to the proper level

Most items in the unit are lubricated by the hydraulic fluid and don't require other lubrication other than to ensure the hydraulic fluid is clean

- Verify the cooling water supply is connected and flowing

Oil temperature will increase 80 degrees Fahrenheit in 20 minutes without water flow

- Ensure the shutoff valve to the pump inlet is fully open
- Keep the power unit exterior clean of oil, dust, dirt, water or chemicals
- Once operating, check the return filter state

Quarterly

- Replace return filter or earlier if the filter's indicator gauge shows a dirty element (before needle is in the red)
- Change the hydraulic fluid every three (3) to six (6) months – see recommended fluid on Table 13

Yearly

- Apply Mobil Polyrex® EM grease (see Appendix A) to grease fittings on motor every 9000 hours

TROUBLESHOOTING

Failure Mode	Possible Cause	Possible Solution
Pump excessively noisy	Pump inlet flow	Ensure that nothing in tank blocks tank outlet
		Verify suction shutoff valve is wide open
	Oil viscosity is too high	Change oil to a lower ISO VG grade
	Air	Pour oil over suction side fitting - if noise stops, disassemble, retape and reassemble
	Pump rotation is wrong	Shut down and change electrical hookup. Verify rotation is counterclockwise - looking from the motor to the pump
	Loose or worn parts	Verify assembly is tight - replace worn out parts
Hydraulic system overheating	Cooling water - insufficient	Verify water flow rate is at least 16 GPM
	Relief valve setting	Reset to a maximum of 2500 psi
	Fittings loose	Verify fittings fully tightened
	Oil viscosity	Change oil
	Excessive internal leakage	Check parts for wear - replace/repair
		Check for contamination
	Excess friction	Look at moving parts inside pump for proper fit
	Leaks in pump	Repair/replace valves
Excessive wear of moving parts	Oil contaminated	Change oil. Replace filter element. Clean breather
	Motor to pump alignment	Verify fastener tightness. If OK, replace motor to pump housing and coupling
	Relief valve setting	Reset to a maximum of 2500 psi
	Air	Pour oil over suction side fitting - if oil disappears, disassemble, retape and reassemble
	Oil viscosity is too low	Change oil to a higher ISO VG grade

Table 15

Failure Mode	Possible Cause		Possible Solution
Flow rate (tool speed) is low	Pump inlet flow		Ensure that nothing in tank blocks tank outlet
			Verify suction shutoff valve is wide open
	Pump		Inspect parts and replace as necessary
	Oil is bypassing		Check relief and unloader valves - reset
	Fittings		Confirm fittings are tight
	Oil viscosity		Change oil to a proper ISO VG grade
	Hoses		Use shorter or larger hoses
	Motor speed is low		See 'motor runs and then slows/stops' to follow
Hot or noisy operation	Misalignment		See 'motor vibrates' to follow
	Grease	Insufficient	Lubricate per APPENDIX A
		Deterioration	Remove old and lubricate per APPENDIX A
		Excess	Reduce quantity of grease
	Motor loose		Check mounting bolts are tight
Motor will not start	Electrical Connections		Verify wiring connections/tighten
			Check voltage/amperage/phase
	Relays tripped		Allow at least five (5) minutes cooling time, then push the reset button followed by the start button
	Starter heater/relay		Replace
	Start button damaged		Replace
	Starter coil damaged		Replace
	Short circuited stator		Rewind motor
	Motor overloaded		Adjust or replace hydraulic valves
Motor stalls	Electrical Connections		Check for open phase
	Motor overloaded		Adjust or replace hydraulic valves
	Low motor voltage		Verify voltage at motor
	Open circuit		Check fuses, overload relay, stator and switches
Motor runs and then slows/stops	Power failure		Verify wiring connections/tighten
Motor overheats	Overload		Adjust or replace hydraulic valves
Motor overheats while under load	Motor vents clogged		Check vents - remove cover and clean as necessary
	Motor connections		Verify all three (3) phases have equal voltage
	Enclosure terminals		Verify all three (3) phases have equal voltage
Motor vibrates after corrections	Pump mounting housing bolts		Tighten
	Motor connections		Verify all three (3) phases have equal voltage
	Coupling damaged		Remove and examine coupling, replace if needed
Wrong Rotation	Phases not correct		Reverse any two connections at the contactor
Unbalanced line current	Unequal terminal voltage		Verify leads and connections
	Single phase		Check for open contacts
Motor does not accelerate properly	Low motor voltage		Verify voltage at motor
	Overload		Adjust or replace hydraulic valves

Table 15 continued

STORAGE AND TRANSPORTATION

- Unpainted surfaces should be coated with rust preventing agent
- Prevent excessive exposure to water and moisture
- Clean the tool after use - steam clean as needed; remove mud, debris and any other substances
- For long term storage, depressurize the system and flush hydraulic fluid

PARTS LIST

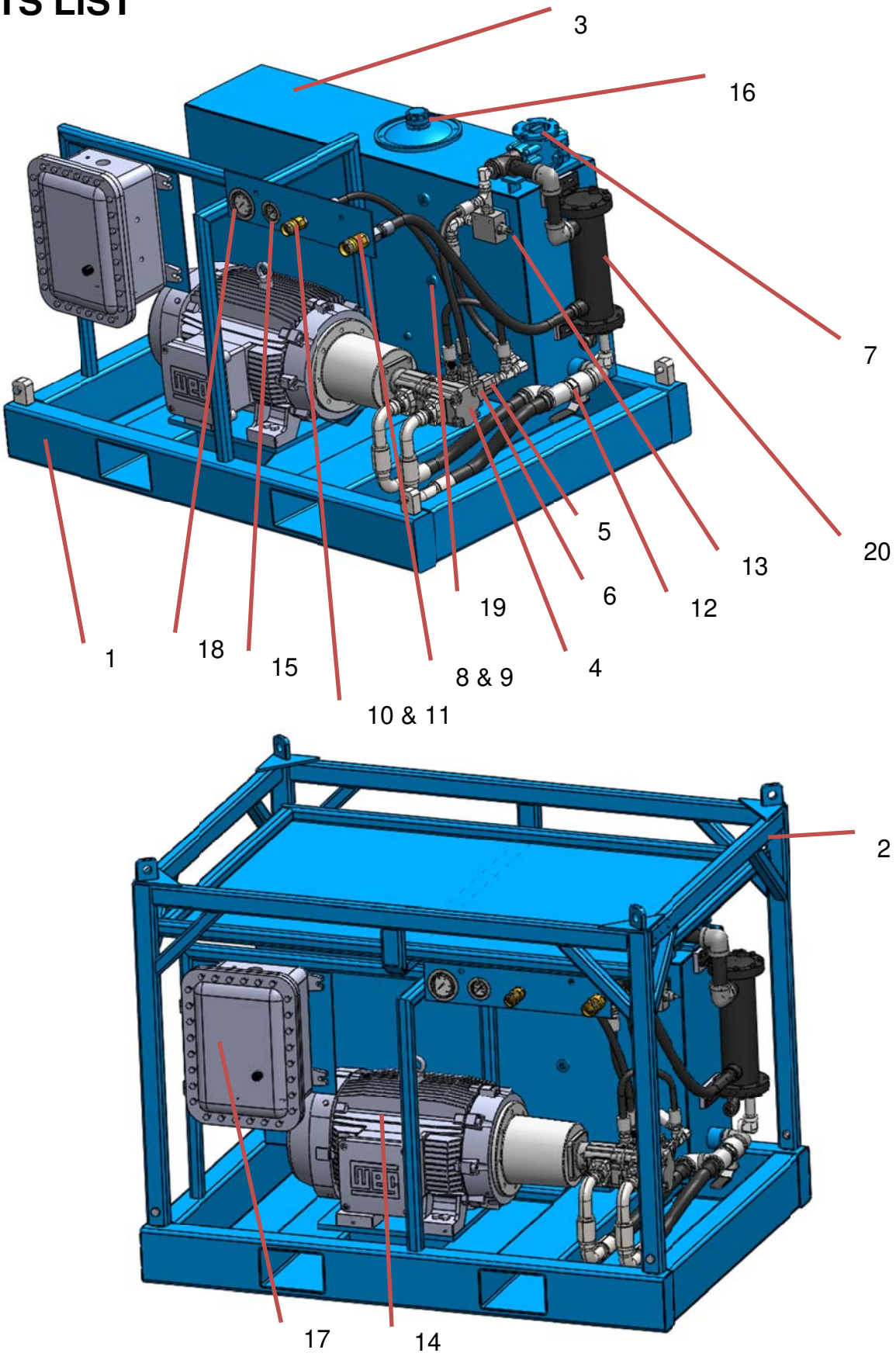


Figure 7 – Electrohydraulic power unit

		ASSEMBLY P/N	T1136E-50	T1136E-60
#	Component	Qty	P/N	P/N
1	SKID	1	T1136E-1	
2	BASKET	1	T1136E-2	
3	TANK, HYDRAULIC	1	T1136E-3	
4	PUMP	1	060023	
5	VALVE, CHECK INLINE	1	060024	
6	VALVE, UNLOADING	1	060025	
7	RETURN FILTER - RFP	1	060017	
8	FEMALE QUICK DISCONNECT RETURN	1	030061	
9	RETURN CAP	1	030060	
10	FEMALE QUICK DISCONNECT PRESSURE	1	030062	
11	PRESSURE CAP	1	030063	
12	BALL VALVE, SHUT OFF	1	060020	
13	RELIEF VALVE	1	060018	
14	MOTOR	1	1136E-50*	1136E-60
15	GAUGE, PRESSURE	1	060012	
16	FILLER CAP/FILLER BREATHER	1	T17567-38	
17	IEC STARTER STATION	1	n/a	12875E
18	ANALOG PANEL THERMOMETER	1	060064	
19	SIGHT GAUGE PLUG	3	060065	
20	OIL COOLER	1	060026	

*includes starter

Table 16: Figure 7 BOM

SPARE PARTS LIST

Component	Req	P/N
Element for Return Filter	2	060040
Fuses, 13/32" dia x 1-1/2"L, 3-2/10 amp	6	FNM-3-2/10
Fuses, 13/32" dia x 1-1/2"L, 2-1/2 amp	6	FNQ-R-2-1/2

Components for Remote location	Req	P/N
Contactor, Coil Voltage VAC Nom 120V	1	LC1F185
Contactor, Auxiliary 2 pole, 10 amp	1	LA1-DN11
Control Transformer 250VA 2P 380V (50 hz)	1	9070TF250D33
Control Transformer 250VA 2P 460V	1	9070TF250D1
Contact Block 1 NC	1	9001KA3
Contact Block 1 NO	1	9001KA2

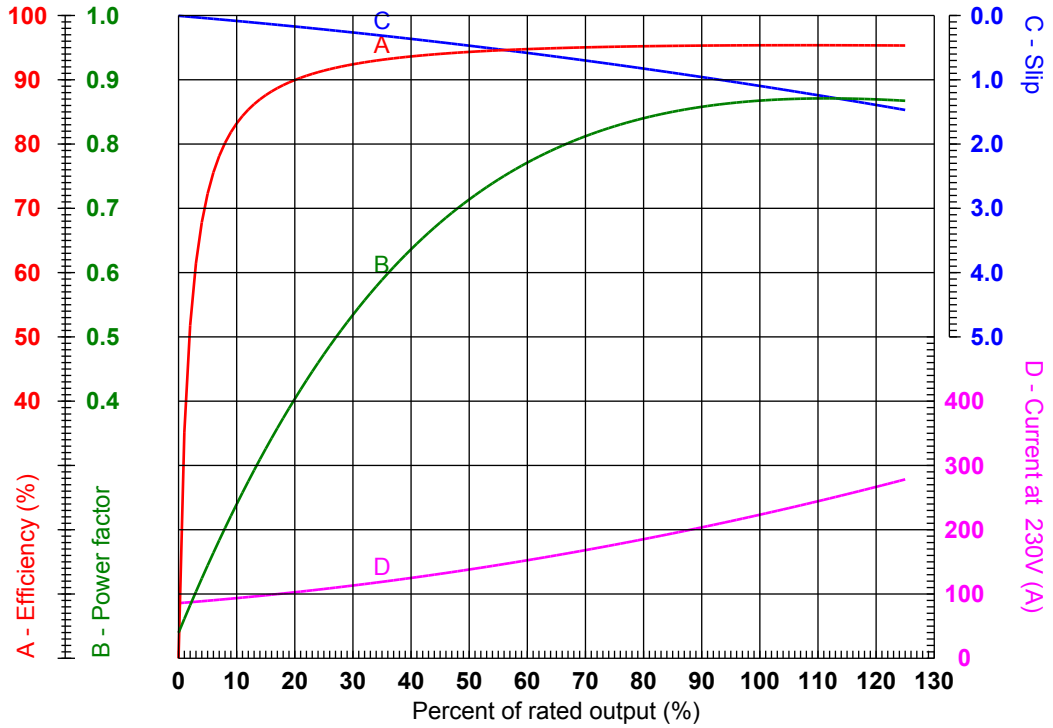
Table 17

APPENDIX A

	No.:
	Date: 11/4/2011

PERFORMANCE CURVES RELATED TO RATED OUTPUT

Three-phase induction motor - Squirrel cage rotor



Customer	:	
Product line	:	Three-Phase : Explosion Proof - NEMA Premium

Output	: 100 HP	Locked rotor current (Il/In)	: 8.7
Frame	: 404/5T	Duty cycle	: S1
Full load speed	: 1780	Service factor	: 1.15
Frequency	: 60 Hz	Design	: B
Voltage	: 208-230/460 V	Locked rotor torque	: 300 %
Insulation class	: F	Breakdown torque	: 320 %
Rated current	: 250-226/113 A		

Notes:

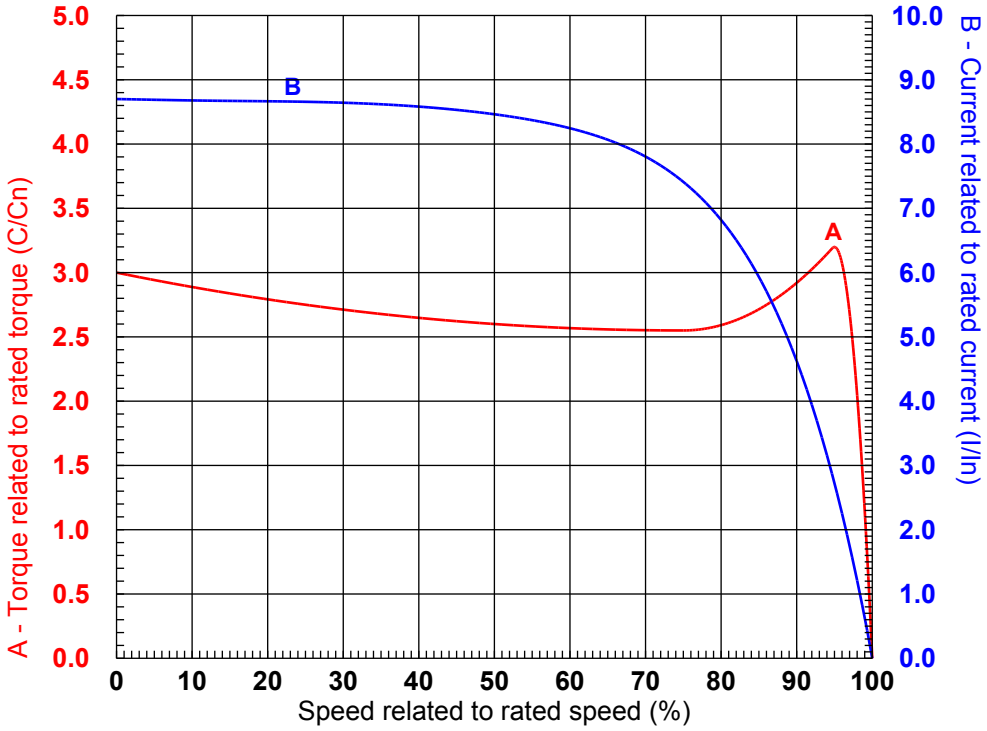
Performed by:	Checked:

APPENDIX A

	No.:
	Date: 11/4/2011

CHARACTERISTIC CURVES RELATED TO SPEED

Three-phase induction motor - Squirrel cage rotor



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Full load speed	: 1780	Service factor	: 1.15
Frequency	: 60 Hz	Design	: B
Voltage	: 208-230/460 V	Locked rotor torque	: 300 %
Insulation class	: F	Breakdown torque	: 320 %
Rated current	: 250-226/113 A		

Notes:

Performed by:	Checked:

APPENDIX B

		No.:
		Date: 18-FEB-2015

DATA SHEET
Three-phase induction motor - Squirrel cage rotor

Customer	:	
Product line	:	Three-Phase : Explosion Proof - NEMA Premium

Frame	:	404/5T
Output	:	75 HP
Frequency	:	50 Hz
Poles	:	4
Full load speed	:	1480
Slip	:	1.33 %
Voltage	:	380 V
Rated current	:	103 A
Locked rotor current	:	773 A
Locked rotor current (Il/In)	:	7.5
No-load current	:	42.0 A
Full load torque	:	263 lb.ft
Locked rotor torque	:	270 %
Breakdown torque	:	310 %
Design	:	A
Insulation class	:	F
Temperature rise	:	80 K
Locked rotor time	:	12 s (hot)
Service factor	:	1.00
Duty cycle	:	S1
Ambient temperature	:	-20°C - +40°C
Altitude	:	1000
Degree of Protection	:	IP54
Approximate weight	:	1222 lb
Moment of inertia	:	26.405 sq.ft.lb
Noise level	:	70 dB(A)

	D.E.	N.D.E.
Bearings	6217 C3	6314 C3
Regreasing interval	9149 h	9789 h
Grease amount	21 g	27 g

Load	Power factor	Efficiency (%)
100%	0.86	94.5
75%	0.80	94.5
50%	0.69	94.0

Notes:

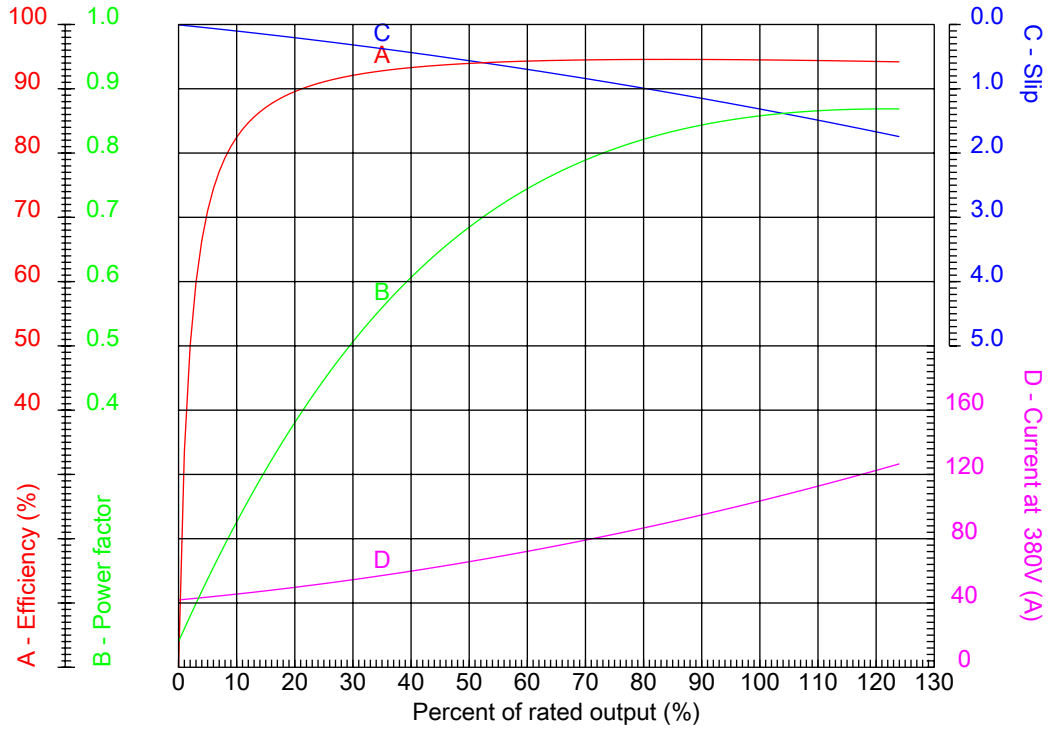
Performed by	Checked

APPENDIX B

	No.:
	Date: 18-FEB-2015

PERFORMANCE CURVES RELATED TO RATED OUTPUT

Three-phase induction motor - Squirrel cage rotor



Customer	:	
Product line	:	Three-Phase : Explosion Proof - NEMA Premium

Frame	: 404/5T	Locked rotor current (Il/In)	: 7.5
Output	: 75 HP	Duty cycle	: S1
Frequency	: 50 Hz	Service factor	: 1.00
Full load speed	: 1480	Design	: A
Voltage	: 380 V	Locked rotor torque	: 270 %
Rated current	: 103 A	Breakdown torque	: 310 %
Insulation class	: F		

Notes:

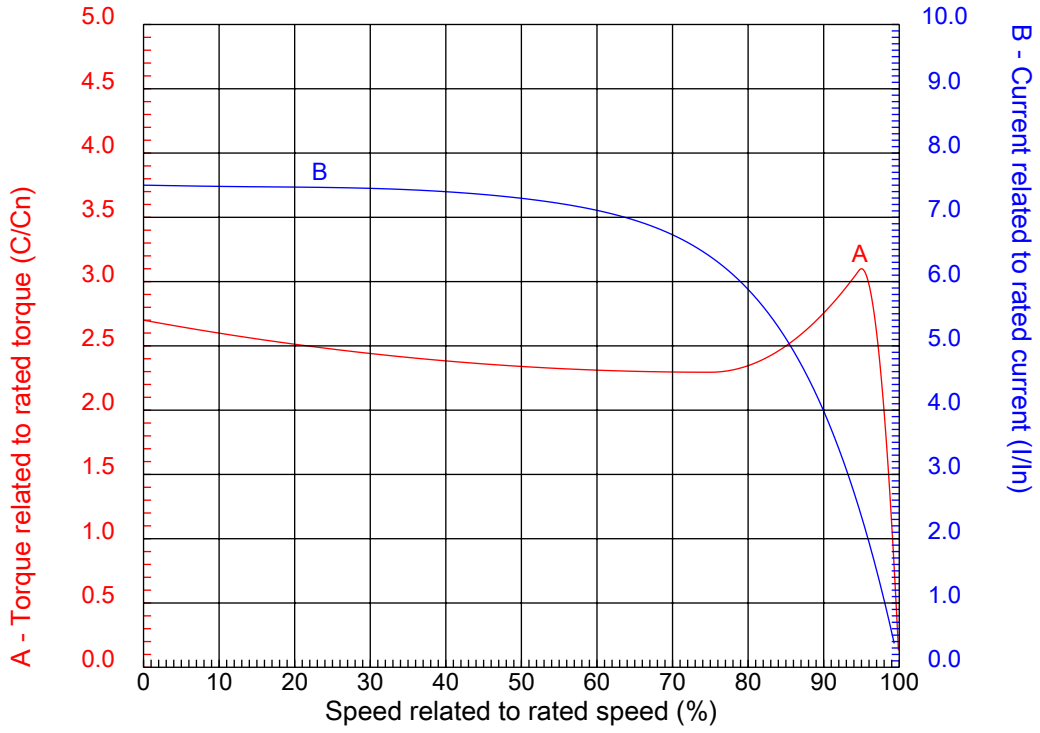
Performed by	Checked

APPENDIX B

	No.:
	Date: 18-FEB-2015

CHARACTERISTIC CURVES RELATED TO SPEED

Three-phase induction motor - Squirrel cage rotor



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Notes:

Performed by	Checked

TOTAL SYSTEMS SOLUTIONS WORLDWIDE™

APPENDIX C

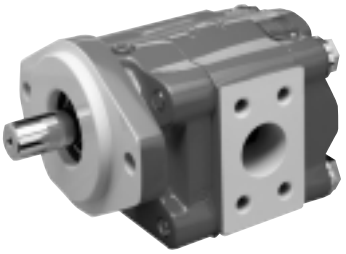
Commercial Hydraulics™

P30/31™, P50/51™, P75/76™ Series Single and Multiple Pumps and Motors

Pressure to 3000 PSI/175 BAR

Output to 120 GPM/ 454 LPM

Motors up to 135 HP



Contents

Average Output Flow - Pumps

PERFORMANCE DATA

Performance data shown are the average results based on a series of laboratory tests of production units and are not necessarily representative of any one unit. Tests were run with the oil reservoir temperature at 120°F and viscosity 150 SSU at 100°F. Requests for more specific data should be directed to our Product Support Department through our sales representatives.

Flow data at 2500 PSI (172 bar) unless noted.

P30/31

Speed RPM	Gear Width Inches				
	1”	1 1/4”	1 1/2”	1 3/4”	2”
900	**6.5**	**8**	**10**	**12**	**13.5**
	24.5	30	38	45.5	51
1200	**9**	**11.5**	**14**	**16**	**18.5**
	34	43.5	53	60.5	70
1500	**11.5**	**14.5**	**17.5**	**20.5**	**23.5**
	43.5	55	66	77.5	89
1800	**14**	**18**	**21.5**	**25**	**29**
	53	68	81.5	94.5	110
2100	**16.5**	**21**	**25**	**29.5**	**34**
	62.5	79.5	94.5	112	129
2400	**19**	**24**	**29**	**34**	**39**
	72	91	110	129	148

gpm/*lpm*

P50/51

Speed RPM	Gear Width Inches						
	1”	1 1/4”	1 1/2”	1 3/4”	2”	2 1/4”	2 1/2”
900	**8.5**	**10.5**	**13**	**15**	**17.5**	**20**	**22**
	32	39.5	49	57	66	75.5	83.5
1200	**12**	**15**	**18**	**21**	**24**	**27**	**30**
	45.5	57	68	79.5	91	102	114
1500	**15**	**19**	**23**	**27**	**31**	**35**	**39**
	57	72	87	102	117	132	148
1800	**18**	**23**	**27.5**	**32.5**	**37.5**	**42**	**47**
	68	87	104	123	142	159	178
2100	**21.5**	**27**	**32.5**	**38.5**	**44**	**49.5**	**55**
	81.5	102	123	146	167	187	208
2400	**25**	**31**	**37**	**44**	**51**	**57**	**63.5**
	94.5	117	140	167	193	216	240

gpm/*lpm*

P75/76

Speed RPM	Gear Width Inches								
	1”	1 1/4”	1 1/2”	1 3/4”	2”	2 1/4”	2 1/2”	2 3/4”*	3”*
900	**11.5**	**15.5**	**19.5**	**23**	**27**	**30.5**	**34.5**	**38**	**42**
	43.5	58.5	74	87	102	115.5	130.5	144	159
1200	**17**	**22**	**27**	**32**	**37.5**	**42**	**48**	**52.5**	**58**
	64.5	83.5	102	121	142	159	182	199	220
1500	**22**	**29**	**35.5**	**41.5**	**48**	**54.5**	**61**	**67**	**74**
	83.5	110	134	157	182	206	231	254	280
1800	**27.5**	**35.5**	**43.5**	**51**	**59**	**66**	**74**	**81.5**	**90**
	104	134	165	193	223	250	280	308	341
2100	**33**	**42**	**51.5**	**60**	**69.5**	**78**	**87**	**96.5**	**106**
	125	159	195	227	263	295	329	365	401
2400	**38**	**49**	**59.5**	**70**	**80**	**90**	**101**	**111**	**122**
	144	185	225	265	303	341	382	420	462

gpm/*lpm*

* Flow data at 2000 PSI (138 bar) rated pressure.

Average Input Power - Pumps

Power data at 2500 PSI (172 bar) unless noted.

P30/31

Speed RPM	Gear Width Inches				
	1”	1 1/4”	1 1/2”	1 3/4”	2”
900	**14**	**17**	**20**	**23**	**25**
	11	13	15	17	19
1200	**19**	**22**	**26**	**30**	**33**
	14	17	20	22	25
1500	**23**	**28**	**33**	**37**	**42**
	17	21	24	27	31
1800	**27**	**33**	**39**	**44**	**50**
	20	25	29	33	37
2100	**32**	**38**	**45**	**51**	**58**
	24	29	34	38	43
2400	**36**	**44**	**51**	**58**	**66**
	26	33	38	43	49

HP/kW

P50/51

Speed RPM	Gear Width Inches						
	1”	1 1/4”	1 1/2”	1 3/4”	2”	2 1/4”	2 1/2”
900	**19**	**22**	**26**	**30**	**34**	**38**	**42**
	14	17	20	23	26	29	32
1200	**25**	**30**	**34**	**40**	**45**	**51**	**56**
	18	22	26	30	34	38	42
1500	**31**	**37**	**43**	**50**	**56**	**63**	**69**
	23	27	32	37	42	47	51
1800	**36**	**44**	**51**	**59**	**67**	**75**	**82**
	27	33	38	44	50	56	61
2100	**42**	**51**	**60**	**69**	**78**	**87**	**96**
	31	38	44	51	58	65	72
2400	**47**	**57**	**68**	**79**	**89**	**99**	**110**
	35	43	51	59	66	74	82

***HP**/kW*

P75/76

Speed RPM	Gear Width Inches								
	1”	1 1/4”	1 1/2”	1 3/4”	2”	2 1/4”	2 1/2”	2 3/4”*	3”*
900	**26**	**32**	**39**	**45**	**51**	**58**	**64**	**57**	**62**
	19	24	29	34	38	43	48	42	46
1200	**35**	**43**	**52**	**60**	**69**	**78**	**86**	**76**	**83**
	26	32	39	45	51	58	64	57	62
1500	**44**	**55**	**65**	**76**	**87**	**98**	**109**	**96**	**105**
	33	41	49	57	65	73	81	72	78
1800	**53**	**66**	**79**	**93**	**106**	**119**	**132**	**116**	**127**
	39	49	59	69	79	89	99	87	95
2100	**62**	**77**	**93**	**108**	**124**	**139**	**154**	**136**	**148**
	46	58	69	81	92	104	115	101	111
2400	**71**	**88**	**106**	**124**	**141**	**159**	**176**	**155**	**169**
	53	66	79	92	105	118	132	116	126

***HP**/kW*

* Input data at 2000 PSI (138 bar) rated pressure.

PL Chart		
Shaft Style	**Integral Shaft & Gear**	**Two Piece Style**
30/31		
SAE “A” Spline	2,600	2,600
SAE “B” Spline	7,900	5,850
SAE “B” Key	4,850	4,850
SAE “BB” Spline	12,150	--
SAE “BB” Key	7,250	5,850
SAE “C” Spline	--	5,850
Connecting Shaft	--	5,850
50/51		
SAE “B” Spline	6,100	6,100
SAE “B-B” Spline	9,400	--
SAE “B-B” Key	5,600	5,600
SAE “C” Spline	12,900	8,500
SAE “C” Key	10,900	8,500
Connecting Shaft	--	8,500
75/76		
SAE “C” Single	8,000	8,000
SAE “C” Tandem	12,500	--
SAE “C” Key	7,500	7,500
Connecting Shaft	--	10,000

PL FACTOR

Each section of a multiple pump or motor should be regarded as a single unit with corresponding delivery and power input requirements. Since the entire input horsepower is fed through a common drive shaft, the power delivered to or from the unit is limited by the physical strength of the shaft. This limit is defined as a “PL” factor; “P” being the operating pressure and “L” the summation of gear widths.

In multiple units the “PL” must be calculated for the first connecting shaft as well as the drive shaft. Each style or type of shaft has a unique “PL” factor as noted in the table below.

Pressure X Total Gear Width = PL
PL MUST NOT EXCEED NUMBER SHOWN IN CHART FOR APPROPRIATE SHAFT.

Average Performance Data - Motors

Motor performance data at 2000 PSI (138 bar).

M30

Speed	1" Gear			1 1/2" Gear			2" Gear		
	Output		Input	Output		Input	Output		Input
RPM	Torque	Power	Flow	Torque	Power	Flow	Torque	Power	Flow
800	**550**	**7**	**9**	**870**	**11**	**13**	**1150**	**14.5**	**17**
	62	5	34	98.5	8	49	130	11	64.5
1200	**550**	**10.5**	**13**	**870**	**16.5**	**18**	**1150**	**22**	**23.5**
	62	8	49	98.5	12.5	68	130	16.5	89
1600	**550**	**14**	**16**	**860**	**22**	**23**	**1140**	**29**	**30.5**
	62	10.5	60.5	97	16.5	87	129	21.5	115
2000	**550**	**17.5**	**19.5**	**850**	**27**	**28**	**1125**	**36**	**37**
	62	13	74	96	20	106	127	27	140

U.S./*Metric* Torque: **In.-lbs.** / Nm Flow: **GPM** / LPM Power: **HP** / kW

M50

Speed	1" Gear			1 1/2" Gear			2" Gear		
	Output		Input	Output		Input	Output		Input
RPM	Torque	Power	Flow	Torque	Power	Flow	Torque	Power	Flow
800	**670**	**8.5**	**10.5**	**1070**	**13.5**	**15.5**	**1450**	**18**	**21**
	75.5	6.5	39.5	121	10	58.5	164	13.5	79.5
1200	**680**	**13**	**15.5**	**1075**	**20.5**	**22.5**	**1450**	**27.5**	**30.5**
	77	9.5	58.5	121.5	15	85	164	20.5	115
1600	**670**	**17**	**20**	**1045**	**26.5**	**30**	**1440**	**36.5**	**40**
	75.5	12.5	75.5	118	20	114	162.5	27	151
2000	**660**	**21**	**25**	**1030**	**32.5**	**37**	**1415**	**44.5**	**49**
	74.5	15.5	94.5	116.5	24	140	160	33	185

U.S./*Metric* Torque: **In.-lbs.** / Nm Flow: **GPM** / LPM Power: **HP** / kW

M75

Speed	1" Gear			1 1/2" Gear			2" Gear		
	Output		Input	Output		Input	Output		Input
RPM	Torque	Power	Flow	Torque	Power	Flow	Torque	Power	Flow
800	**1050**	**13.5**	**20.5**	**1650**	**21**	**28**	**2200**	**28**	**35.5**
	118.5	10	77.5	186.5	15.5	106	248.5	21	134
1200	**1025**	**19.5**	**27.5**	**1600**	**30.5**	**38**	**2200**	**42**	**49.5**
	116	14.5	104	181	22.5	144	248.5	31.5	187
1600	**1000**	**25.5**	**34**	**1575**	**40**	**49**	**2175**	**55**	**64**
	113	19	129	178	30	185	245.5	41	242
2000	**950**	**30**	**41.5**	**1550**	**49**	**59**	**2175**	**67.5**	**78**
	107.5	22.5	157	175	36.5	223	245.5	50.5	295

U.S./*Metric* Torque: **In.-lbs.** / Nm Flow: **GPM** / LPM Power: **HP** / kW

M50 (continued)

Speed RPM	2 1/2" Gear		
	Output		Input
	Torque	Power	Flow
800	**1850**	**23.5**	**26**
	209	17.5	98.5
1200	**1840**	**35**	**37.5**
	208	26	142
1600	**1750**	**44.5**	**49.5**
	197.5	33	187
2000	**1720**	**54.5**	**61.5**
	194.5	40.5	233

M75 (continued)

Speed RPM	2 1/2" Gear			3" Gear		
	Output		Input	Output		Input
	Torque	Power	Flow	Torque	Power	Flow
800	**2875**	**36.5**	**43**	**3625**	**46**	**50.5**
	325	27	163	409.5	34.5	191
1200	**2850**	**54**	**60.5**	**3575**	**68**	**72**
	322	40.5	229	404	50.5	273
1600	**2800**	**71**	**78.5**	**3500**	**89**	**93**
	316.5	53	297	395.5	66.5	352
2000	**2750**	**87**	**96.5**	**3425**	**109**	**114**
	310.5	65	365	387	81.5	431

Average Performance Data - Motors

Motor performance data at 2500 PSI (172 bar) unless noted.

M31

Speed	1" Gear			1 1/2" Gear			2" Gear		
	Output		Input	Output		Input	Output		Input
RPM	Torque	Power	Flow	Torque	Power	Flow	Torque	Power	Flow
800	**675**	**8.5**	**9**	**1035**	**13**	**13**	**1385**	**17.5**	**17**
	76.5	6.5	34	117	9.5	49	156.5	13	64.5
1200	**685**	**13**	**13**	**1055**	**20**	**18**	**1410**	**27**	**23.5**
	77.5	9.5	49	119	15	68	159.5	20	89
1600	**680**	**17.5**	**16**	**1030**	**26**	**23**	**1390**	**35**	**30.5**
	77	13	60.5	116.5	19.5	87	157	26	115
2000	**660**	**21**	**19.5**	**1010**	**32**	**28**	**1370**	**43.5**	**37**
	74.5	15.5	74	114	24	106	155	32.5	140

U.S./*Metric* Torque: **In.-lbs.** / Nm Flow: **GPM** / LPM Power: **HP** / kW

M51

Speed	1" Gear			1 1/2" Gear			2" Gear		
	Output		Input	Output		Input	Output		Input
RPM	Torque	Power	Flow	Torque	Power	Flow	Torque	Power	Flow
800	**825**	**10.5**	**10.5**	**1310**	**16.5**	**15.5**	**1810**	**23**	**21**
	93	8	39.5	148	12.5	58.5	204.5	17	79.5
1200	**850**	**16**	**15.5**	**1340**	**25.5**	**22.5**	**1830**	**35**	**30.5**
	96	12	58.5	151.5	19	85	207	26	115
1600	**830**	**21**	**20**	**1330**	**34**	**30**	**1805**	**46**	**40**
	94	15.5	75.5	150.5	25.5	114	204	34.5	151
2000	**800**	**25.5**	**25**	**1290**	**41**	**37**	**1770**	**56**	**49**
	90.5	19	94.5	146	30.5	140	200	42	185

U.S./*Metric* Torque: **In.-lbs.** / Nm Flow: **GPM** / LPM Power: **HP** / kW

M76

Speed	1" Gear			1 1/2" Gear			2" Gear		
	Output		Input	Output		Input	Output		Input
RPM	Torque	Power	Flow	Torque	Power	Flow	Torque	Power	Flow
800	**1410**	**18**	**20.5**	**2140**	**27**	**28**	**2875**	**36.5**	**35.5**
	159.5	13.5	77.5	242	20	106	325	27	134
1200	**1400**	**26.5**	**27.5**	**2140**	**41**	**38**	**2870**	**54.5**	**49.5**
	158	20	104	242	30.5	144	324.5	40.5	187
1600	**1375**	**35**	**34**	**2110**	**53.5**	**49**	**2830**	**72**	**64**
	155.5	26	129	238.5	40	185	319.5	53.5	242
2000	**1350**	**43**	**41.5**	**2090**	**66.5**	**59**	**2800**	**89**	**78**
	152.5	32	157	236	49.5	223	316.5	66.5	295

U.S./*Metric* Torque: **In.-lbs.** / Nm Flow: **GPM** / LPM Power: **HP** / kW

M51 (continued)

Speed RPM	2 1/2" Gear		
	Output		Input
	Torque	Power	Flow
800	**2330**	**29.5**	**26**
	263.5	22	98.5
1200	**2340**	**44.5**	**37.5**
	264.5	33	142
1600	**2300**	**58.5**	**49.5**
	260	43.5	187
2000	**2250**	**71.5**	**61.5**
	254	53.5	233

M76 (continued)

Speed RPM	2 1/2" Gear			3" Gear*		
	Output		Input	Output		Input
	Torque	Power	Flow	Torque	Power	Flow
800	**3650**	**46.5**	**43**	**3625**	**46**	**50.5**
	412.5	34.6	163	409.5	34.5	191
1200	**3650**	**69.5**	**60.5**	**3575**	**68**	**72**
	412.5	52	229	404	50.5	273
1600	**3600**	**91.5**	**78.5**	**3500**	**89**	**93**
	406.5	68	297	395.5	66.5	352
2000	**3500**	**111**	**96.5**	**3425**	**109**	**114**
	395.5	83	365	387	81.5	431

* Motor performance data at 2000 PSI (138 bar) rated pressure.

Dimensional Data

Model		A[1]	Bs[2][3]	Bm[3][4]	C[5][6]	D[5][7]	E[3]	F[2]	G	H	I	J	K
P30/31	**in.**	**1.62**	**5.44**	**8.69**	**5.44**	**5.88**	**2.94**	**0.75**	**1.75**	**2.50**	**0.88**	**2.69**	**5.38**
	mm.	41.3	138.1	220.7	138.1	149.2	74.6	19.1	44.5	63.5	22.2	68.3	136.5
P50/51	**in.**	**2.19**	**5.88**	**9.50**	**5.44**	**5.88**	**3.38**	**0.75**	**1.75**	**2.88**	**1.00**	**3.00**	**6.00**
	mm.	55.6	149.2	241.3	138.1	149.2	85.7	19.1	44.5	73.0	25.4	76.2	152.4
P75/76	**in.**	**2.19**	**6.75**	**10.75**	**7.75**	**7.94**	**3.75**	**1.00**	**2.00**	**3.00**	**1.25**	**3.94**	**7.88**
	mm.	55.6	171.5	273.1	196.9	201.6	95.3	25.4	50.8	76.2	31.8	100.0	200.0

***U.S.**/Metric*

NOTES

1. Dimension will vary with shaft type
2. Dimension + gear width
3. Dimension is for Type 1 SEC. For Type 2: subtract 1.12" (28.4 mm) for 30/31: subtract 1.00" (25.4 mm) for 50/51.
4. Dimension + total gear width
5. Dimension will vary with port type. Subtract 0.25" (6.4 mm) for S.F. ports.
6. For 2.25" and 2.50" gear width in 50/51 series, dimention is 6.75" (171.5 mm).
7. Dimension is for wide B-C. Narrow B-C dimensions: 5.00" (127 mm) for 30/31 and 50/51; 7.19" (182.6 mm) for 75/76.
8. Dimension + 1/2 front section gear width

Model		L[3][8]	M[4]
P30/31	**in.**	**3.31**	**3.25**
	mm.	84.1	82.6
P50/51	**in.**	**3.75**	**3.62**
	mm.	95.3	92.1
P75/76	**in.**	**4.75**	**4.00**
	mm.	120.7	101.6

Approximate Weight

Single Unit

Model	Unit Weight	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	2 3/4"	3"
P30/31	**Pounds**	**33**	**34**	**35**	**36**	**37**	**-**	**-**	**-**	**-**
	KG	15	15.5	16	16.5	17	-	-	-	-
P50/51	**Pounds**	**37**	**38.5**	**40**	**41.5**	**43**	**48.5**	**50**	**-**	**-**
	KG	17	17.5	18	19	19.5	22	22.5	-	-
P75/76	**Pounds**	**72**	**75**	**77**	**80**	**82**	**85**	**87**	**90**	**92**
	KG	33	34	35	36	37	39	40	41	42

Approximate Weight

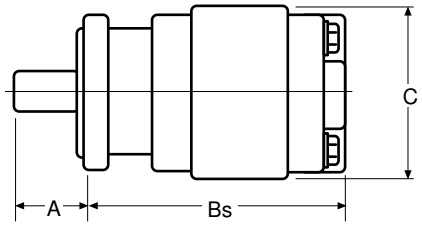
Multiple Unit*

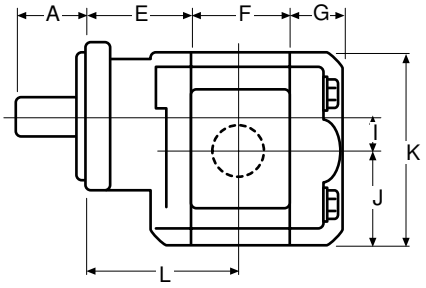
Model	Add per gear section	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	2 3/4"	3"
P30/31	**Pounds**	**27**	**28**	**29**	**31**	**32**	**-**	**-**	**-**	**-**
	KG	12	12.5	13	14	14.5	-	-	-	-
P50/51	**Pounds**	**31**	**32.5**	**34**	**35.5**	**37**	**42.5**	**44**	**-**	**-**
	KG	14	15	15.5	16	17	19	20	-	-
P75/76	**Pounds**	**59**	**62**	**64**	**67**	**69**	**72**	**74**	**77**	**79**
	KG	27	28	29	31	32	33	34	35	36

*Determine the approximate weight from Single Unit chart and add weight of each additional assembly from this chart.

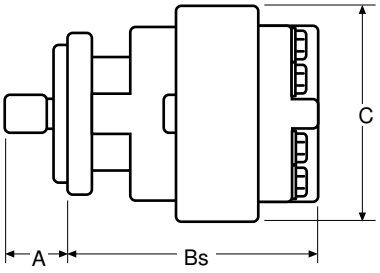
Dimensional Data

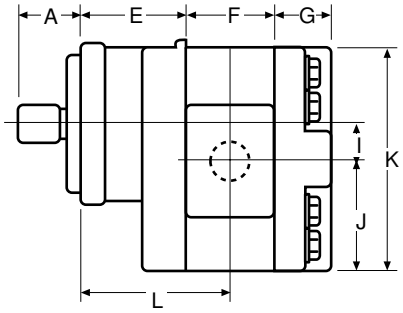
Single Unit - P30/31/50/51



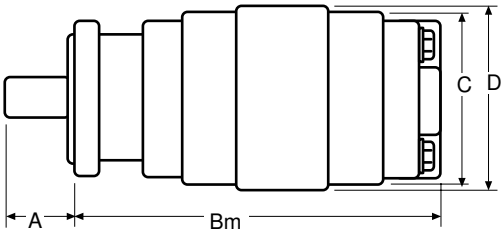


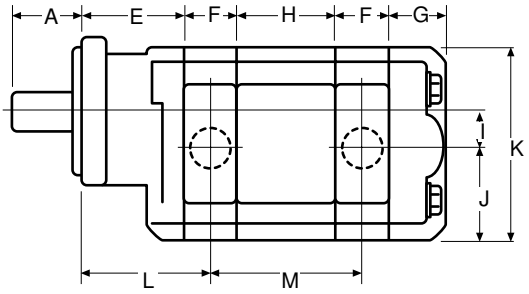
Single Unit - P75/76



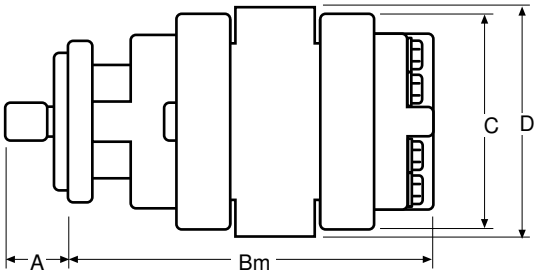


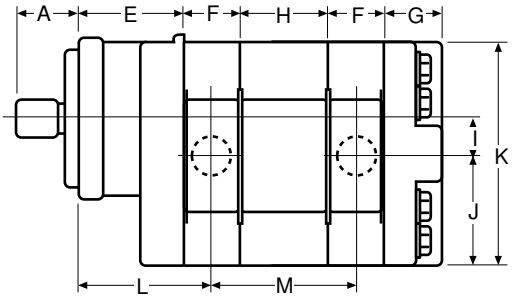
Multiple Unit - P30/31/50/51



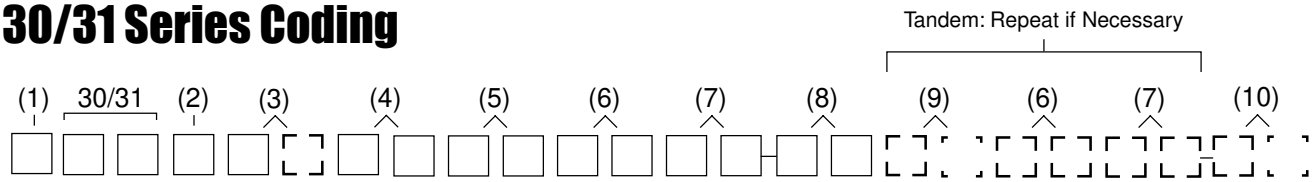


Multiple Unit - P75/76





30/31 Series Coding



Pump/Motor (1)

P	Pump
M	Motor

Unit (2)

A	Single Unit
B	Tandem Unit
C	Single or Tandem w. two-piece shaft (O.B. bearing required)

Shaft End Cover (3)

1	Pump, cw w/o O.B. bearing
2	Pump, ccw w/o O.B. bearing
3	Pump, bi-rotational w/o O.B. bearing (30 series only)
4	Pump, cw with O.B. bearing
5	Pump, ccw with O.B. bearing
6	Pump, bi-rotational with O.B. bearing (30 series only)
8	Motor, bi-rot. with O.B. bearing + 1/4" NPT drain
9	Motor, bi-rot. w/o O.B. bearing + 1/4" NPT drain
18	Motor, bi-rot. with O.B. bearing + 1/4" BSPP drain
19	Motor, bi-rot. w/o O.B. bearing + 1/4" BSPP drain

Shaft End Cover (4) *(type 1 unless noted)*

00	Pad mount
05	6 bolt flange - 3.25" dia. bolt circle
42	SAE 4 bolt "B" ANSI 101-4
78	SAE 4 bolt "C" ANSI 127-4
91	30-30, 31-31, & 50-30, 51-31 for piggyback
92	75-30, 76-31 for piggyback
94	SAE 2 bolt "A" ANSI 82-2
96	SAE 2 bolt "B" ANSI 101-2, **type 2** (not available with O.B. bearing)
97	SAE 2 bolt "B" ANSI 101-2

Port End Cover (5) (Rear Ported)

Left	Right	Single	Tandem	Extended Studs
Unported				
-	-	**BE**	**BI**	**BY**
NPT Porting (30 series only)				
3/4"	-	**KE**	**KI**	**KY**
-	3/4"	**LE**	**LI**	**LY**
3/4"	3/4"	**ME**	**MI**	**MY**
NPT Porting (30 series only) - Modified Casting*				
1"	1"	**QU**	**QU**	**-**

* Modified PEC casting is for higher pressure/larger port applications.

Port End Cover (5) (Rear Ported) continued

Left	Right	Single	Tandem	Extended Studs
O.D.T. Porting				
3/4"	-	**CE**	**CI**	**CY**
-	3/4"	**DE**	**DI**	**DY**
3/4"	3/4"	**FE**	**FI**	**FY**
1"	3/4"	**GE**	**GI**	**GY**
3/4"	1"	**HE**	**HI**	**HY**
O.D.Tube Porting (30 series only)				
1"	1"	**JE**	**JI**	**JY**
O.D.Tube Porting - Modified Casting*				
3/4"	-	**CA**	**CU**	**CO**
-	3/4"	**DA**	**DU**	**DO**
3/4"	3/4"	**JA**	**JU**	**BO**
1"	3/4"	**KA**	**KU**	**-**
3/4"	1"	**LA**	**LU**	**-**
1"	-	**MA**	**MU**	**YO**
-	1"	**RA**	**SU**	**RO**
1"	1"	**ZA**	**ZU**	**ZO**
1 1/4"	1"	**GU**	**GU**	**-**
1"	1 1/4"	**HU**	**HU**	**-**
BSPP Porting				
3/4"	-	**WE**	**WI**	**WY**
-	3/4"	**XE**	**XI**	**XY**
3/4"	3/4"	**ZE**	**ZI**	**ZY**
Metric Straight Thread				
3/4"	-	**NE**	**NI**	**NY**
-	3/4"	**PE**	**PI**	**PY**
3/4"	3/4"	**QE**	**QI**	**QY**
1"	3/4"	**RE**	**RI**	**RY**
3/4"	1"	**SE**	**SI**	**SY**

Port End Cover (5) (Side Ported)

Left	Right	Single	Tandem	Extended Studs
O.D.Tube Porting - Modified Casting*				
1 1/4"	1"	**TU**	**TU**	**-**
1"	1 1/4"	**XU**	**XU**	**-**

	CW	CCW	Double
Piggyback Port End - Pump Only			
Type 30-30, 31-31 (double 30-30 only)	**KO**	**LO**	**MO**

For All Units

To determine direction of shaft rotation, view the unit with the shaft pointing toward you, and the idler (driven) gear beneath the shaft. With clockwise rotation, flow will be left to right. The pump inlet port will be on the left, outlet on the right. The flow is in the opposite direction with counter-clockwise rotation. Inverting the pump will reverse the inlet and outlet ports but not the direction of rotation.

Gear Housing (6)

Series				30	30	30	30	30	30	31	31	31	31	31
Housing Code				07	10	12	15	17	20	10	12	15	17	20
Displacement (C.I.R.)				1.48	1.97	2.46	2.96	3.45	3.94	1.97	2.46	2.96	3.45	3.94
Maximum (PSI)				2500	2500	2500	2500	2250	2250	3000	3000	3000	2500	2500
IN	**OUT**	**CW**	**CCW**											
													No Porting	
-	-	**AB**	**AB**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
													NPT Porting	
1/2"	-	**IL**	**IM**	**X**	**X**									
-	1/2"	**IM**	**IL**	**X**	**X**									
1/2"	1/2"	**IR**	**IR**	**X**										
3/4"	-	**IC**	**ID**		**X**	**X**	**X**	**X**	**X**					
-	3/4"	**ID**	**IC**		**X**	**X**	**X**		**X**					
3/4"	3/4"	**IF**	**IF**		**X**	**X**	**X**	**X**	**X**					
1"*	3/4"	**IJ**	**IG**		**X***	**X**	**X**	**X**						
1 1/4"*	3/4"	**IK**	**IH**				**X***	**X**						
1"*	-	**YC**	**YD**		**X***	**X**	**X**	**X**						
-	1"	**YD**	**YC**			**X**	**X**	**X**						
1"	1"	**YF**	**YF**			**X**	**X**	**X**	**X**					
1 1/4"*	1"	**YJ**	**YG**				**X***	**X**	**X**					
1 1/4"*	-	**IA**	**IB**				**X***	**X**	**X**					
-	1 1/4"	**IB**	**IA**					**X**	**X**					
1 1/4"	1 1/4"	**YL**	**YL**					**X**	**X**					
1 1/2"*	-	**YA**	**YB**						**X***					
1 1/2"*	1 1/4"	**YP**	**YM**						**X***					
													OD Tube Porting	
3/4"*	-	**EC**	**ED**		**2000**	**X**	**X**	**X**		**X***	**X**	**X**	**X**	**X**
-	3/4"	**ED**	**EC**		**2000**	**X**	**X**	**X**			**X**	**X**	**X**	**X**
3/4"	3/4"	**EF**	**EF**		**2000**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**
1"*	3/4"	**EJ**	**EG**		**2000***	**X***	**X**	**X**	**X**		**X***	**X***		
1 1/4"*	3/4"	**EK**	**EH**				**X***	**X***				**X***	**X***	
1 1/2"*	3/4"	**IP**	**IN**					**X***	**X***				**X***	
7/8"	-	**EZ**	-			**X**								
-	7/8"	**-**	**EZ**			**X**								
1"*	7/8"	**EM**	**EL**			**X***								
1"*	-	**AC**	**AD**		**X***	**2000**	**X**	**X**	**X**	**X***	**X***	**2500**	**X**	**X**
-	1"	**AD**	**AC**			**2000**	**X**	**X**	**X**			**2500**	**X**	**X**
1"	1"	**AF**	**AF**				**X**	**X**	**X**			**2500**	**X**	**X**
1 1/4"*	1"	**AJ**	**AG**				**X***	**X***	**X**			**2500***	**X***	**X***
1 1/2"*	1"	**AK**	**AH**					**X***	**X***				**X***	**X***
1 1/4"*	-	**AA**	**AO**				**X***	**2000**				**X***	**X***	
-	1 1/4"	**AO**	**AA**					**2000**						
1 1/4"	1 1/4"	**AL**	**AL**					**2000**	**X**					**X**
1 1/2"*	1 1/4"	**AP**	**AM**					**2000***	**X***					**X***
1 1/2"*	-	**AE**	**AU**					**X***	**2000**					**X***
-	1 1/2"	**AU**	**AE**						**2000**					

NOTES
Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
NPT ports are not recommended for use at pressures in excess of 1500 PSI.
"X" Means both codes are available.
"2000" or "2500" indicates maximum pressure rating on port.

Gear Housing (6) *continued*

Series					30	30	30	30	30	30	31	31	31	31	31
Housing Code					07	10	12	15	17	20	10	12	15	17	20
Displacement (C.I.R.)					1.48	1.97	2.46	2.96	3.45	3.94	1.97	2.46	2.96	3.45	3.94
Maximum (PSI)					2500	2500	2500	2500	2250	2250	3000	3000	3000	2500	2500
IN	OUT	CW	CCW												
													Split Flange Porting		
3/4”	-	UC	UD		X	X	UD	X			X	X	X	X	
-	3/4”	UD	UC		X	X	UD	X			X	X	X	X	
3/4”	3/4”	UF	UF	X	X		X				X	X	X		
1”*	3/4”	UJ	UG		X	X	UJ	UJ	X		X*	X			
1 1/4”*	3/4”	UK	UH			X	X	X	X			X*	X*		
1”*	-	OC	OD			X	X	X	OD		2500	X	X		
-	1”	OD	OC			X	X	X	OD		2500	X	X		
1”	1”	OF	OF		X	X	X	X	X		2500	X	X	X	X
1 1/4”*	1”	OJ	OG			X*	X	X	X			X*	X*	X	X
1 1/2”*	1”	OK	OH					X*	X					X*	X*
1 1/4”*	-	OA	OB			2000	X	X	X			X*	2500		
-	1 1/4”	OB	OA			2000	X	X	X				2500		
1 1/4”	1 1/4”	OL	OL				X	X	X					X	X
1 1/2”*	1 1/4”	OP	OM					X*	X					X*	X*
1 1/2”*	-	OE	OU					2000	X					X*	X
-	1 1/2”	OU	OE					2000	X						X
													BSPP Porting		
3/4”*	-	YN	YQ	X*	X	X	X	X	X		2500	X	X		YQ
-	3/4”	YQ	YN		X	X	X	X	X		2500	X	X		YQ
3/4”	3/4”	YS	YS		X	X		X	X		2500	X	X		X
1”*	3/4”	YV	YT		X*	X*	YV	YV			2500*	X*	YV*	X	YV
1 1/4”*	3/4”	YW	YU					X*	X*				YU*	X*	
1”*	-	SL	RQ			2000	X	X	X		SL*		2500	X	
-	1”	RQ	SL			2000	X	X	X				2500	X	
1”	1”	MP	MP			2000	X	X						X	X
1 1/4”*	1”	IX	VY				X*	X*	X*				2500*	X*	
1 1/4”*	-	NJ	UI					2000	X						X*
-	1 1/4”	UI	NJ					2000	X						
1 1/4”	1 1/4”	PF	PF						2000						
1 1/2”*	1”	VI	HW											X*	X*
											Metric Straight Thread Porting				
3/4”*	-	EN	TQ		X	X	TQ				2500	X			
-	3/4”	TQ	EN		X	X	TQ				2500	X			
3/4”	3/4”	ES	ES		X	X					2500	X			
1”*	3/4”	EV	ET		X*	X*	EV	EV				X*	X*		
1 1/4”*	3/4”	EW	EU										X*		
1”*	-	NL	ER		X*		X	ER	ER				2500		
-	1”	ER	NL				X	ER	ER				2500		
1”	1”	CM	CM			2000	X						2500		
1 1/4”*	1”	EX	VE				X*	X*	X*				2500*		
1 1/2”*	1”	VA	HA				X*	X*	X*					X*	X*
1 1/4”	1 1/4”	PA	PA					2000	X						
1 1/2”	1 1/4”	SA	QA						X*						

NOTES
Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
“X” Means both codes are available.
“2000” or “2500” indicates maximum pressure rating on port.

Gear Housing (6) *continued*

Series			30	30	30	30	30	30	31	31	31	31	31
Housing Code			07	10	12	15	17	20	10	12	15	17	20
Displacement (C.I.R.)			1.48	1.97	2.46	2.96	3.45	3.94	1.97	2.46	2.96	3.45	3.94
Maximum (PSI)			2500	2500	2500	2500	2250	2250	3000	3000	3000	2500	2500
IN	**OUT**	**CW CCW**											
									Metric Straight Thread Porting				
3/4"	-	**VN VQ**		**X**	**X**	**X**	**X**	**X**	**X**	**X**			**X**
-	3/4"	**VQ VN**		**X**	**X**	**X**	**X**	**X**	**X**	**X**			**X**
3/4"	3/4"	**VS VS**		**X**	**X**				**X**				
1"*	3/4"	**RV VT**		**X**	**X**	**X**	**X**		**X***	**X**			
1 1/4"*	3/4"	**RW RU**			**X***		**X**			**X***	**X***		
1"*	-	**UL UR**		**X**	**X**	**X**	**X**	**X**	**2500**	**X**	**X**		
-	1"	**UR UL**		**X**	**X**	**X**	**X**	**X**	**2500**	**X**	**X**		
1"	1"	**UM UM**			**X**	**X**	**X**			**X**	**X**	**X**	**X**
1 1/4"*	1"	**UX VU**			**X***	**X**	**X**	**X**		**X***	**X***	**X**	**X**
1 1/2"*	1"	**VO HO**					**X***	**X**				**X***	**X***
1 1/4"*	-	**NO UO**				**X**		**X**		**X***	**2500**		
-	1 1/4"	**UO NO**				**X**		**X**		**X***	**2500**		
1 1/4"	1 1/4"	**PO PO**				**X**	**X**	**X**				**X**	**X**
1 1/2"*	1 1/4"	**SO QO**					**X***	**X**				**X***	**X***
1 1/2"*	-	**UY TO**				**X***	**2000**					**X***	**X**
-	1 1/2"	**TO UY**					**2000**						**X**

NOTES:
Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
"X" Means both codes are available.
"2000" or "2500" indicates maximum pressure rating on port.

Gear Width (7)

30 Series

	Gear Width	in.^{3}/rev.	cm^3/rev.	Max Pressure
05	1/2"	0.99	16.1	2500 psi (172 bar)
07	3/4"	1.48	24.2	2500 psi (172 bar)
10	1"	1.97	32.3	2500 psi (172 bar)
12	1 1/4"	2.46	40.4	2500 psi (172 bar)
15	1 1/2"	2.96	48.4	2500 psi (172 bar)
17	1 3/4"	3.45	56.5	2250 psi (155 bar)
20	2"	3.94	64.6	2250 psi (155 bar)

31 Series

	Gear Width	in.^{3}/rev.	cm^3/rev.	Max Pressure
05	1/2"	0.99	16.1	3000 psi (207 bar)
07	3/4"	1.48	24.2	3000 psi (207 bar)
10	1"	1.97	32.3	3000 psi (207 bar)
12	1 1/4"	2.46	40.4	3000 psi (207 bar)
15	1 1/2"	2.96	48.4	3000 psi (207 bar)
17	1 3/4"	3.45	56.5	2500 psi (172 bar)
20	2"	3.94	64.6	2500 psi (172 bar)

Shaft Type (8) *(type 1 unless noted)*

For single, tandem, or two piece shaft unless noted.

07	SAE “C” 14 tooth spline 1.25” dia., ANSI 32-4 (two piece only)
12	Keyed shaft .75 dia., .19”X.19”X1.56” key (two piece only)
14	30-30, 31-31 piggyback shaft
22	50-30, 51-31 piggyback shaft
23	75-30, 76-31 piggyback shaft
25	SAE “B” 13 tooth spline .88” dia., ANSI 22-4
30	SAE “B” keyed .88” dia., 1/4”X3/8” X 1” key, ANSI 22-1
32	Clutch pump shaft, tapered & keyed, 1:4 taper (single & two piece), #6 woodruff key
43	SAE “B-B” keyed 1.00” dia. 1/4”X3/8”X1 1/4” key, ANSI 25-1 modified length
65	SAE “B” 13 tooth spline .875” dia., ANSI 22-4, **type 2** (single & tandem)
66	SAE “B” keyed .88” dia, 1/4”X3/8”X1” key, **type 2** (single & tandem)
67	SAE “B-B” keyed 1.00” dia., 1/4”X3/8”X1 1/4” key, ANSI 25-1 modified length, **type 2** (single & tandem)
68	6 tooth spline 1.00” dia.
90	SAE “B” keyed w/ 5/8”-18 thread, .875” dia, ANSI 22-2 modified length (single & tandem)
95	SAE “A” 9 tooth spline, .62” dia. ANSI 16-4 (single only)
98	SAE “B-B” 15 tooth spline, 1.00” dia., ANSI 25-4 (single & tandem)

Bearing Carriers (9) Pump Only

Orientation
Rear Section
Front Section

Common Inlet Passage

IN	OUT	CW	CCW
-	-	**C**	**D**
* -	-	**A**	**U**

** 31 Series only. Used when only one adjacent gear housing has an inlet port.*

NPT Porting (30 Series only)

1”	-	**TB**	**BT**
1 1/4”	-	**VB**	**BV**
1”	3/4”	**TX**	**XT**
1 1/4”	3/4”	**VX**	**XV**
1 1/4”	1”	**VZ**	**ZV**
1”	3/4”	**TJ**	**JT**
1 1/4”	3/4”	**VJ**	**JV**
1 1/4”	1”	**VK**	**KV**
1 1/2”	1”	**KW**	**-**
1”	3/4”	**ZX**	**XZ**
1”	3/4”	**ZS**	**SZ**

ODT Porting

	1”	-	**CB**	**BC**
	1 1/4”	-	**DB**	**BD**
	1 1/2”	-	**FB**	**BF**
*	-	3/4”	-	**JP**
	1”	3/4”	**CJ**	**JC**
	1 1/4”	3/4”	**DJ**	**JD**
	1 1/2”	3/4”	**FJ**	**JF**
	1 1/4”	1”	**DK**	**KD**
	1 1/2”	1”	**FK**	**KF**

** 30 Series only.*

1”	3/4”	**CR**	**RC**
1 1/4”	3/4”	**DR**	**RD**
*1 1/2”	3/4”	**FR**	**RF**
1 1/4”	1”	**DS**	**SD**
1 1/2”	1”	**FS**	**SF**

** 30 Series only.*

1”	3/4”	**KJ**	**JK**
1”	3/4”	**KX**	**XK**

Split Flange Porting

IN	OUT	CW	CCW
1”	-	**LB**	**BL**
1 1/4”	-	**MB**	**BM**
1 1/2”	-	**NB**	**BN**
-	3/4”	**BR**	**RB**
1”	3/4”	**LR**	**RL**
1 1/4”	3/4”	**MR**	**RM**
1 1/2”	3/4”	**NR**	**RN**
1 1/4”	1”	**MS**	**SM**
1 1/2”	1”	**NS**	**SN**
1”	3/4”	**LX**	**XL**
1 1/4”	3/4”	**MX**	**XM**
*1 1/2”	3/4”	**NX**	**XN**
1 1/4”	1”	**MZ**	**ZM**
1 1/2”	1”	**NZ**	**ZN**

** 30 Series only.*

1”	3/4”	**SR**	**RS**
1”	3/4”	**RZ**	**ZR**

BSPP Porting

	1”	-	**CX**	**XC**
	1 1/4”	-	**DX**	**XD**
	1 1/2”	-	**FX**	**XF**
*	-	3/4”	**-**	**TL**
	1”	3/4”	**CT**	**TC**
	1 1/4”	3/4”	**DT**	**TD**
	1 1/2”	3/4”	**FT**	**TF**
	1 1/4”	1”	**DV**	**VD**
	1 1/2”	1”	**FV**	**VF**

** 31 Series only.*

1”	3/4”	**GM**	**MG**
1 1/4”	3/4”	**HM**	**MH**
1 1/4”	1”	**HN**	**NH**
1 1/2”	1”	**WN**	**NW**
1”	3/4”	**PN**	**NP**
1”	3/4”	**SX**	**XS**

Bearing Carriers (9) (Pump Only) - *continued*

Metric Split Flange Porting

IN	OUT	CW	CCW
1”	-	**CH**	**HC**
1 1/4”	-	**DH**	**HD**
1 1/2”	-	**FH**	**HF**
-	3/4”	**PW**	**WP**
1”	3/4”	**CW**	**WC**
1 1/4”	3/4”	**DW**	**WD**
1 1/2”	3/4”	**FW**	**WF**
1 1/4”	1”	**DC**	**CD**
1 1/2”	1”	**FC**	**CF**
1”	3/4”	**GQ**	**QG**
1 1/4”	3/4”	**HQ**	**QH**
1 1/4”	1”	**HS**	**SH**
1 1/2”	1”	**WS**	**SW**
1”	3/4”	**ST**	**TS**
1”	3/4”	**PX**	**XP**

Metric Straight Thread Porting

IN	OUT	CW	CCW
1”	-	**CL**	**LC**
1 1/4”	-	**DL**	**LD**
1 1/2”	-	**FL**	**LF**
1”	3/4”	**CZ**	**ZC**
1 1/4”	3/4”	**DZ**	**ZD**
1 1/2”	3/4”	**FZ**	**ZF**
1 1/4”	1”	**DN**	**ND**
1 1/2”	1”	**FN**	**NF**
1”	3/4”	**GT**	**TG**
1 1/4”	3/4”	**HT**	**TH**
1 1/4”	1”	**HV**	**VH**
1 1/2”	1”	**WV**	**VW**
1”	3/4”	**KL**	**LK**
1”	3/4”	**PV**	**VP**

Bearing Carriers (9) Motor Only

No Ports

IN	OUT	DUAL
-	-	**B**

NPT Porting (30 Series only)

1”	1”	**TT**
1 1/4”	1 1/4”	**VV**

ODT Porting

1”	1”	**CC**
1 1/4”	1 1/4”	**BB**
1 1/2”	1 1/2”	**FF**

Split Flange Porting

1”	1”	**LL**
1 1/4”	1 1/4”	**MM**
1 1/2”	1 1/2”	**NN**

BSPP Porting

1”	1”	**EE**
1 1/4”	1 1/4”	**GG**

Metric Split Flange Porting

IN	OUT	DUAL
1”	1”	**RR**
1 1/4”	1 1/4”	**SS**

Metric Straight Thread Porting

1”	1”	**KK**
1 1/4”	1 1/4”	**JJ**

Connecting Shaft (10)

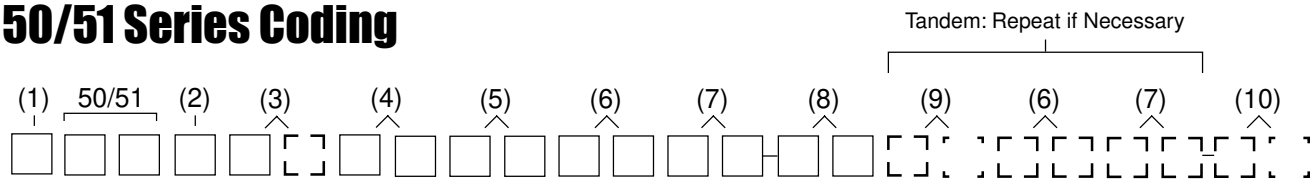
For connecting tandem units.

1	Connecting Shaft - Multiple Units
14	Piggyback Pump Connecting Shaft P30 to P30, P31 to P31
22	Piggyback Pump Connecting Shaft P50 to P30, P51 to P31
23	Piggyback Pump Connecting Shaft P75 to P30, P76 to P31

NOTE

Split flange thread depths may be more shallow than S.A.E. standard. Contact Product Support Department for actual dimensions.

50/51 Series Coding



Pump/Motor (1)

P	Pump
M	Motor

Unit (2)

A	Single Unit
B	Tandem Unit
C	Single or Tandem w. two-piece shaft (O.B. bearing required)

Shaft End Cover (3)

1	Pump, cw w/o O.B. bearing
2	Pump, ccw w/o O.B. bearing
3	Pump, bi-rotational w/o O.B. bearing (50 series only)
4	Pump, cw with O.B. bearing
5	Pump, ccw with O.B. bearing
6	Pump, bi-rotational with O.B. bearing (50 series only)
8	Motor, bi-rot. with O.B. bearing + 1/4" NPT drain
9	Motor, bi-rot. w/o O.B. bearing + 1/4" NPT drain
18	Motor, bi-rot. with O.B. bearing + 1/4" BSPP drain
19	Motor, bi-rot. w/o O.B. bearing + 1/4" BSPP drain

Shaft End Cover (4) *(type 1 unless noted)*

00	4 bolt pad mount
42	SAE 4 bolt "B" ANSI 101-4
78	SAE 4 bolt "C" ANSI 127-4
91	50-50, 51-51 for piggyback
92	75-50, 76-51 for piggyback
96	SAE 2 bolt "B" ANSI 101-2, **type 2**
97	SAE 2 bolt "B" ANSI 101-2
98	SAE 2 bolt "C" ANSI 127-2
99	SAE 2 bolt "C" ANSI 127-2, **type 2**

Port End Cover (5) (Rear Ported)

Left	Right	Single	Tandem	Extended Studs
Unported				
-	-	**BE**	**BI**	**BY**
NPT Porting (50 series only)				
3/4"	-	**KE**	**KI**	**KY**
-	3/4"	**LE**	**LI**	**LY**
3/4"	3/4"	**ME**	**MI**	**MY**
O.D.T. Porting				
3/4"	-	**CE**	**CI**	**CY**
-	3/4"	**DE**	**DI**	**DY**
3/4"	3/4"	**FE**	**FI**	**FY**

Port End Cover (5) continued

Left	Right	Single	Tandem	Extended Studs
BSPP Porting				
3/4"	-	**WE**	**WI**	**WY**
-	3/4"	**XE**	**XI**	**XY**
3/4"	3/4"	**ZE**	**ZI**	**ZY**
Metric Straight Thread				
3/4"	-	**NE**	**NI**	**NY**
-	3/4"	**PE**	**PI**	**PY**
3/4"	3/4"	**QE**	**QI**	**QY**

Note: 3/4" PEC ports are rated to 2500 PSI max.

	CW	CCW	Double
Piggyback Port End - Pump Only			
Type 50-50, 51-51 & 50-30, 51-31	**KO**	**LO**	**MO**

Optional:

- Port end cover with integral R/V
- Larger rear ports
  1 1/4 x 1 S.F. or ODT
- Larger side ports
  1 1/4 S.F. or ODT inlet
  1" ODT outlet
- Larger rear ports, but requires special gear housing and cap screws
  1 1/2 x 1 1/2 NPT up to 1500 PSI

Contact Product Support Development for additional information.

FOR ALL UNITS

To determine direction of shaft rotation, view the unit with the shaft pointing toward you, and the idler (driven) gear beneath the shaft. With clockwise rotation, flow will be left to right. The inlet pump port will be on the left, outlet on the right. The flow is in the opposite direction with counter-clockwise rotation. Inverting the pump will reverse the inlet and outlet ports but not the direction of rotation.

Gear Housing (6)

Series				50	50	50	50	50	50	50	50	51	51	51	51	51	51	51
Housing Code				07	10	12	15	17	20	22	25	10	12	15	17	20	22	25
Displacement (C.I.R.)				1.91	2.55	3.19	3.83	4.46	5.10	5.74	6.38	2.55	3.19	3.83	4.46	5.10	5.74	6.38
Maximum (PSI)				2500	2500	2500	2500	2000	2000	2000	2000	3000	3000	3000	3000	2500	2500	2500
IN	**OUT**	**CW**	**CCW**															
																No Porting		
-	-	**AB**	**AB**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
																NPT Porting		
3/4"	-	**IC**	**ID**		**X**	**ID**	**ID**	**ID**										
-	3/4"	**ID**	**IC**		**X**	**ID**	**ID**	**ID**										
3/4"	3/4"	**IF**	**IF**		**X**	**X**	**X**	**X**	**X**									
1"*	3/4"	**IJ**	**IG**		**X***	**X**	**X**	**IJ**	**IJ**									
1 1/4"*	3/4"	**IK**	**IH**				**X**											
1"	-	**YC**	**YD**			**X**	**YD**	**YD**	**YD**	**YD**								
-	1"	**YD**	**YC**			**X**	**YD**	**YD**	**YD**	**YD**								
1"	1"	**YF**	**YF**			**X**	**X**	**X**	**X**	**X**	**X**							
1 1/4"*	1"	**YJ**	**YG**				**X***	**X**	**X**	**X**	**YJ**							
1 1/4"*	-	**IA**	**IB**				**X***	**X***	**X**	**IB**	**IB**							
-	1 1/4"	**IB**	**IA**						**X**	**IB**	**IB**							
1 1/4"	1 1/4"	**YL**	**YL**					**X**	**X**	**X**	**X**							
1 1/2"	1"	**YK**	**YH**								**X**							
1 1/2"*	1 1/4"	**YP**	**YM**						**X***	**X**	**X**							
1 1/2"*	1 1/2"	**YR**	**YR**								**X**							
															OD Tube Porting			
3/4"*	-	**EC**	**ED**		**2000**	**2000**	**X**	**ED**	**X**			**X***	**X***		**X**			
-	3/4"	**ED**	**EC**		**2000**	**2000**	**X**	**ED**	**X**						**X**			
3/4"	3/4"	**EF**	**EF**		**2000**	**2000**	**X**	**X**	**X**					**2500**	**X**			
1"*	3/4"	**EJ**	**EG**		**2000***	**2000***	**X**	**EJ***	**EJ**						**X**			
1 1/4"*	3/4"	**EK**	**EH**				**X***	**X***						**2500***	**X***			
1"*	-	**AC**	**AD**		**X***	**X***	**2000**	**X**	**AD**	**AD**	**AD**	**X***	**X***	**X***	**X***	**X**		
-	1"	**AD**	**AC**				**2000**	**X**	**AD**	**AD**	**AD**					**X**		
1"	1"	**AF**	**AF**				**2000**	**X**	**X**		**X**					**X**	**X**	**X**
1 1/4"*	1"	**AJ**	**AG**				**2000***	**X***	**X***	**AJ**	**AJ**					**X***		
1 1/2"*	1"	**AK**	**AH**					**X***	**X***	**X***						**X***		**X**
1 1/4"*	-	**AA**	**AO**				**X***	**X***	**X***	**AO**	**AO**			**X***	**X***		**X**	**X**
-	1 1/4"	**AO**	**AA**							**AO**	**AO**						**X**	**X**
1 1/4"	1 1/4"	**AL**	**AL**						**X**	**X**	**X**						**X**	**X**
1 1/2"*	1 1/4"	**AP**	**AM**						**X***	**X***	**X**						**X***	**X***
1 1/2"*	-	**AE**	**AU**						**X***	**X***						**X***	**X***	**X**
-	1 1/2"	**AU**	**AE**															**X**
1 1/2"	1 1/2"	**AR**	**AR**								**X**							**X**

NOTES

NPT ports are not recommended for use at pressures in excess of 1500 PSI.
Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
"X" Means both codes are available.
"2000" or "2500" indicates maximum pressure rating on port.

Gear Housing (6) *continued*

Series				50	50	50	50	50	50	50	51	51	51	51	51	51	51
Housing Code				10	12	15	17	20	22	25	10	12	15	17	20	22	25
Displacement (C.I.R.)				2.55	3.19	3.83	4.46	5.10	5.74	6.38	2.55	3.19	3.62	4.46	5.10	5.74	6.38
Maximum (PSI)				2500	2500	2500	2000	2000	2000	2000	3000	3000	3000	3000	2500	2500	2500
IN	**OUT**	**CW**	**CCW**												**Split Flange Porting**		
3/4"	-	**UC**	**UD**	**X**	**X**	**UD**	**UD**				**2500**	**X**					
-	3/4"	**UD**	**UC**	**X**	**X**	**UD**	**UD**				**2500**	**X**					
3/4"	3/4"	**UF**	**UF**					**X**		**X**	**2500**	**X**	**X**				
1"*	3/4"	**UJ**	**UG**	**X***	**X***	**UJ**	**UJ**	**UJ**			**2500***	**X***	**X***				
1 1/4"*	3/4"	**UK**	**UH**									**X***	**X***	**X***			
1"*	-	**OC**	**OD**	**2000**	**X***	**X**	**X**	**X**	**OD**	**X**		**X***	**2500**	**X**	**X**		
-	1"	**OD**	**OC**	**2000**	**2000**	**X**	**X**	**X**	**OD**	**X**			**2500**	**X**	**X**		
1"	1"	**OF**	**OF**		**2000**	**X**	**X**	**X**	**X**	**X**			**2500**	**X**	**X**	**X**	**X**
1 1/4"*	1"	**OJ**	**OG**		**2000***	**X***	**X***	**X**	**OJ**	**OJ**			**2500***	**X***	**X***		
1 1/2"*	1"	**OK**	**OH**			**X***	**X***	**X***	**X**	**X**			**2500***	**X***	**X***	**X**	
1 1/4"*	-	**OA**	**OB**		**X***	**X***	**X***	**X**	**OB**	**OB**		**X***	**X***				
-	1 1/4"	**OA**	**OB**					**X**	**OB**	**OB**							
1 1/4"	1 1/4"	**OL**	**OL**			**2000**	**X**	**X**	**X**	**X**					**X**	**X**	**X**
1 1/2"*	1 1/4"	**OP**	**OM**			**2000***	**X***	**X***	**X**	**X**					**X***	**X**	**X**
1 1/2"*	-	**OE**	**OU**			**X***	**X***	**X**		**X**			**X***	**X***	**X***		
-	1 1/2"	**OU**	**OE**					**X**		**X**							
1 1/2"	1 1/2"	**OR**	**OR**					**X**	**X**	**X**						**X**	**X**
2"*	-	**XB**	**ZB**												**X***		
2"*	1"	**UQ**	**UB**					**X***	**X***	**X***							
2"*	1 1/4"	**OQ**	**ON**					**X***	**X***	**ON***					**X***	**X***	**X***
2"*	1 1/2"	**OV**	**OS**					**X***	**X***	**X***						**X***	**X***
2"	2"	**OX**	**OX**							**X**							
															BSPP Porting		
3/4"*	-	**YN**	**YQ**	**X***	**X**	**YQ**	**YQ**				**X***	**2500**	**2500**	**YQ**	**YQ**		
-	3/4"	**YQ**	**YN**		**X**	**YQ**	**YQ**					**2500**	**2500**	**YQ**	**YQ**		
3/4"	3/4"	**YS**	**YS**	**2000**	**X**	**X**				**X**		**2500**	**2500**		**X**		
1"*	3/4"	**YV**	**YT**	**2000***	**X***	**YV***	**YV***	**YV**				**2500***	**2500***	**YV***	**YV***		
1 1/4"*	3/4"	**YW**	**YU**			**YW***											
1"*	-	**SL**	**RQ**		**SL***	**RQ***	**RQ***	**RQ**	**RQ**	**RQ**	**RQ***	**SL***	**RQ***	**RQ***	**RQ***	**RQ**	**RQ**
-	1"	**RQ**	**SL**					**RQ**	**RQ**	**RQ**					**2500**	**RQ**	**RQ**
1"	1"	**MP**	**MP**			**2000**	**X**	**X**		**X**					**2500**		**X**
1 1/4"*	1"	**IX**	**VY**			**2000***	**X***	**VY***	**IX**	**IX**					**2500***	**IX**	**IX**
1 1/2"	1"	**VI**	**HW**							**X**							
1 1/4"*	-	**NJ**	**UI**				**NJ***		**UI**	**UI**						**UI**	**UI**
-	1 1/4"	**UI**	**NJ**						**UI**	**UI**						**UI**	**UI**
1 1/4"	1 1/4"	**PF**	**PF**						**X**	**X**						**X**	**X**
1 1/2"*	1 1/4"	**IS**	**IQ**							**X**							**X***
															Metric Straight Thread		
3/4"*	-	**EN**	**TQ**	**X***	**TQ**	**TQ**	**TQ**				**X***	**TQ***	**TQ***	**TQ**			
-	3/4"	**TQ**	**EN**		**TQ**	**TQ**	**TQ**					**2500**	**2500**	**TQ**			
3/4"	3/4"	**ES**	**ES**	**2000**	**X**							**2500**					
1"*	3/4"	**EV**	**ET**	**2000***	**X***	**EV***	**EV**	**EV**				**2500***	**2500***	**EV***	**EV***		
1"*	-	**NL**	**ER**			**ER***	**ER**	**ER**	**ER**				**ER***	**ER***	**ER***	**ER**	
-	1"	**ER**	**NL**				**ER**	**ER**	**ER**								
1"	1"	**CM**	**CM**			**2000**	**X**	**X**						**2500**			
1 1/4"*	-		**UA**					**UA***	**UA**	**UA**					**UA***	**UA**	**UA**
1 1/4"*	1"	**EX**	**VE**			**2000***	**X***	**EX***	**EX**	**EX**				**2500***	**X***	**EX**	**EX**
1 1/4"	1 1/4"	**PA**	**PA**					**X**	**X**	**X**						**X**	**X**
1 1/2"*	1 1/4"	**SA**	**QA**					**X***	**X***	**X**						**X***	**X***

NOTES: Shaded cells are acceptable for motor codes. * This porting is acceptable for low pressure inlet port only. "X" Means both codes are available. "2000" or "2500" indicates maximum pressure rating on port.

Gear Housing (6) *continued*

Series				50	50	50	50	50	50	50	51	51	51	51	51	51	51
Housing Code				10	12	15	17	20	22	25	10	12	15	17	20	22	25
Displacement (C.I.R.)				2.55	3.19	3.83	4.46	5.10	5.74	6.38	2.55	3.19	3.62	4.46	5.10	5.74	6.38
Maximum (PSI)				2500	2500	2500	2000	2000	2000	2000	3000	3000	3000	3000	2500	2500	2500
IN	OUT	CW	CCW												*Metric Split Flange Porting*		
3/4"*	-	VN	VQ	VQ	VQ	VQ	VQ				X*						
-	3/4"	VQ	VN	VQ	VQ	VQ	VQ										
1"*	3/4"	RV	VT	X*	RV*	RV	RV	RV			2500*	X*					
1 1/4"*	3/4"	RW	RU									X*	X*				
1"*	-	UL	UR		UR*	UR	UR	UR	UR			X*	X*	X	X		
-	1"	UR	UL			UR	UR	UR	UR					X	X		
1"	1"	UM	UM		2000	X	X	X	X				2500	X	X	X	
1 1/4"*	1"	UX	VU		2000*	UX*	UX*	UX	UX	UX			2500*	X*	X*		
1 1/2"*	1"	VO	HO			X*	X*	X*					2500*	X*	X*	X	
1 1/4"*	-	NO	UO				UO*	UO	UO	UO		X*	X*				
-	1 1/4"	UO	NO					UO	UO	UO							
1 1/4"	1 1/4"	PO	PO			2000	X	X	X	X					X	X	X
1 1/2"*	1 1/4"	SO	QO			2000*	X*	X*	X	X					X*	X	X
1 1/2"*	-	UY	TO			X*	X*		X					X*	X*		
-	1 1/2"	TO	UY						X								
1 1/2"	1 1/2"	SV	SV					X	X	X						X	X
2"*	1 1/4"	JM	JR					X*	X*	X*					X*	X*	X*
2"*	1 1/2"	JQ	JN					X*	X*	X*						X*	X*

NOTES

Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
"X" Means both codes are available.
"2000" or "2500" indicates maximum pressure rating on port.

Gear Width (7)

50 Series

	Gear Width	in.^{3}/rev.	cm^3/rev.	Max Pressure
05	1/2"	1.28	20.9	2500 psi (172 bar)
07	3/4"	1.91	31.3	2500 psi (172 bar)
10	1"	2.55	41.8	2500 psi (172 bar)
12	1 1/4"	3.19	52.2	2500 psi (172 bar)
15	1 1/2"	3.83	62.7	2500 psi (172 bar)
17	1 3/4"	4.46	73.1	2000 psi (138 bar)
20	2"	5.10	83.6	2000 psi (138 bar)
22	2 1/4"	5.74	94.0	2000 psi (138 bar)
25	2 1/2"	6.38	104.5	2000 psi (138 bar)

51 Series

	Gear Width	in.^{3}/rev.	cm^3/rev.	Max Pressure
05	1/2"	1.28	20.9	3000 psi (207 bar)
07	3/4"	1.91	31.3	3000 psi (207 bar)
10	1"	2.55	41.8	3000 psi (207 bar)
12	1 1/4"	3.19	52.2	3000 psi (207 bar)
15	1 1/2"	3.83	62.7	3000 psi (207 bar)
17	1 3/4"	4.46	73.1	3000 psi (207 bar)
20	2"	5.10	83.6	2500 psi (172 bar)
22	2 1/4"	5.74	94.0	2500 psi (172 bar)
25	2 1/2"	6.38	104.5	2500 psi (172 bar)

Shaft Type (8) *(type 1 unless noted)*

For single, tandem, or two piece shaft unless noted.

07	SAE "C" 14 tooth spline 1.25" dia., ANSI 32-4
11	SAE "C" keyed 1.25" dia., 5/16"X15/32"X1 1/2" key, ANSI 32-1
22	50-50, 51-51 piggyback shaft
23	75-50, 76-51 piggyback shaft
25	SAE "B" 13 tooth spline .88" dia., ANSI 22-4
43	SAE "B-B" keyed 1.00" dia. 1/4"X3/8"X1 1/4" key, ANSI 25-1
53	SAE "C" 14 tooth spline 1.25" dia., ANSI-32-4, **type 2** (single & tandem)
65	SAE "B" 13 tooth spline .88" dia., ANSI 22-4, **type 2** (single & tandem)
67	SAE "B-B" keyed 1.00 dia., 1/4"X3/8"X1 1/4" key, ANSI 25-1, **type 2** (single & tandem)
73	SAE "C" keyed 1.25" dia., 5/16" x 15/32" x 2 1/4" key, extended length (two-piece only)
98	SAE "B-B" 15 tooth spline, 1.00" dia., ANSI 25-4 (single & tandem)

Bearing Carriers (9) Pump Only

Common Inlet Passage

IN	OUT	CW	CCW
-	-	C	D
* -	-	A	U

** 51 Series only. Used when only one adjacent gear housing has an inlet port.*

NPT Porting (50 Series only)

1”	-	TB	BT
1 1/4”	-	VB	BV
1 1/2”	-	WB	BW
1”	3/4”	TX	XT
1 1/4”	3/4”	VX	XV
1 1/2”	3/4”	WX	XW
1 1/4”	1”	VZ	ZV
1 1/2”	1”	WZ	ZW
1”	3/4”	TJ	JT
1 1/4”	3/4”	VJ	JV
1 1/4”	1”	VK	KV
1 1/2”	1”	WK	KW
1”	3/4”	ZX	XZ

ODT Porting

1”	-	CB	BC
1 1/4”	-	DB	BD
1 1/2”	-	FB	BF
-	3/4”	PJ	*JP
1”	3/4”	CJ	JC
1 1/4”	3/4”	DJ	JD
1 1/2”	3/4”	FJ	JF
1 1/4”	1”	DK	KD
1 1/2”	1”	FK	KF

* 51 Series only.

1”	3/4”	CR	RC
1 1/4”	3/4”	DR	RD
*1 1/2”	3/4”	FR	RF
1 1/4”	1”	DS	SD
1 1/2”	1”	FS	SF
-	1”	HZ	*ZH

* 51 Series only.

1”	3/4”	KJ	JK

Split Flange Porting

IN	OUT	CW	CCW
1”	-	LB	BL
1 1/4”	-	MB	BM
1 1/2”	-	NB	BN
-	3/4”	BR	RB
1”	3/4”	LR	RL
1 1/4”	3/4”	MR	RM
1 1/2”	3/4”	NR	RN
1 1/4”	1”	MS	SM
1 1/2”	1”	NS	SN
1”	3/4”	LX	XL
1 1/4”	3/4”	MX	XM
1 1/4”	1”	MZ	ZM
1 1/2”	1”	NZ	ZN
1”	3/4”	SR	RS

BSPP Porting

	1”	-	CX	XC
	1 1/4”	-	DX	XD
	1 1/2”	-	FX	XF
*	-	3/4”	-	TL
	1”	3/4”	CT	TC
	1 1/4”	3/4”	DT	TD
	1 1/2”	3/4”	FT	TF
	1 1/4”	1”	DV	VD
	1 1/2”	1”	FV	VF

* 50 Series only.

1”	3/4”	GM	MG
1 1/4”	3/4”	HM	MH
1 1/2”	3/4”	WM	MW
1 1/4”	1”	HN	NH
1 1/2”	1”	WN	NW
1”	3/4”	PN	NP

NOTE

Split flange thread depths may be more shallow than S.A.E. standard. Contact Product Support Department for actual dimensions.

Bearing Carriers (9) Pump Only - *continued*

Metric Split Flange Porting

IN	OUT	CW	CCW
1”	-	CH	HC
1 1/4”	-	DH	HD
1 1/2”	-	FH	HF
-	3/4”	PW	WP
1”	3/4”	CW	WC
1 1/4”	3/4”	DW	WD
1 1/2”	3/4”	FW	WF
1 1/4”	1”	DC	CD
1 1/2”	1”	FC	CF
1”	3/4”	GQ	QG
1 1/4”	3/4”	HQ	QH
1 1/2”	3/4”	WQ	QW
1 1/4”	1”	HS	SH
1 1/2”	1”	WS	SW
1”	3/4”	ST	TS

Metric Straight Thread Porting

IN	OUT	CW	CCW
1”	-	CL	LC
1 1/4”	-	DL	LD
1 1/2”	-	FL	LF
1”	3/4”	CZ	ZC
1 1/4”	3/4”	DZ	ZD
1 1/2”	3/4”	FZ	ZF
1 1/4”	1”	DN	ND
1 1/2”	1”	FN	NF
1”	3/4”	GT	TG
1 1/4”	3/4”	HT	TH
1 1/2”	3/4”	WT	TW
1 1/4”	1”	HV	VH
1 1/2”	1”	WV	VW
1”	3/4”	KL	LK

Bearing Carriers (9) (Motor Only)

No Ports

IN	OUT	DUAL
-	-	B

NPT Porting (30 Series only)

1”	1”	TT
1 1/4”	1 1/4”	VV
1 1/2”	1 1/2”	WW

ODT Porting

1”	1”	CC
1 1/4”	1 1/4”	BB
1 1/2”	1 1/2”	FF

Split Flange Porting

1”	1”	LL
1 1/4”	1 1/4”	MM
1 1/2”	1 1/2”	NN

BSPP Porting

IN	OUT	DUAL
1”	1”	EE
1 1/4”	1 1/4”	GG

Metric Split Flange Porting

1”	1”	RR
1 1/4”	1 1/4”	SS

Metric Straight Thread Porting

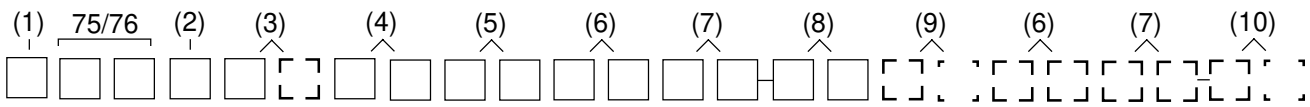
1”	1”	KK
1 1/4”	1 1/4”	JJ

Connecting Shaft (10)

For connecting tandem units.

1	Connecting Shaft - Multiple Units
22	Piggyback Pump Connecting Shaft for P50 to P50, P51 to P51
23	Piggyback Pump Connecting Shaft for P75 to P50, P76 to P51

75/76 Series Coding



Pump/Motor (1)

P	Pump
M	Motor

Unit (2)

A	Single Unit
B	Tandem Unit
C	Single or Tandem w/ two-piece shaft (O.B. bearing required)

Shaft End Cover (3)

1	Pump, cw w/o O.B. bearing
2	Pump, ccw w/o O.B. bearing
3	Pump, bi-rotational w/o O.B. bearing (75 series only)
4	Pump, cw with O.B. bearing
5	Pump, ccw with O.B. bearing
6	Pump, bi-rotational w/ O.B. bearing (75 series only)
8	Motor, bi-rot. with O.B. bearing + 1/4" NPT drain
9	Motor, bi-rot. w/o O.B. bearing + 1/4" NPT drain
18	Motor, bi-rot. with O.B. bearing + 1/4" BSPP drain
19	Motor, bi-rot. w/o O.B. bearing + 1/4" BSPP drain

Shaft End Cover (4) *(type 1 only)*

42	SAE 4 bolt "B" ANSI 101-4
78	SAE 4 bolt "C" ANSI 127-4
80	SAE 4 bolt "D" ANSI 152-4
98	SAE 2 bolt "C" ANSI 127-2

Port End Cover (5) (Rear Ported)

Left	Right	Single	Tandem	Extended Studs
Unported				
-	-	**BE**	**BI**	**BY**
O.D.T. Porting				
1"	1"	**JE**	**JI**	**JY**
Metric Straight Thread				
1"	1"	**TE**	**TI**	**TY**

	CW	CCW	Double
Piggyback Port End - Pump Only			
Type 75-50, 76-51 & 75-30, 76-31	**KO**	**LO**	**MO**

For All Units

To determine direction of shaft rotation, view the unit with the shaft pointing toward you, and the idler (driven) gear beneath the shaft. With clockwise rotation, flow will be left to right. The inlet pump port will be on the left, outlet on the right. The flow is in the opposite direction with counter-clockwise rotation. Inverting the pump will reverse the inlet and outlet ports but not the direction of rotation.

Gear Housing (6)

Series			75	75	75	75	75	75/76	75	75	75/76	75/76	76	76	76	76	76	76
Housing Code			07	10	12	15	17	20	22	25	27	30	10	12	15	17	22	25
Displacement (C.I.R.)			3.07	4.1	5.12	6.15	7.17	8.2	9.22	10.25	11.275	12.3	4.1	5.12	6.15	7.17	9.22	10.25
Maximum (PSI)			2500	2500	2500	2500	2500	2500	2250	2250	2000	2000	3000	3000	3000	3000	2500	2500
IN	**OUT**	**CW CCW**															***No Porting***	
I	I	I I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
-	-	**AB AB**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
																	NPT Porting	
3/4"	-	**IC ID**	**ID**	**ID**	**ID**	**ID**												
-	3/4"	**ID IC**	**ID**	**ID**	**ID**	**ID**												
1"	3/4"	**IJ IG**		**X**	**IJ**	**IJ**												
1"	-	**YC YD**			**YD**	**YD**		**X/-**										
-	1"	**YD YC**			**YD**	**YD**		**X/-**										
1"	1"	**YF YF**		**X**	**X**													
1 1/4"	1"	**YJ YG**			**X**	**X**												
1 1/4"	1 1/4"	**YL YL**			**X**	**X**	**X**											
																	OD Tube Porting	
3/4"	-	**EC ED**	**ED**	**ED**	**ED**	**ED**												
1"*	3/4"	**EJ EG**	**X***		**EJ**	**EJ**							**2500***					
1 1/4"*	3/4"	**EK EH**		**X***										**X***				
1"*	-	**AC AD**			**AD**	**AD**								**2500**	**X**			
-	1"	**AD AC**			**AD**	**AD**								**2500**	**X**			
1"	1"	**AF AF**		**2000**	**X**	**X**	**X**	**X/-**						**2500**	**X**			
1 1/4"*	1"	**AJ AG**		**2000***	**X***									**2500***	**X***			
1 1/2"*	1"	**AK AH**				**X***									**X***			
1 1/4"	1 1/4"	**AL AL**				**2000**	**2000**	**2000/-**	**X**	**X**		**X/-**						
1 1/2"*	1 1/4"	**AP AM**				**2000***	**2000***											
1 1/2"	1 1/2"	**AR AR**							**X**	**X**								
																	Split Flange Porting	
3/4"	-	**UC UD**	**UD**	**UD**	**UD**	**UD**												
-	3/4"	**UD UC**	**UD**	**UD**	**UD**	**UD**												
1"	3/4"	**UJ UG**	**X**	**X**	**UJ**	**UJ**	**UJ**	**UJ**					**X**					
1"	-	**OC OD**		**OD**	**X**	**OD**	**OD**	**OD**										
-	1"	**OD OC**		**OD**	**X**	**OD**	**OD**	**OD**										
1"	1"	**OF OF**		**X**	**X**	**X**	**X**	**X/X**		**X**	**X/-**	**X/-**	**X**	**X**	**X**	**X**	**X**	
1 1/4"*	1"	**OJ OG**		**2000***	**X**	**X**	**OJ**	**OJ/-**	**OJ**	**OJ**		**-/X**	**X***	**X***				
1 1/2"*	1"	**OK OH**			**X***	**X***	**X***	**X/-**	**X**					**X***	**X***	**X***		
1 1/4"	-	**OA OB**			**OB**	**OB**	**OB**	**OB/-**	**OB**	**OB**								
-	1 1/4"	**OB OA**			**OB**	**OB**	**OB**	**OB/-**	**OB**	**OB**								
1 1/4"	1 1/4"	**OL OL**		**2000**	**X**	**X**	**X**	**X/X**	**X**	**X**	**X/X**	**X/X**		**2500**	**X**	**X**	**X**	**X**
1 1/2"*	1 1/4"	**OP OM**			**X***	**X***	**X***	**X/X**	**X**	**X**	**OP/-**	**OP/-**		**2500***	**X***	**X***	**X**	
1 1/2"	-	**OE OU**						**X/X**	**X**	**OU**	**OU/-**	**OU/-**					**X**	
-	1 1/2"	**OU OE**						**X/X**	**X**	**OU**	**OU/-**	**OU/-**					**X**	
1 1/2"	1 1/2"	**OR OR**				**2000**	**2000**	**X/X**	**X**	**X**	**X/X**	**X/X**					**X**	**X**
2"*	1"	**UQ -**						**X*/-**										
2"*	1 1/4"	**OQ ON**					**X***	**X*/X***	**X***	**X***	**X/X**	**X/X**				**X***	**X***	**X***
2"*	1 1/2"	**OV OS**					**2000***	**X*/X***	**X***	**X***	**X/X**	**X/X**					**X***	**X***
2"	2"	**OX OX**								**X**	**X/X**	**X/X**						
2 1/2"*	1 1/4"	**US UN**								**X***								
2 1/2"*	1 1/2"	**OW OT**								**X***	**X*/X***	**X*/X***						**X***
2 1/2"*	2"	**OZ OY**										**X*/-**						

NOTES

NPT ports are not recommended for use at pressures in excess of 1500 PSI.
Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
"X" Means both codes are available.
"2000" or "2500" indicates maximum pressure rating on port.

Gear Housing (6) *continued*

Series			75	75	75	75	75	75/76	75	75	75/76	75/76	76	76	76	76	76	76
Housing Code			07	10	12	15	17	20	22	25	27	30	10	12	15	17	22	25
Displacement (C.I.R.)			3.07	4.1	5.12	6.15	7.17	8.2	9.22	10.25	11.275	12.3	4.1	5.12	6.15	7.17	9.22	10.25
Maximum (PSI)			2500	2500	2500	2500	2500	2500	2250	2250	2000	2000	3000	3000	3000	3000	2500	2500
IN	**OUT**	**CW CCW**															***BSPP Porting***	
3/4"	-	**YN YQ**	**YQ**	**YQ**	**YQ**	**YQ**		**YQ/-**					**YQ**	**YQ**	**YQ**			
-	3/4"	**YQ YN**	**YQ**	**YQ**	**YQ**	**YQ**		**YQ/-**					**YQ**	**YQ**	**YQ**			
3/4"	3/4"	**YS YS**											**X**					
1"*	3/4"	**YV YT**	**X***	**YV***	**YV**	**YV**		**YV/YV**					**X***	**YV***	**YV**		**YV**	
1"*	-	**SL RQ**			**X**	**RQ**	**RQ**	**RQ/RQ**		**RQ**			**SL***	**RQ***	**RQ**			**RQ**
-	1"	**RQ SL**			**X**	**RQ**	**RQ**	**RQ/RQ**		**RQ**					**RQ**			**RQ**
1"	1"	**MP MP**		**2000**	**X**	**X**								**2500**	**X**	**X**		
1 1/4"*	1"	**IX VY**		**2000***	**X***	**IX***		**IX/-**	**IX**			**IX/-**		**2500***	**IX***		**X***	
1 1/4"*	-	**NJ UI**			**UI***													**UI**
-	1 1/4"	**UI NJ**																**UI**
1 1/4"	1 1/4"	**PF PF**				**2000**	**2000**	**X/-**		**X**		**-/X**					**X**	**X**
1 1/2"*	1"	**VI HW**				**X***	**VI***	**-/VI***							**VI***			
1 1/2"*	1 1/4"	**IS IQ**				**2000***	**2000***	**-/X***									**X***	
																	Metric Straight Thread	
3/4"	-	**EN TQ**	**TQ**	**TQ**	**TQ**	**TQ**							**TQ**	**TQ**	**TQ**			
-	3/4"	**TQ EN**	**TQ**	**TQ**	**TQ**	**TQ**							**TQ**	**TQ**	**TQ**			
1"*	3/4"	**EV ET**	**X***		**EV**	**EV**								**EV***	**EV**			
1"*	-	**NL ER**												**ER***	**ER**			
-	1"	**ER NL**			**ER**	**ER**								**2500**	**ER**			
1"	1"	**CM CM**		**2000**	**X**	**X**								**2500**	**X**			
																	Metric Split Flange Porting	
3/4"	-	**VN VQ**	**VQ**	**VQ**	**VQ**	**VQ**												
-	3/4"	**VQ VN**	**VQ**	**VQ**	**VQ**	**VQ**												
1"	3/4"	**RV VT**	**X**	**X**	**RV**	**RV**	**RV**	**RV/-**					**X**					
1"	-	**UL UR**		**UR**	**UR**	**UR**	**UR**	**UR/-**										
-	1"	**UR UL**		**UR**	**UR**	**UR**	**UR**	**UR/-**										
1"	1"	**UM UM**		**X**	**X**	**X**	**X**	**X/X**					**X**	**X**	**X**	**X**		
1 1/4"*	1"	**UX VU**		**X***	**X**	**UX**	**UX**	**UX/-**	**UX**	**UX**			**X***	**X***				
1 1/2"*	1"	**VO HO**			**X***	**X***								**X***	**X***			
1 1/4"	-	**NO UO**			**UO**	**UO**	**UO**	**UO/-**	**UO**	**UO**								
-	1 1/4"	**UO NO**			**UO**	**UO**	**UO**	**UO/-**	**UO**	**UO**								
1 1/4"	1 1/4"	**PO PO**			**X**	**X**	**X**	**X/X**	**X**	**X**	**X/X**	**X/X**		**2500**	**X**	**X**	**X**	**X**
1 1/2"*	1 1/4"	**SO QO**				**X***	**X***	**X/X**	**X**	**SO**	**SO**	**SO**		**2500***	**X***	**X***		
1 1/2"*	-	**UY TO**						**X/X**	**X**	**X**	**TO**	**TO**				**X***	**X**	
-	1 1/2"	**TO UY**						**X/X**	**X**	**X**	**TO**	**TO**					**X**	
1 1/2"	1 1/2"	**SV SV**					**2000**	**X/X**	**X**	**X**	**X/X**	**X/X**					**X**	**X**
2"*	1 1/4"	**JM JR**					**X***	**X*/X***	**X***	**X***	**-/X***	**-/X***				**X***	**X***	**X***
2"*	1 1/2"	**JQ JN**					**2000***	**X*/X***	**X***	**X***	**X/X**	**X/X**					**X***	**X***
2"	2"	**JS JS**									**-/X**	**X/X**						
2 1/2"*	1 1/2"	**LJ JX**									**X*/X***	**X*/X***						**X***

NOTES

Shaded cells are acceptable for motor codes.
* This porting is acceptable for low pressure inlet port only.
"X" Means both codes are available.
"2000" or "2500" indicates maximum pressure rating on port.

Gear Width (7)

75 Series

	Gear Width	in.³/rev.	cm³/rev.	Max Pressure
07	3/4”	3.08	50.4	2500 psi (172 bar)
10	1”	4.10	67.2	2500 psi (172 bar)
12	1 1/4”	5.13	84.0	2500 psi (172 bar)
15	1 1/2”	6.15	100.8	2500 psi (172 bar)
17	1 3/4”	7.18	117.6	2500 psi (172 bar)
20	2”	8.20	134.4	2500 psi (172 bar)
22	2 1/4”	9.23	151.2	2250 psi (155 bar)
25	2 1/2”	10.25	168.0	2250 psi (155 bar)
27	2 3/4”	11.28	184.8	2000 psi (138 bar)
30	3”	12.30	201.6	2000 psi (138 bar)

76 Series

	Gear Width	in.³/rev.	cm³/rev.	Max Pressure
07	3/4”	3.08	50.4	3000 psi (207 bar)
10	1”	4.10	67.2	3000 psi (207 bar)
12	1 1/4”	5.13	84.0	3000 psi (207 bar)
15	1 1/2”	6.15	100.8	3000 psi (207 bar)
17	1 3/4”	7.18	117.6	3000 psi (207 bar)
20	2”	8.20	134.4	2500 psi (172 bar)
22	2 1/4”	9.23	151.2	2500 psi (172 bar)
25	2 1/2”	10.25	168.0	2500 psi (172 bar)
27	2 3/4”	11.28	184.8	2000 psi (138 bar)
30	3”	12.30	201.6	2000 psi (138 bar)

Shaft Type (8)

For single, tandem, or two piece shaft unless noted.

07	SAE “C” 14 tooth spline 1.25” dia., ANSI 32-4
11	SAE “C” keyed 1.25” dia., 5/16”X15/32”X1 1/2” key, ANSI 32-1

Bearing Carriers (9) (Pump Only)

Common Inlet Passage

-	-	**C**	**D**
* **-**	**-**	**A**	**U**

* 76 Series only. Used when only one adjacent gear housing has an inlet port.

Bearing Carriers (9) (Motor Only)

No Ports

IN	OUT	DUAL
I	I	I
-	-	**B**

ODT Porting

1”	1”	**CC**
1 1/4”	1 1/4”	**BB**

Split Flange Porting

*	1”	1”	**LL**
	1 1/4”	1 1/4”	**MM**
	1 1/2”	1 1/2”	**NN**

* 76 Series only.

BSPP Porting

1”	1”	**EE**
1 1/4”	1 1/4”	**GG**
1 1/2”	1 1/2”	**HH**

Metric Split Flange Porting

IN	OUT	DUAL
I	I	I
1”	1”	**RR**
1 1/4”	1 1/4”	**SS**
1 1/2”	1 1/2”	**XX**

Metric Straight Thread Porting

1”	1”	**KK**
1 1/4”	1 1/4”	**JJ**
1 1/2”	1 1/2”	**ZZ**

Connecting Shaft (10)

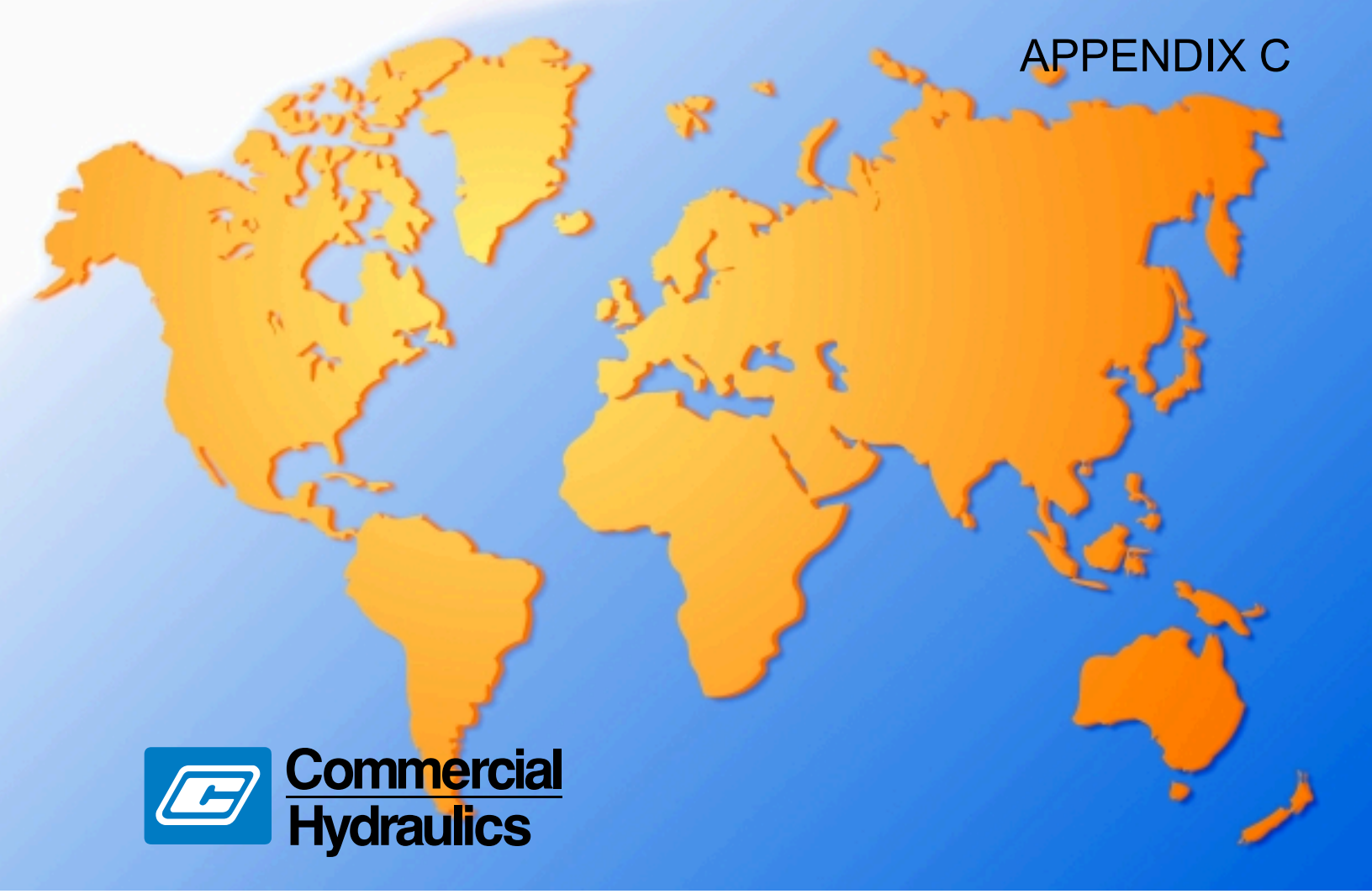
For connecting tandem units.

1	Connecting Shaft - Multiple Units
23	Piggyback Pump Connecting Shaft for P75 to P75

NOTE

Split flange thread depths may be more shallow than S.A.E. standard. Contact Product Support Department for actual dimensions.

APPENDIX C



Commercial Hydraulics

AUSTRALIA
Commercial Hydraulics
265 Ingles Street, P.O. Box 191
Port Melbourne, Victoria 3207
Phone: ++ 61 39 646 2017
Fax: ++ 61 39 646 2257

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Fax: ++ 55 11 7998 2099

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294 Queen St. East, Suite C
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Acton, Ontario L7J 2M6
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Phone: ++ 519 853 3837

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20, rue Pierre Mendès-France, Torcy
77202 Marne La Vallee, Cedex 01
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Fax: ++ 33 1 64 62 10 93

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09326 Geringswalde
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Fax: ++ 49 - 37382 82 210

Commercial Hydraulics/
Sachsenhydraulik
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Neefestraße 96 09116 Chemnitz
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Fax: ++ 49 - 371 30 13 88

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Grantham NG31 9SJ, Lincolnshire
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Fax: ++ 44 1476 592739

Commercial Hydraulics/Ultra
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Cheltenham Road East, Nr Staverton
Airport, Gloucester. GL2 9QN
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Fax: ++ 44 1452 858222

Commercial Hydraulics/Keelavite
Tachbrook Park Drive, Tachbrook Park
Warwick CV34 6TU
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Fax: ++ 44 1926 889 239

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Fax: ++ 39 45 676 7229

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Phone: ++ 214 241 1975
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Pump Division
101 Canterbury Road, P.O. Box 219
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Fax: ++ 704 739 2269

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Cylinder Division
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Commercial Hydraulics/CEC
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CH.3031.2.2000

Moduflow™ *Plus* Series

ILP and RFP Low Pressure Filters

Low Pressure Filters

Moduflow™ *Plus* Series

Applications for Moduflow Filters

- Power Unit Fabrication
- Off-line Filter Loops
- Mobile Equipment

The Moduflow filter is widely considered the most versatile filter available on the market. The unique diverter valve assembly, and inside to outside flow through the element, allows the Moduflow to be configured for in-line, in-tank or suction filtration.

The flow diverter minimizes turbulence and pressure loss through the filter, improving system performance.

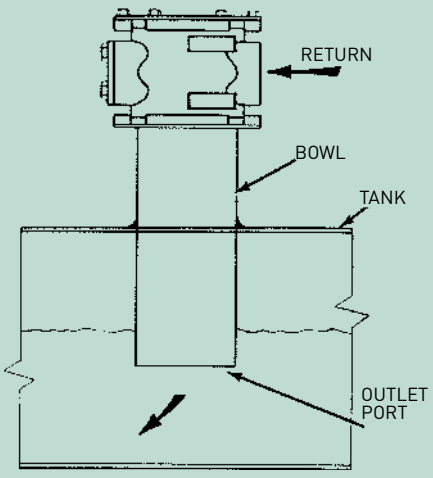
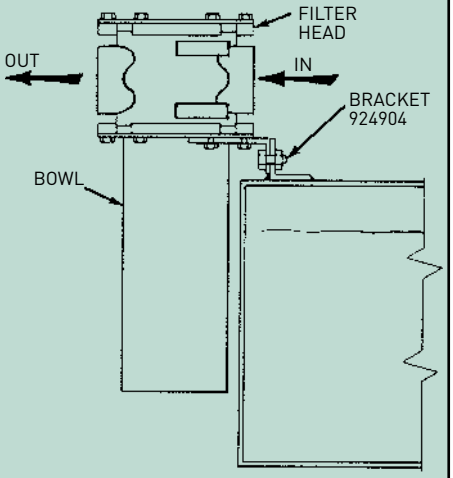
The newly designed closed bottom elements for the RFP and ILP models insures all contamination remains trapped within the element as the filter is serviced.

A wide variety of visual and electrical indicators allows you to know exactly when the element needs to be serviced. There is even a "no element" indicator that can sense when there is not an element installed in the filter.

From top to bottom, the Moduflow filter series provides the high level of filtration and long term dependability so vital to today's hydraulic systems.

Parker's new patented Moduflow element was designed with built-in diverter cone and bypass valve, to meet your application needs.

Mounting / Porting Styles

RFP Return Filter	ILP In-Line Filter
	

Parker Hannifin Corporation
Hydraulic Filter Division
Metamora, OH

Features

Flanges
- NPT or SAE ¾" to 2"
- Lightweight aluminum

Cover
- Slotted for quick release
- Lightweight aluminum

Indicators
- Visual or electrical
- Mounted on either side
- Standard "no element" indication

Bowl
- Single or double length
- Durable steel construction

Bypass
(not visible)
- Integral 35 psi bypass replaced with every element change

Element
(not visible)
- Available in cellulose, wire mesh or high performance Microglass III media
- Single or double length

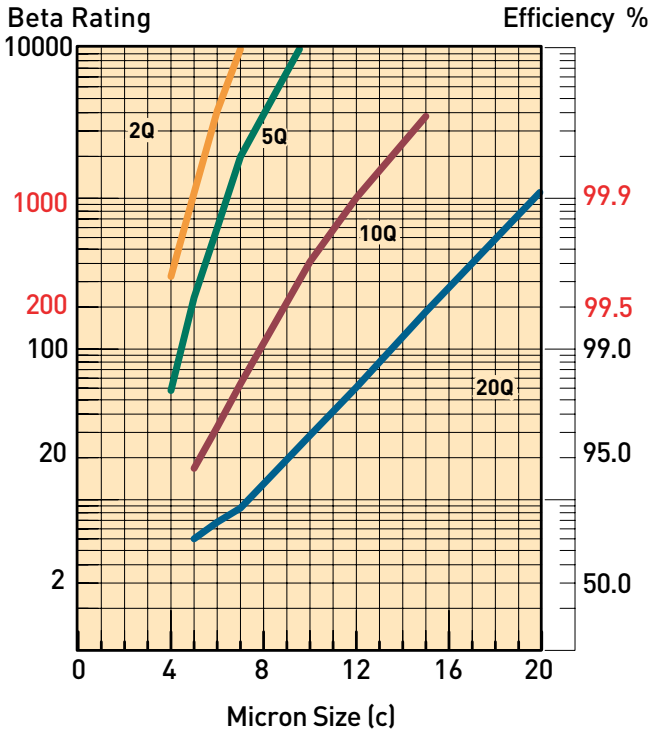
Feature	Advantage	Benefit
• Top access element service	• Oil remains in housing • Quicker elements change	• No Spills • Reduced maintenance costs
• Slotted cover	• Quick release cover • Cap screws remain in housing	• Reduced maintenance costs • No loose parts to lose
• Closed bottom elements	• Removes all contaminant during element service	• No downtime contamination from servicing
• Visual or electrical indicators	• Know exactly when to service elements	• Helps prevent bypass condition • No premature disposal
• Flange face ports	• Flexible mounting (3/4" to 2")	• Easy plumbing to your system

Low Pressure Filters

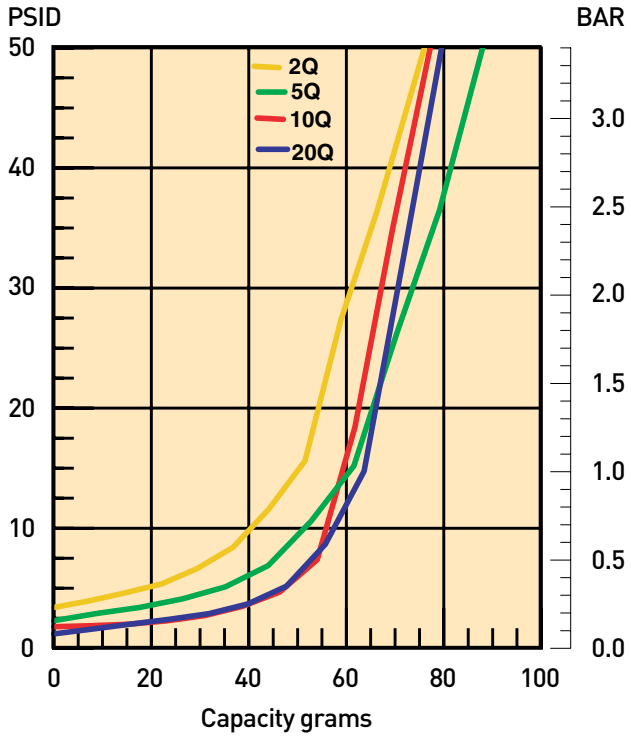
Moduflow™ Plus Series

RFP-1 & ILP-1 Element Performance

Efficiency

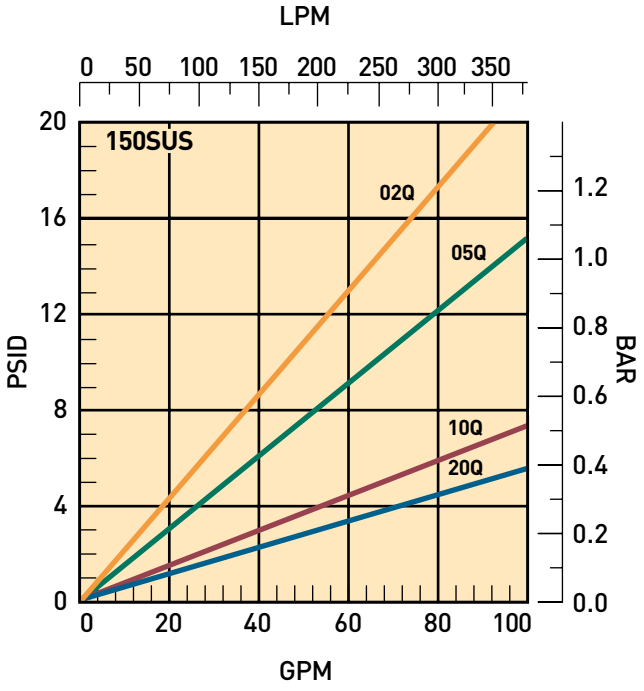


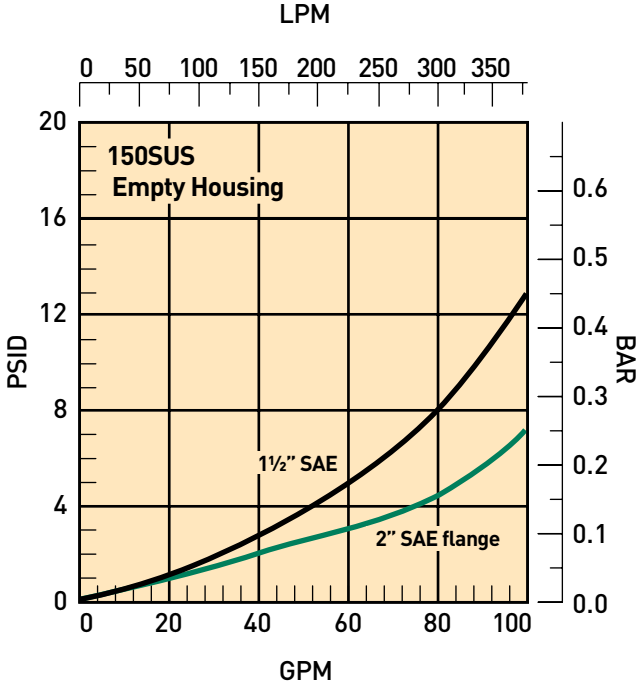
Capacity



Multipass tests run @ 40 gpm to 50 psid terminal - 5mg/L BUGL

Flow vs. Pressure Loss

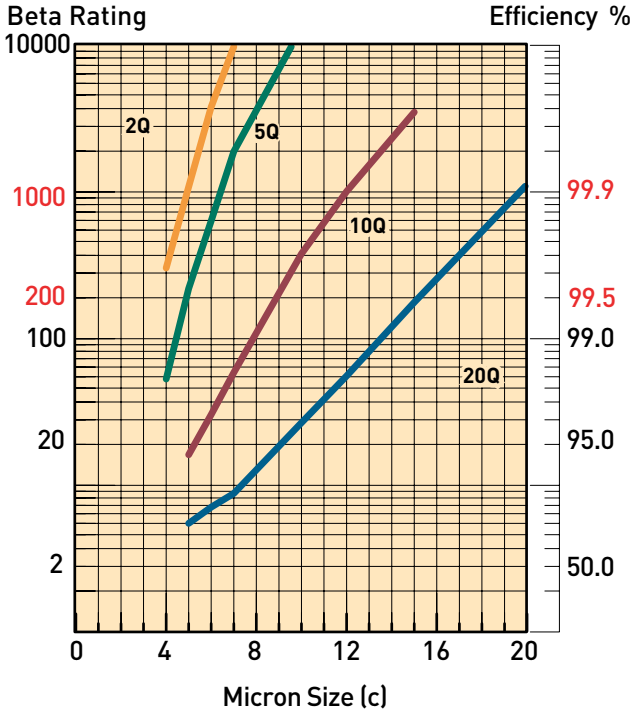




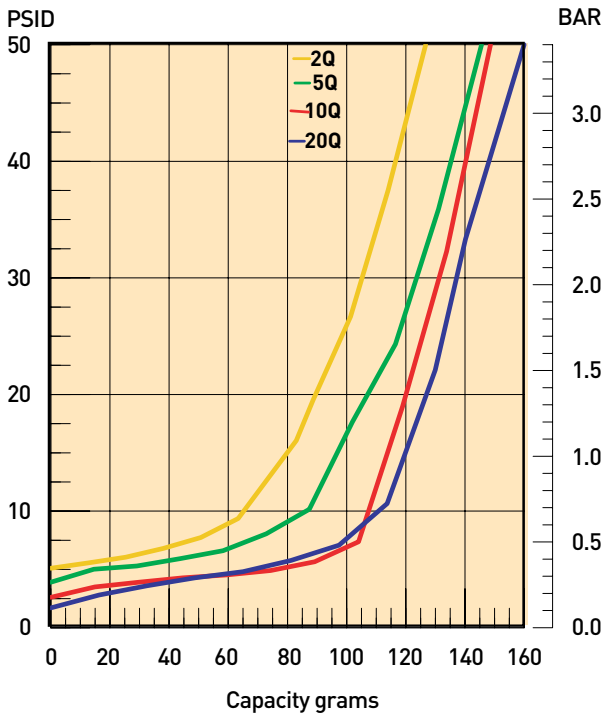
Parker Hannifin Corporation
Hydraulic Filter Division
Metamora, OH

RFP-2 & ILP-2 Element Performance

Efficiency

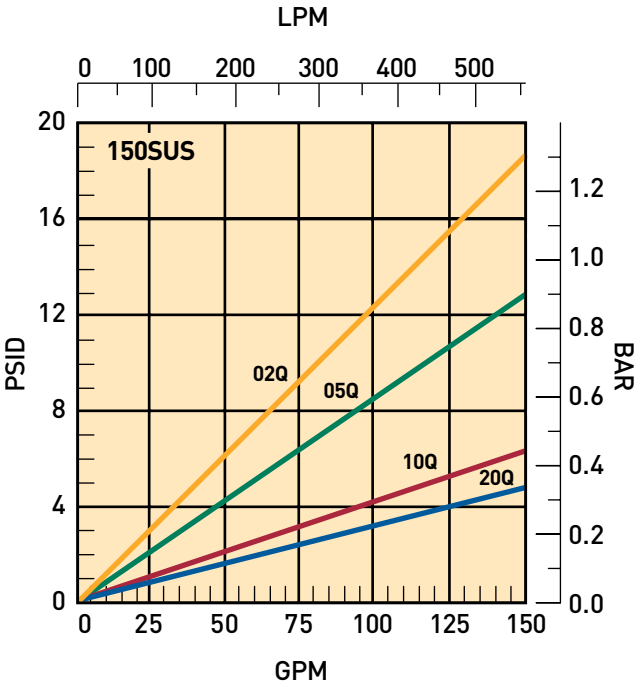


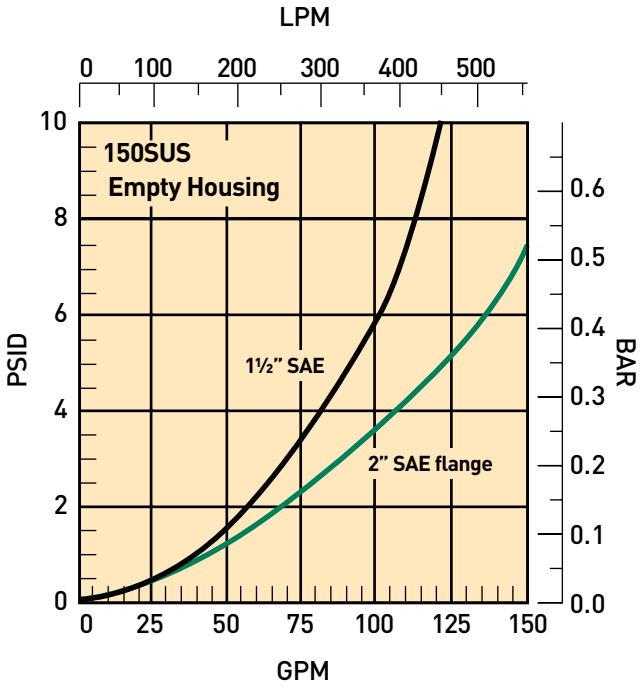
Capacity



Multipass tests run @ 80 gpm to 50 psid terminal - 5mg/L BUGL

Flow vs. Pressure Loss





Low Pressure Filters

Moduflow™ *Plus* Series

Specifications: RFP, ILP

Pressure Ratings:
Maximum Allowable Operating Pressure (MAOP): 200 psi (13.8 bar)
Design Safety Factor: 2:1
Rated Fatigue Pressure: 150 psi (10.3 bar)

Element Burst Rating: 70 psid (4.8 bar)

Filter Materials:
Head, Cover, Flanges: die cast aluminum
Bowl: steel

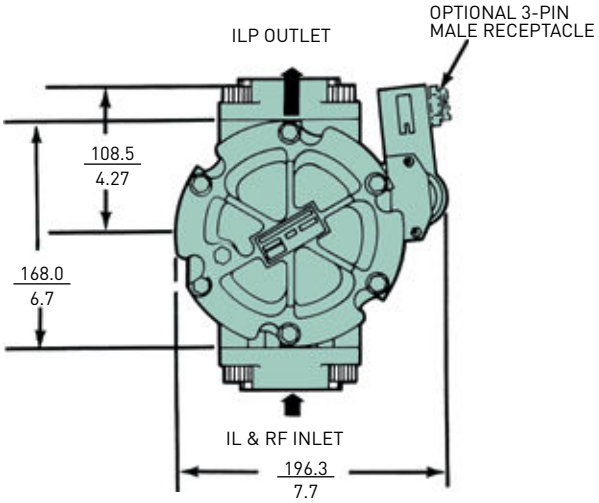
Operating Temperatures:
Nitrile: -40°F to 225°F (-40°C to 107°C)
Fluorocarbon: -15°F to 275°F (-26°C to 135°C)

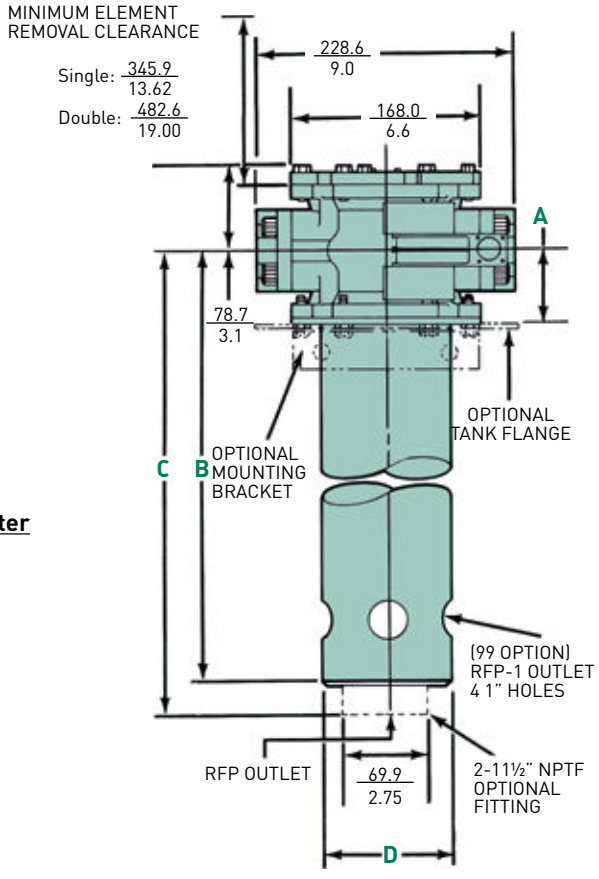
Weight (approximate):
Single: 20 lbs. (9.1 kg)
Double: 25 lbs. (11.3 kg)

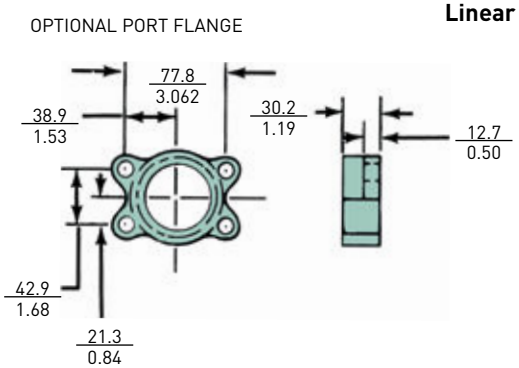
Indicators:
Visual (optional)
Electrical (optional) 15A @ 250VAC / .5A @ 125 VDC
Electrical ("D" option) 5A @ 250VAC / 3A @ 28 VDC

Color Coding:
White (normally closed)
Red (normally open)
Black (common)

	Dimensions: mm / inch			
Model	**A**	**B**	**C**	**D**
RFP-1 without optional 2" fitting	65.0 2.56	330.2 13.0	–	110.0 4.3
ILP-1	65.0 2.56	330.2 13.0	N/A	110.0 4.3
RFP-1 with optional 2" fitting	68.3 2.69	–	383.4 15.07	114.0 4.5
RFP-2	68.3 2.69	617.5 24.31	623.8 24.56	114.0 4.5
ILP-2	68.3 2.69	617.5 24.31	N/A	114.0 4.5







Linear Measure: millimeter / inch

Parker Hannifin Corporation
Hydraulic Filter Division
Metamora, OH

HYDAC ISO Cleanliness Levels

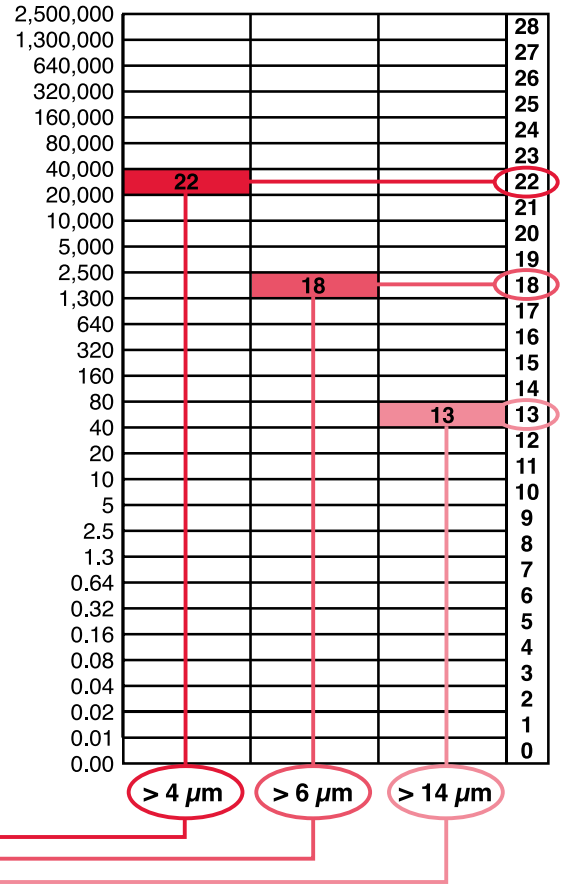
ISO 4406 Code

Cleanliness levels are defined by three numbers divided by slashes (/.) These numbers correspond to 4, 6, and 14 micron, in that order. Each number refers to an ISO Range Code, which is determined by the number of particles for that size (4,6, & 14µm) and larger present in 1 ml of fluid. Each range is double the range below. Refer to the chart below to see the actual ranges.

Example:

larger than 4µm = 22,340
larger than 6µm = 1,950
larger than 14µm = 43

ISO Code = 22 / 18 / 13



Achieving the appropriate cleanliness level in a system

The only way to achieve and maintain the appropriate cleanliness level in a hydraulic or lubrication system, is to implement a comprehensive filtration program. HYDAC offers all of the products that are needed to do just that! - They include:

Solid Contamination

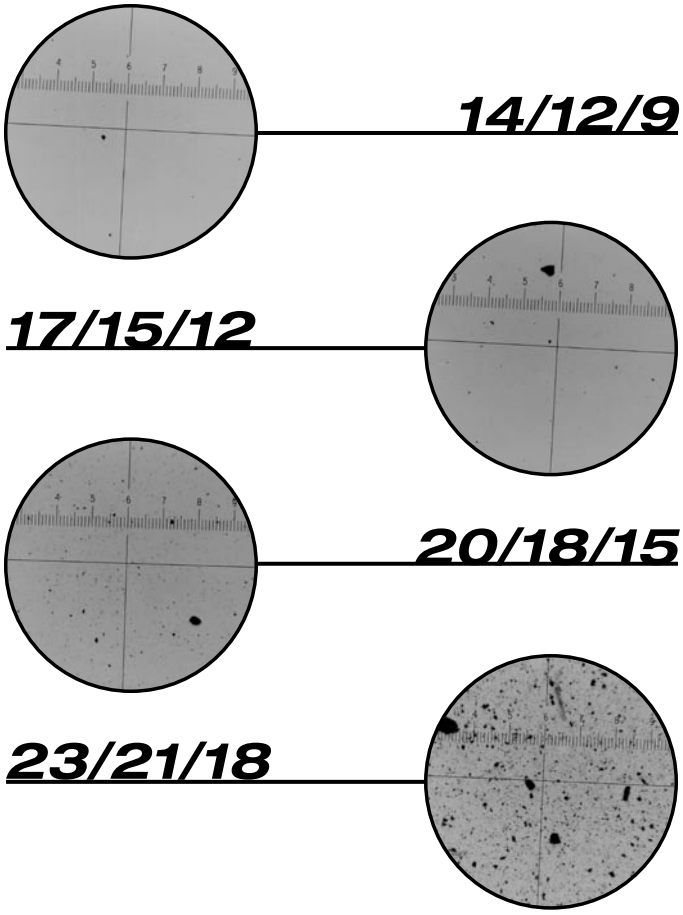
- pressure filters
- return line filters
- offline filtration loops
- oil transfer units for precleaning of new oil
- portable and online contamination monitors
- reservoir breathers and filler/breathers

Water Content

- water content sensors
- reservoir breathers with silica gel desiccant
- vacuum dehydration water removal units
- water removal elements

Fluid Analysis

- bottle sampling kits
- complete analysis kits



ISO Cleanliness Levels

Finding the cleanliness level required by a system

1. Starting at the left hand column, select the most sensitive component used in the system.
2. Move to the right to the column that describes the system pressure and conditions.
3. Here you will find the recommended ISO class level, and recommended element micron rating.

	Low/Medium Pressure Under 2000 psi (moderate conditions)		High Pressure 2000 to 2999 psi (low/medium with severe conditions[1])		Very High Pressure 3000 psi and over (high pressure with severe conditions[1])	
	ISO Target Levels	Micron Ratings	ISO Target Levels	Micron Ratings	ISO Target Levels	Micron Ratings
Pumps						
Fixed Gear or Fixed Vane	20/18/15	20	19/17/14	10	18/16/13	5
Fixed Piston	19/17/14	10	18/16/13	5	17/15/12	3
Variable Vane	18/16/13	5	17/15/12	3	not applicable	not applicable
Variable Piston	18/16/13	5	17/15/12	3	16/14/11	3[2]
Valves						
Check Valve	20/18/15	20	20/18/15	20	19/17/14	10
Directional (solenoid)	20/18/15	20	19/17/14	10	18/16/13	5
Standard Flow Control	20/18/15	20	19/17/14	10	18/16/13	5
Cartridge Valve	19/17/14	10	18/16/13	5	17/15/12	3
Proportional Valve	17/15/12	3	17/15/12	3	16/14/11	3[2]
Servo Valve	16/14/11	3[2]	16/14/11	3[2]	15/13/10	3[2]
Actuators						
Cylinders, Vane Motors, Gear Motors	20/18/15	20	19/17/14	10	18/16/13	5
Piston Motors, Swash Plate Motors	19/17/14	10	18/16/13	5	17/15/12	3
Hydrostatic Drives	16/15/12	3	16/14/11	3[2]	15/13/10	3[2]
Test Stands	15/13/10	3[2]	15/13/10	3[2]	15/13/10	3[2]
Bearings						
Journal Bearings	17/15/12	3	not applicable	not applicable	not applicable	not applicable
Industrial Gearboxes	17/15/12	3	not applicable	not applicable	not applicable	not applicable
Ball Bearings	15/13/10	3[2]	not applicable	not applicable	not applicable	not applicable
Roller Bearings	16/14/11	3[2]	not applicable	not applicable	not applicable	not applicable

1. Severe conditions may include high flow surges, pressure spikes, frequent cold starts, extremely heavy duty use, or the presence of water
2. Two or more system filters of the recommended rating may be required to achieve and maintain the desired Target Cleanliness Level.

FREE Poster!

The information on these two pages is also available on our **ISO Cleanliness Guidelines** poster.

Visit our web site to request your FREE copy.

www.hydacusa.com/poster

Every Company has to have a Toolbox
at Texas International Oilfield Tools.

We provide the tools to fuel the world!