SHIPCO® PUMPS
www.shipcopumps.com

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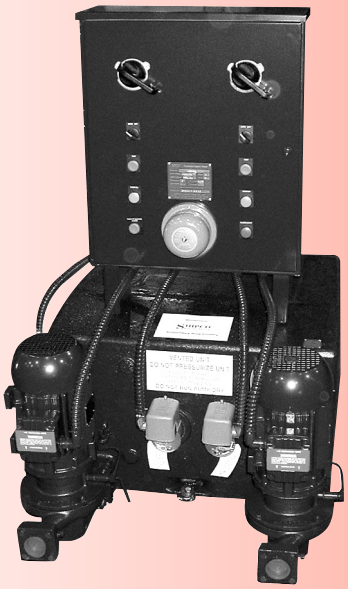
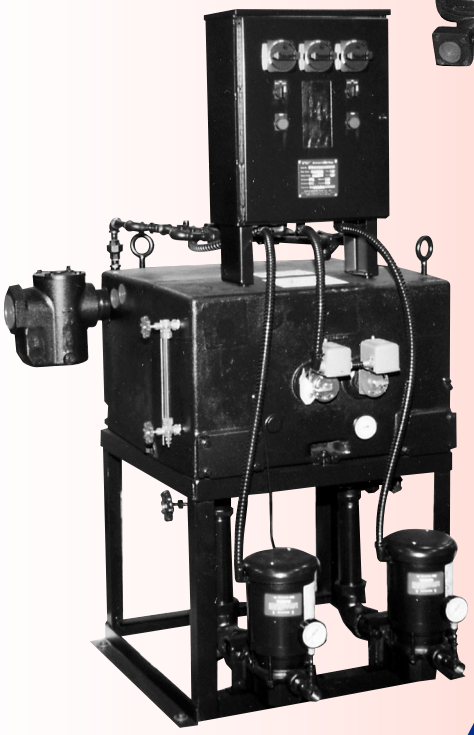
Pride

Quality

Craftsmanship

BULLETIN 137
Revised 8/17





TYPE PMC

PROPELLER MAKE-UP CAST IRON RECEIVER BOILER FEED UNITS

PMC Units handle condensate to 210˚F

AND

TYPE PMEC

PROPELLER MAKE-UP ELEVATED CAST IRON RECEIVER BOILER FEED UNITS

PMEC Units handle condensate to 212˚F

20 Year Warranty Against Corrosion Failure on Receiver

NOTE: If unit used as a surge tank, pumps should run continously.

SHIPCO® PUMPS are equipped with Mechanical Seals rated for temperatures up to 250°F as standard.

Higher temperature seals and special faces available upon request.

TYPE PMC BOILER FEED UNITS

BOILER CAP. BHP	PUMP CAP. GPM	PUMP DISCH. PRESS. PSIG	MOTOR HP 3500 RPM ONLY	PHASE	DISCH. SIZE INCHES	CATALOG NO.	REC. CAP. GALS.	INLET SIZE INCHES
40	6	20	1/3	1 or 3	3/4"	6 PMC-20	25	2"
		25	1/2	1 or 3		6 PMC-25		
		30	3/4	1 or 3		6 PMC-30		
		40	1-1/2	1 or 3		6 PMC-40		
		50	1-1/2	1 or 3		6 PMC-50		
		60	3	3		6 PMC-60		
		70	3	3		6 PMC-70		
		75	3	3	1-1/2"	6 PMC-75		
		80	5	3		6 PMC-80		
		90	5	3		6 PMC-90		
		100	5	3		6 PMC-100		
		110	7-1/2	3		6 PMC-110		
		120	10	3		6 PMC-120		
		130	10	3		6 PMC-130		
		140	10	3		6 PMC-140		
		150	15	3		6 PMC-150		
		160	15	3		6 PMC-160		
55	9	20	1/3	1 or 3	3/4"	9 PMC-20	37	3"
		25	1/2	1 or 3		9 PMC-25		
		30	3/4	1 or 3		9 PMC-30		
		40	1-1/2	1 or 3		9 PMC-40		
		50	1-1/2	1 or 3		9 PMC-50		
		60	3	3		9 PMC-60		
		70	3	3		9 PMC-70		
		75	3	3	1-1/2"	9 PMC-75		
		80	5	3		9 PMC-80		
		90	5	3		9 PMC-90		
		100	5	3		9 PMC-100		
		110	7-1/2	3		9 PMC-110		
		120	10	3		9 PMC-120		
		130	10	3		9 PMC-130		
		140	10	3		9 PMC-140		
		150	15	3		9 PMC-150		
		160	15	3		9 PMC-160		
80	12	20	1/2	1 or 3	3/4"	12 PMC-20	57	3"
		25	3/4	1 or 3		12 PMC-25		
		30	3/4	1 or 3		12 PMC-30		
		40	1 1/2	1 or 3		12 PMC-40		
		50	1-1/2	1 or 3		12 PMC-50		
		60	3	3		12 PMC-60		
		70	3	3		12 PMC-70		
		75	3	3	1-1/2"	12 PMC-75		
		80	5	3		12 PMC-80		
		90	5	3		12 PMC-90		
		100	5	3		12 PMC-100		
		110	7-1/2	3		12 PMC-110		
		120	10	3		12 PMC-120		
		130	10	3		12 PMC-130		
		140	10	3		12 PMC-140		
		150	15	3		12 PMC-150		
		160	15	3		12 PMC-160		
100	15	20	1/2	1 or 3	3/4"	15 PMC-20	80	4"
		25	3/4	1 or 3		15 PMC-25		
		30	1	1 or 3		15 PMC-30		
		40	1-1/2	1 or 3		15 PMC-40		
		50	2	1 or 3		15 PMC-50		
		60	3	3		15 PMC-60		
		70	5	3		15 PMC-70		
		75	5	3	1-1/2"	15 PMC-75		
		80	5	3		15 PMC-80		
		90	5	3		15 PMC-90		
		100	5	3		15 PMC-100		
		110	7-1/2	3		15 PMC-110		
		120	10	3		15 PMC-120		
		130	10	3		15 PMC-130		
		140	10	3		15 PMC-140		
		150	15	3		15 PMC-150		
		160	15	3		15 PMC-160		

TYPE PMC BOILER FEED UNITS

BOILER CAP. BHP	PUMP CAP. GPM	PUMP DISCH. PRESS. PSIG	MOTOR HP 3500 RPM ONLY	PHASE	DISCH. SIZE INCHES	CATALOG NO.	REC. CAP. GALS.	NLET SIZE INCHES
125	18	20	1/2	1 or 3	1-1/2”	18 PMC-20	80	4"
		25	3/4	1 or 3		18 PMC-25		
		30	1	1 or 3		18 PMC-30		
		40	1-1/2	1 or 3		18 PMC-40		
		50	2	1 or 3		18 PMC-50		
		60	3	3		18 PMC-60		
		70	5	3		18 PMC-70		
		75	5	3		18 PMC-75		
		80	5	3		18 PMC-80		
		90	5	3		18 PMC-90		
		100	5	3		18 PMC-100		
		110	7-1/2	3		18 PMC-110		
		120	10	3		18 PMC-120		
		130	10	3		18 PMC-130		
		140	10	3		18 PMC-140		
		150	15	3		18 PMC-150		
		160	15	3		18 PMC-160		
150	21	20	3/4	1 or 3	1-1/2”	21 PMC-20	125	4"
		25	3/4	1 or 3		21 PMC-25		
		30	1	1 or 3		21 PMC-30		
		40	1-1/2	1 or 3		21 PMC-40		
		50	2	1 or 3		21 PMC-50		
		60	3	3		21 PMC-60		
		70	5	3		21 PMC-70		
		75	5	3		21 PMC-75		
		80	5	3		21 PMC-80		
		90	5	3		21 PMC-90		
		100	5	3		21PMC-100		
		110	7-1/2	3		21 PMC-110		
		120	10	3		21 PMC-120		
		130	10	3		21 PMC-130		
		140	10	3		21 PMC-140		
		150	15	3		21 PMC-150		
		160	15	3		21 PMC-160		
200	30	20	3/4	1 or 3	1-1/2”	30 PMC-20	125	4"
		25	3/4	1 or 3		30 PMC-25		
		30	1	1 or 3		30 PMC-30		
		40	2	1 or 3		30 PMC-40		
		50	2	1 or 3		30 PMC-50		
		60	3	3		30 PMC-60		
		70	5	3		30 PMC-70		
		75	5	3		30 PMC-75		
		80	5	3		30 PMC-80		
		90	7-1/2	3		30 PMC-90		
		100	7-1/2	3		30PMC-100		
		110	10	3		30 PMC-110		
		120	10	3		30 PMC-120		
		130	10	3		30 PMC-130		
		140	15	3		30 PMC-140		
		150	15	3		30 PMC-150		
		160	15	3		30 PMC-160		
250	35	20	3/4	1 or 3	1-1/2”	35 PMC-20	160	4"
		25	1	1 or 3		35 PMC-25		
		30	1-1/2	1 or 3		35 PMC-30		
		40	2	1 or 3		35 PMC-40		
		50	3	3		35 PMC-50		
		60	5	3		35 PMC-60		
		70	5	3		35 PMC-70		
		75	5	3		35 PMC-75		
		80	5	3		35 PMC-80		
		90	7-1/2	3		35 PMC-90		
		100	7-1/2	3		35 PMC-100		
		110	10	3		35 PMC-110		
		120	10	3		35 PMC-120		
		130	15	3		35 PMC-130		
		140	15	3		35 PMC-140		
		150	15	3		35 PMC-150		
		160	15	3		35 PMC-160		

TYPE PMC BOILER FEED UNITS

BOILER CAP. BHP	PUMP CAP. GPM	PUMP DISCH. PRESS. PSIG	MOTOR HP 3500 RPM ONLY	PHASE	DISCH. SIZE INCHES	CATALOG NO.	REC. CAP. GALS.	INLET SIZE INCHES
300	42	20	1	1 or 3	1-1/2”	42 PMC-20	260	4"
		25	1-1/2	1 or 3		42 PMC-25		
		30	2	1 or 3		42 PMC-30		
		40	3	3		42 PMC-40		
		50	3	3		42 PMC-50		
		60	5	3		42 PMC-60		
		70	5	3		42 PMC-70		
		75	7-1/2	3		42 PMC-75		
		80	7-1/2	3		42 PMC-80		
		90	7-1/2	3		42 PMC-90		
		100	7-1/2	3		42 PMC-100		
		110	10	3		42 PMC-110		
		120	10	3		42 PMC-120		
		130	15	3		42 PMC-130		
		140	15	3		42 PMC-140		
		150	15	3		42 PMC-150		
		160	15	3		42 PMC-160		
400	55	20	2	1 or 3	1-1/2”	55 PMC-20	260	4"
		25	2	1 or 3		55 PMC-25		
		30	3	3		55 PMC-30		
		40	3	3		55 PMC-40		
		50	5	3		55 PMC-50		
		60	5	3		55 PMC-60		
		70	7-1/2	3		55 PMC-70		
		75	7-1/2	3		55 PMC-75		
		80	7-1/2	3		55 PMC-80		
		90	7-1/2	3		55 PMC-90		
		100	10	3		55 PMC-100		
		110	10	3		55 PMC-110		
		120	15	3		55 PMC-120		
		130	15	3		55 PMC-130		
		140	15	3		55 PMC-140		
		150	15	3		55 PMC-150		
		160	20	3		55 PMC-160		
600	82	20	3	3	2”	82 PMC-20	500	4"
		25	3	3		82 PMC-25		
		30	3	3		82 PMC-30		
		40	5	3		82 PMC-40		
		50	5	3		82 PMC-50		
		60	7-1/2	3		82 PMC-60		
		70	7-1/2	3		82 PMC-70		
		75	7-1/2	3		82 PMC-75		
		80	10	3		82 PMC-80		
		90	10	3		82 PMC-90		
		100	10	3		82 PMC-100		
		110	15	3		82 PMC-110		
		120	15	3		82 PMC-120		
		130	15	3		82 PMC-130		
		140	15	3		82 PMC-140		
		150	20	3		82 PMC-150		
		160	20	3		82 PMC-160		
750	104	20	3	3	2”	104 PMC-20	500	4"
		25	3	3		104 PMC-25		
		30	3	3		104 PMC-30		
		40	5	3		104 PMC-40		
		50	7-1/2	3		104 PMC-50		
		60	7-1/2	3		104 PMC-60		
		70	10	3		104 PMC-70		
		75	10	3		104 PMC-75		
		80	10	3		104 PMC-80		
		90	10	3		104 PMC-90		
		100	15	3		104 PMC-100		
		110	15	3		104 PMC-110		
		120	15	3		104 PMC-120		
		130	15	3		104 PMC-130		
		140	20	3		104 PMC-140		
		150	20	3		104 PMC-150		
		160	20	3		104 PMC-160		

Charted units are a representation of the typical systems and sizes used. Higher pump pressures and larger pump capacities are available.

ELECTRICAL CONTROL PANELS

SHIPCO® PUMPS has the panel assemblies to make your installation an easy and fast connection. Control Panels are available to comply with all NEMA and JIC specifications. The controls are designed for efficient automatic operation of the condensate, vacuum and boiler feed pumps, as required. Panels are clearly identified with nameplates for easy reference to unit serial number and corresponding wiring diagrams.

Panels feature independent pump control circuits. This allows partial operation of duplex units for servicing and repairs. Internal wiring is numbered to match the wiring diagram for identification.

Magnetic Starters are usually required for single phase motors 1 horsepower and over, and all 3 phase motors. Overload relays are recommended to protect the wiring and motors, should an unbalanced condition occur.

Disconnects are available as an integral part of the panel to meet electrical code and service requirements.

Selector Switches are available for pump control. **SHIPCO®** PUMPS recommends two normal types.

Lead-off-Lag selector switches allow manual alternation of the lead pump for even wear.

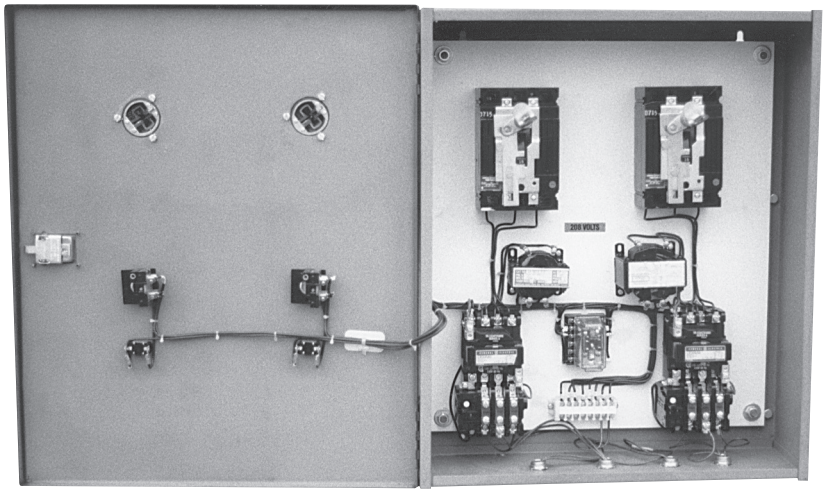
Auto-Off selector switches with **test push buttons** — for use with electrical alternators.

Electrical Alternators are available as an integral part of the panel. Two separate boiler level switches must be provided for automatic standby.

Control Circuit Transformers provide step down voltage for control circuits. Control circuits are normally recommended to be 115/1/60.

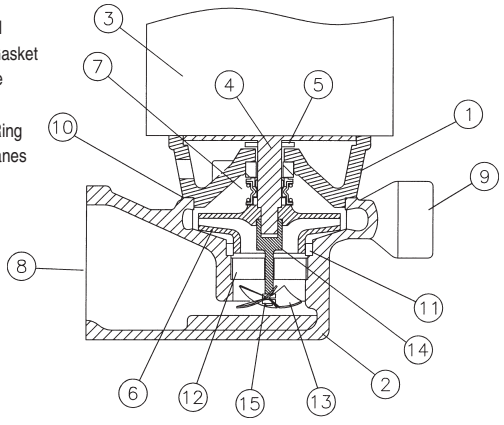
Relays, Pilot Lights, Alarm Lights, Alarm Bells, etc. are available upon request.

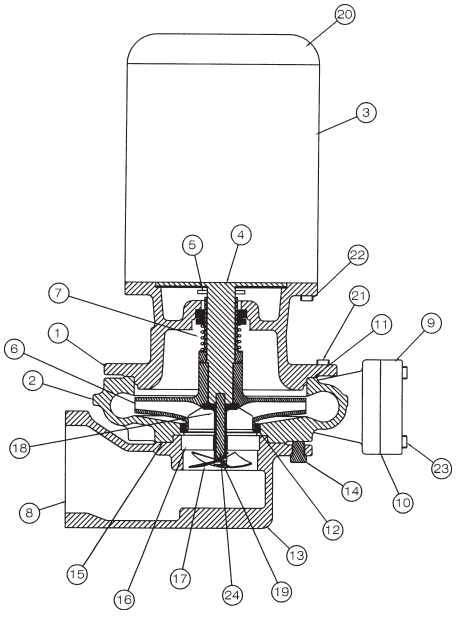
Control panels available and can be factory mounted and wired to NEMA and J.I.C. specifications.
(NOTE: Magnetic starters should be provided for all three phase motors.)



Model P - 56J Frame

1. Pump Head
2. Pump Case
3. Motor
4. Motor Shaft
5. Water Slinger
6. Impeller
7. Mechanical Seal
8. Pump Suction Gasket
9. Pump Discharge
10. Gasket
11. Case Wearing Ring
12. Straightening Vanes
13. Propeller
14. Propeller Shaft
15. Locking Nut (2)





Model P - JM Frame

1. Pump Head
2. Pump Case
3. Motor
4. Motor Shaft
5. Water Slinger
6. Impeller
7. Mechanical Seal
8. Pump Suction Gasket
9. Discharge Flange
10. Pump Discharge Gasket
11. Head Gasket
12. Wear Ring
13. Suction Housing
14. Capscrews (Suction Housing to Case)
15. Suction Housing Gasket
16. Straightening Vanes
17. Propeller
18. Propeller Stem
19. Locking Nut
20. Drip Cover
21. Capscrews
22. Capscrews
23. Capscrews
24. Propeller Stem Bolt

TYPE PMEC BOILER FEED UNITS

BOILER CAP. BHP	PUMP CAP. GPM	PUMP DISCH. PRESS. PSIG	MOTOR HP 3500 RPM ONLY	PHASE	DISCH. SIZE INCHES	CATALOG NO.	REC. CAP. GALS.	INLET SIZE INCHES
40	6	20	1/3	1 or 3	3/4"	6 PMEC-20	25	2"
		25	1/2	1 or 3		6 PMEC-25		
		30	3/4	1 or 3		6 PMEC-30		
		40	1-1/2	1 or 3		6 PMEC-40		
		50	1-1/2	1 or 3		6 PMEC-50		
		60	3	3		6 PMEC-60		
		70	3	3		6 PMEC-70		
		75	3	3	1-1/2"	6 PMEC-75		
		80	5	3		6 PMEC-80		
		90	5	3		6 PMEC-90		
		100	5	3		6 PMEC-100		
		110	7-1/2	3		6 PMEC-110		
		120	10	3		6 PMEC-120		
		130	10	3		6 PMEC-130		
		140	10	3		6 PMEC-140		
		150	15	3		6 PMEC-150		
		160	15	3		6 PMEC-160		
55	9	20	1/3	1 or 3	3/4"	9 PMEC-20	37	3"
		25	1/2	1 or 3		9 PMEC-25		
		30	3/4	1 or 3		9 PMEC-30		
		40	1-1/2	1 or 3		9 PMEC-40		
		50	1-1/2	1 or 3		9 PMEC-50		
		60	3	3		9 PMEC-60		
		70	3	3		9 PMEC-70		
		75	3	3	1-1/2"	9 PMEC-75		
		80	5	3		9 PMEC-80		
		90	5	3		9 PMEC-90		
		100	5	3		9 PMEC-100		
		110	7-1/2	3		9 PMEC-110		
		120	10	3		9 PMEC-120		
		130	10	3		9 PMEC-130		
		140	10	3		9 PMEC-140		
		150	15	3		9 PMEC-150		
		160	15	3		9 PMEC-160		
80	12	20	1/2	1 or 3	3/4"	12 PMEC-20	57	3"
		25	3/4	1 or 3		12 PMEC-25		
		30	3/4	1 or 3		12 PMEC-30		
		40	1 1/2	1 or 3		12 PMEC-40		
		50	1-1/2	1 or 3		12 PMEC-50		
		60	3	3		12 PMEC-60		
		70	3	3		12 PMEC-70		
		75	3	3	1-1/2"	12 PMEC-75		
		80	5	3		12 PMEC-80		
		90	5	3		12 PMEC-90		
		100	5	3		12 PMEC-100		
		110	7-1/2	3		12 PMEC-110		
		120	10	3		12 PMEC-120		
		130	10	3		12 PMEC-130		
		140	10	3		12 PMEC-140		
		150	15	3		12 PMEC-150		
		160	15	3		12 PMEC-160		
100	15	20	1/2	1 or 3	3/4"	15 PMEC-20	80	4"
		25	3/4	1 or 3		15 PMEC-25		
		30	1	1 or 3		15 PMEC-30		
		40	1-1/2	1 or 3		15 PMEC-40		
		50	2	1 or 3		15 PMEC-50		
		60	3	3		15 PMEC-60		
		70	5	3		15 PMEC-70		
		75	5	3	1-1/2"	15 PMEC-75		
		80	5	3		15 PMEC-80		
		90	5	3		15 PMEC-90		
		100	5	3		15 PMEC-100		
		110	7-1/2	3		15 PMEC-110		
		120	10	3		15 PMEC-120		
		130	10	3		15 PMEC-130		
		140	10	3		15 PMEC-140		
		150	15	3		15 PMEC-150		
		160	15	3		15 PMEC-160		

TYPE PMEC BOILER FEED UNITS

BOILER CAP. BHP	PUMP CAP. GPM	PUMP DISCH. PRESS. PSIG	MOTOR HP 3500 RPM ONLY	PHASE	DISCH. SIZE INCHES	CATALOG NO.	REC. CAP. GALS.	INLET SIZE INCHES
125	18	20	1/2	1 or 3	1-1/2”	18 PMEC-20	80	4"
		25	3/4	1 or 3		18 PMEC-25		
		30	1	1 or 3		18 PMEC-30		
		40	1-1/2	1 or 3		18 PMEC-40		
		50	2	1 or 3		18 PMEC-50		
		60	3	3		18 PMEC-60		
		70	5	3		18 PMEC-70		
		75	5	3		18 PMEC-75		
		80	5	3		18 PMEC-80		
		90	5	3		18 PMEC-90		
		100	5	3		18 PMEC-100		
		110	7-1/2	3		18 PMEC-110		
		120	10	3		18 PMEC-120		
		130	10	3		18 PMEC-130		
		140	10	3		18 PMEC-140		
		150	15	3		18 PMEC-150		
		160	15	3		18 PMEC-160		
150	21	20	3/4	1 or 3	1-1/2”	21 PMEC-20	125	4"
		25	3/4	1 or 3		21 PMEC-25		
		30	1	1 or 3		21 PMEC-30		
		40	1-1/2	1 or 3		21 PMEC-40		
		50	2	1 or 3		21 PMEC-50		
		60	3	3		21 PMEC-60		
		70	5	3		21 PMEC-70		
		75	5	3		21 PMEC-75		
		80	5	3		21 PMEC-80		
		90	5	3		21 PMEC-90		
		100	5	3		21PMEC-100		
		110	7-1/2	3		21 PMEC-110		
		120	10	3		21 PMEC-120		
		130	10	3		21 PMEC-130		
		140	15	3		21 PMEC-140		
		150	15	3		21 PMEC-150		
		160	15	3		21 PMEC-160		
200	30	20	3/4	1 or 3	1-1/2”	30 PMEC-20	125	4"
		25	3/4	1 or 3		30 PMEC-25		
		30	1	1 or 3		30 PMEC-30		
		40	2	1 or 3		30 PMEC-40		
		50	2	1 or 3		30 PMEC-50		
		60	3	3		30 PMEC-60		
		70	5	3		30 PMEC-70		
		75	5	3		30 PMEC-75		
		80	5	3		30 PMEC-80		
		90	7-1/2	3		30 PMEC-90		
		100	7-1/2	3		30PMEC-100		
		110	10	3		30 PMEC-110		
		120	10	3		30 PMEC-120		
		130	10	3		30 PMEC-130		
		140	15	3		30 PMEC-140		
		150	15	3		30 PMEC-150		
		160	15	3		30 PMEC-160		
250	35	20	3/4	1 or 3	1-1/2”	35 PMEC-20	160	4"
		25	1	1 or 3		35 PMEC-25		
		30	1-1/2	1 or 3		35 PMEC-30		
		40	2	1 or 3		35 PMEC-40		
		50	3	3		35 PMEC-50		
		60	5	3		35 PMEC-60		
		70	5	3		35 PMEC-70		
		75	5	3		35 PMEC-75		
		80	5	3		35 PMEC-80		
		90	7-1/2	3		35 PMEC-90		
		100	7-1/2	3		35 PMEC-100		
		110	10	3		35 PMEC-110		
		120	10	3		35 PMEC-120		
		130	15	3		35 PMEC-130		
		140	15	3		35 PMEC-140		
		150	15	3		35 PMEC-150		
		160	15	3		35 PMEC-160		

TYPE PMEC BOILER FEED UNITS

BOILER CAP. BHP	PUMP CAP. GPM	PUMP DISCH. PRESS. PSIG	MOTOR HP 3500 RPM ONLY	PHASE	DISCH. SIZE INCHES	CATALOG NO.	REC. CAP. GALS.	INLET SIZE INCHES
300	42	20	1	1 or 3	1-1/2”	42 PMEC-20	260	4"
		25	1-1/2	1 or 3		42 PMEC-25		
		30	2	1 or 3		42 PMEC-30		
		40	3	3		42 PMEC-40		
		50	3	3		42 PMEC-50		
		60	5	3		42 PMEC-60		
		70	5	3		42 PMEC-70		
		75	7-1/2	3		42 PMEC-75		
		80	7-1/2	3		42 PMEC-80		
		90	7-1/2	3		42 PMEC-90		
		100	7-1/2	3		42 PMEC-100		
		110	10	3		42 PMEC-110		
		120	10	3		42 PMEC-120		
		130	15	3		42 PMEC-130		
		140	15	3		42 PMEC-140		
		150	15	3		42 PMEC-150		
		160	15	3		42 PMEC-160		
400	55	20	2	1 or 3	1-1/2”	55 PMEC-20	260	4"
		25	2	1 or 3		55 PMEC-25		
		30	3	3		55 PMEC-30		
		40	3	3		55 PMEC-40		
		50	5	3		55 PMEC-50		
		60	5	3		55 PMEC-60		
		70	7-1/2	3		55 PMEC-70		
		75	7-1/2	3		55 PMEC-75		
		80	7-1/2	3		55 PMEC-80		
		90	7-1/2	3		55 PMEC-90		
		100	10	3		55 PMEC-100		
		110	10	3		55 PMEC-110		
		120	15	3		55 PMEC-120		
		130	15	3		55 PMEC-130		
		140	15	3		55 PMEC-140		
		150	15	3		55 PMEC-150		
		160	20	3		55 PMEC-160		
600	82	20	3	3	2”	82 PMEC-20	500	4"
		25	3	3		82 PMEC-25		
		30	3	3		82 PMEC-30		
		40	5	3		82 PMEC-40		
		50	5	3		82 PMEC-50		
		60	7-1/2	3		82 PMEC-60		
		70	7-1/2	3		82 PMEC-70		
		75	7-1/2	3		82 PMEC-75		
		80	10	3		82 PMEC-80		
		90	10	3		82 PMEC-90		
		100	10	3		82 PMEC-100		
		110	15	3		82 PMEC-110		
		120	15	3		82 PMEC-120		
		130	15	3		82 PMEC-130		
		140	15	3		82 PMEC-140		
		150	20	3		82 PMEC-150		
		160	20	3		82 PMEC-160		
750	104	20	3	3	2”	104 PMEC-20	500	4"
		25	3	3		104 PMEC-25		
		30	3	3		104 PMEC-30		
		40	5	3		104 PMEC-40		
		50	7-1/2	3		104 PMEC-50		
		60	7-1/2	3		104 PMEC-60		
		70	10	3		104 PMEC-70		
		75	10	3		104 PMEC-75		
		80	10	3		104 PMEC-80		
		90	10	3		104 PMEC-90		
		100	15	3		104 PMEC-100		
		110	15	3		104 PMEC-110		
		120	15	3		104 PMEC-120		
		130	15	3		104 PMEC-130		
		140	20	3		104 PMEC-140		
		150	20	3		104 PMEC-150		
		160	20	3		104 PMEC-160		

Charted units are a representation of the typical systems and sizes used. Higher pump pressures and larger pump capacities are available.

PMC & PMEC Unit Description

PMC Pumps are "The Pumps That Pump" even when traps start to leak and temperatures go to boiling!

Propeller Boiler Feed Pumps are designed to handle hot condensate with low NPSH requirements. The type "P" pumps require only 2 feet of NPSH to handle water at its saturation temperature. Floor mounted units can handle condensate at temperatures to 210°F.

Elevated units can handle condensate at temperatures to 212°F.

Cast Iron Receivers provide years of service even with the most aggressive waters. Receivers are available from 25 gallon to 500 gallon capacity. The receivers are fully vented and operate at atmospheric pressure. (Receivers are not ASME code stamped.)

Butterfly Suction Valve is an optional part of the service features of the PMC units. By closing the butterfly suction valves the PMC pumps are isolated from the receiver for servicing without draining the receiver. PMEC units (elevated) have valves in the suction piping as standard.

Basket Inlet Strainers are a recommended feature of the PMC units. The large dirt pocket and vertical self cleaning screens help prevent unnecessary wear and problems with the PMC pumps.

Gauge Glass provides a quick check of receiver water level.

Dial Thermometer provides a quick check of condensate temperature.

Discharge Pressure Gauges provide a quick check of pump operation at design conditions.

The heart of the PMC unit is the Type "P" pump. The type "P" pump is designed for vertical flange mounting as shown.

Pump Head and Case are made of close grained cast iron.

Impeller is cast bronze, enclosed vane, precision balanced, and trimmed to design conditions for smooth durable operation.

Case Wearing Ring is bronze and easily renewable to keep the type "P" pump at peak performance.

Motors are heavy duty ball bearing design.

Water Safety Slingers are installed to help prevent water from entering the motor from seal leakage.

Motor Shaft is stainless steel on 56J Frame motors. JM motors have a bronze shaft sleeve or optional stainless steel shaft sleeve.

Straightening Vanes provide a directed flow into the eye of the centrifugal impeller.

Axial Flow Impeller provides low NPSH characteristics and is precision finished for smooth vibration-free operation.

Discharge Companion Flange allows the pump to be removed and eliminates the need of additional unions.

Solenoid make-up valve and float switch adds make-up water to receiver when required.

Preheat Option (Receivers 125 Gallon or larger) is a boiler feed receiver having an inlet for gravity and/or pumped returns. A stainless steel diffuser tube should be utilized for high-pressure returns and/or drips can be installed below the water line. A direct injection style heater assembly, sometimes called a preheat tube, made of slotted stainless steel schedule 40 pipe is installed below the water to admit steam that is being regulated through a temperature regulator. Make-up water is admitted through a slow closing solenoid valve and external float switch assembly. An external float switch assembly should be used in lieu of an internal style for make-up, for cut-offs and alarms due to turbulence of the steam mixing with the water inside the vessel.

All Units are completely assembled, piped, wired, and individually tested before shipment. Testing includes a complete hydrostatic test for leaks, electrical tests for controls and accessories, and performance test for pumps at design conditions. After testing, the units are packaged for shipment.

When should a Boiler Feed Unit be used?

In general, a boiler feed unit should be used on all installations using today's high efficiency boilers.

1. High efficiency boilers have less water capacity than older, less efficient boilers. The excess system condensate must be collected and stored in the boiler feed unit instead of being returned to the boiler directly.
2. High efficiency boilers require the water level to be maintained in a smaller relative range. The boiler level controls operate the boiler feed pumps, keeping the water level in an efficient operating range.
3. Make-up water for the system can be added to the boiler feed receiver. The cold city water (usually at 50°F or less) is mixed with the return condensate to produce a blend temperature and reduce thermal shock to the boiler.
4. Properly sizing the boiler feed receiver for the system lag time and mixed high demand cycles in spring and fall allows adequate storage for high condensate. Reusing high quality condensate in lieu of raw make-up water reduces corrosion in the boiler and piping.

Sizing Boiler Feed Units

A properly sized and correctly installed Boiler Feed Unit can help reduce your overall operating costs by:

- Maintaining the proper water level for the most efficient operation.
- Retaining the high quality condensate to be reused and blended with the required make-up, thus reducing thermal shock and corrosion.

Sizing Pump Flow Rate

Pump selection is based on flow rate (GPM) and pump discharge pressure (PSIG). Boilers are usually rated in boiler horsepower (BHP). The evaporation rate (also referred to as condensing rate) of one boiler horsepower (BHP) is .069 gallons per minute (GPM). Therefore, to calculate the evaporation rate, multiply the BHP by .069. For example, the evaporation for 200 BHP would be 13.9 GPM (200 x .069).

However, sometimes the load of boilers may be stated in other metrics such as Square Feet EDR or lbs/hr. The table below shows equivalences to convert to BHP. For example, to convert EDR to BHP, divide load by 139.4.

	Condensing Rate (GPM)	BTUs/Hr.	Lbs/Hour	Sq. Ft. EDR
1 Boiler HP (BHP)	.069	33,475	34.5	139.4
1,000 Sq. Ft. EDR	.50	240,000	247.3	1,000

FIGURE D

Boiler Feed Applications

Pump flow rates are sized differently depending on the application:

a. Pumps Run On/Off
b. Pumps Run Continuously

For *On/Off applications*, the boiler feed pumps are typically sized at 2.0 times the evaporation rate.

For *Continuous Run* applications, the boiler feed pumps are typically sized at 1.5 times the evaporation rate.

This method of sizing boiler feed pumps helps to balance the boiler conditions and reduce thermal shock to the boiler. Thermal shock can be caused if the feed pumps are oversized. Oversizing also tends to cause short cycling. (Note: Some boiler manufacturers have special requirements that differ from the above guidelines.)

Surge Tank Applications

Surge tank pumps must be continuous run and are sized at the evaporation rate or full load of system.

For both boiler feed and surge tank applications, SHIPCO® pumps are fitted with bleed lines that eliminate the need for bypass orifices in most applications since the bleed line provides sufficient flow to protect the mechanical seal if the pump should dead head.

Sizing Pump Discharge Pressure

The rules-of-thumb for sizing the pump discharge pressure depend of whether pumps are used on a boiler feed unit or a surge tank and the type of application as explained below.

Boiler Feed Applications

Discharge pressure should be equal to the maximum boiler operating pressure, plus the increase in elevation, plus the friction loss of pipe, fittings, and valves, plus a safety margin of typically 5 to 10 PSIG. Good engineering practices also call for a balancing valve to be installed in the discharge piping. Balancing the pump will limit the motor horsepower load and help prevent cavitation.

Boiler feed units are usually located near the boilers they feed. To be safe you should determine the amount of vertical rise + friction loss in pipe + valve loss + feed valve loss (if any) + back pressure in line (boiler operating pressure) + a safety margin of approximately 5 PSIG. The amount of these values, or these values added together, are normally expressed in feet of head. To convert between PSIG and feet of head use the following equation: **2.31 feet of head = 1 PSIG**.

The discharge pressure on boiler feed pumps is sized differently depending on the type of application:

a. Boiler Feed Pump Runs On/Off
b. Boiler Feed Pump Runs Continuously (without a Stack Economizer)
c. Boiler Feed Pump Runs Continuously (with a Stack Economizer)

Boiler Feed On/Off applications generally have low-pressure steam boilers running in the range of .5 to 15 PSIG with returns. Returns could be gravity and pumped. Therefore, a discharge pressure of 20 PSIG should be adequate.

Boiler Feed Continuous Run without Stack Economizer application, an additional 10 PSIG is required to overcome the pressure drop through the modulating feed valve on the boiler. However, the Cv rating of the valve should be verified to ensure 10 PSIG is sufficient. Generally these applications have a high-pressure steam boiler.

Boiler Feed Continuous Run with Stack Economizer application, an additional 30 PSIG is required to overcome the pressure drop through both the modulating feed valve and the stack economizer. However, the Cv rating of the modulating valve and the pressure drop through the stack economizer should be verified to ensure the 30 PSIG is sufficient. Generally these applications have a high-pressure steam boiler.

Notes:

1) The discharge pressure for a boiler feed pump vessel must be able to overcome the boiler safety relief valve setting plus three percent of valve setting and meet most state and local codes.
2) The pressure drops mentioned above are based on the valves used in typical SHIPCO® designs. The pressure drops may vary based on the modulating valve used.

Surge Tank Applications

Transfer pumps run continuously. The discharge pressure of the transfer pumps on a surge tank are sized differently depending on the type of application:

a. Feeding an atmospheric deaerator
b. Feeding a pressurized deaerator

For *Atmospheric Deaerator* applications, the discharge pressure is 25 PSIG assuming a pressure drop of 10 PSIG through the modulating transfer valve.

For *Pressurized Deaerator* applications, the discharge pressure is 35 PSIG assuming a pressure drop of 10 PSIG through the modulating transfer valve and the safety relief valve set at 15 PSIG on the deaerator.

Notes:

1) The pressure drops mentioned above are based on the valves used in typical Shipco® designs. The pressure drops may vary based on the modulating valve used.

For more information on surge tanks, see Shipco® Bulletin 166.

Engineering Selection Data

Receiver Sizing — PMC Units

The receivers in this series of units are sized to allow for approximately a 10 minute system lag time. The lag time of the system is the time from which the steam evaporated at the boiler, travels to the radiation device, condenses to water and returns to the boiler. This is adequate for most small systems. (Larger multi-building systems, the receiver is sized for a 15 minute lag time.)

Boiler required make-up water is added to the receiver on PMC Units. This helps, by tempering the make-up water, reduce thermal shock to the boiler.

Surge Tank Application

On surge tank applications, the receiver is typically sized to provide 15 minutes Gross Gallons of storage, which equates to approximately 10 minutes of Net Gallons.

Sizing Steam Regulator for Preheat (if option included)

Shipco® preheat tubes are designed for a 5–7 PSIG of pressure (i.e., the steam pressure entering the preheat tube after the supply pressure is reduced).

To size a steam regulator requires information on the following variables:

- Condensing Rate or Equivalently System Load expressed in GPM
- Available pressure (PSIG) at the steam regulator
- Blend Temperature (°F)
- Target Temperature (°F)

The condensing rate can be calculated if the system load is expressed in other metrics by using the Power and Heat Equivalency Table (see Figure F).

The blend temperature of the returns plus make-up water is calculated as follows:

Percent of Make-up x Temperature (°F) of Make-up = **M**

Percent of Returns x Temperature (°F) of Returns = **R**

(M+R) = Blend Temperature

Example: For 30% make-up at 50°F and 70% returns at 150°F, blend temperature = 120°F.

(.30 x 50) + (.70 x 150) = 15 + 105 = 120

If the blend temperature is 120°F and the applications require the blend temperature to be heated up to 200°F, then the Target Temperature = 200 (°F).

The Temperature Rise is the difference between the Target Temperature and the Blend Temperature.

Target Temperature - Blend Temperature = Temperature Rise

The steam regulating valve controls the amount of steam required to maintain temperature at the target temperature. The size of the steam regulating valve is based on 1) lbs/hr of steam required to raise the blend temperature to the target temperature and 2) steam supply pressure (PSIG).

$$\frac{\text{Load (in gallons per minute)} \times \text{Temperature rise}}{2} = \text{Steam required (lbs/hr)}$$

Example: Assume system load of 100 HP Boiler is operating at 100 PSIG; Blend temperature of 120°F; Heating feed water to 200°F; One boiler horsepower equals .069 gallons per minute; 100 BHP x .069 GPM = 6.9 load in gallons per minute

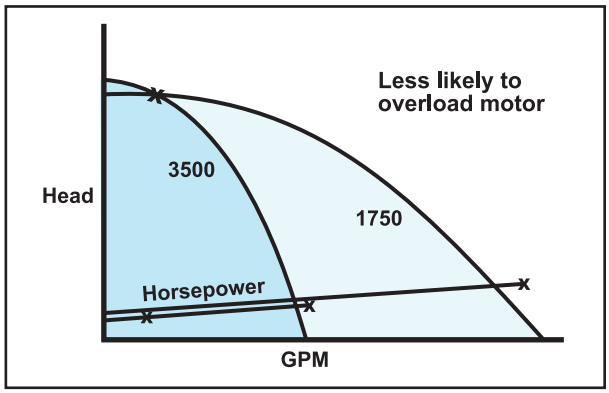
$$\frac{6.9 \text{ GPM} \times (200-120)}{2} = 276 \text{ lbs/hr of steam required}$$

Using the values for the amount of steam supplied (lbs/hr) and the steam supply pressure (PSIG), the size and type of regulator valve can be selected.

Another critical design factor for preheat to keep in mind is that the higher the supply pressure, the smaller the valve and therefore the lower the cost.

Why Are 3500 RPM Centrifugal Pumps Recommended for Most Boiler Feed and Surge Tank Applications?

1. More efficient than 1750 RPM for most condensate and boiler feed applications.
2. Operating and repair costs are lower because pumps are more efficient and the motors and parts are less expensive.
3. Less likely to overload motor than 1750 RPM pumps because of much steeper head—capacity, characteristic especially for small capacities (see diagram below). If actual head on the pump is lower than the design head, the pump will operate at higher capacities with accompanying higher power. The 3500 RPM pump maximum load is lower.



4. Just as durable as 1750 RPM centrifugal pumps for the same head and capacity. Centrifugal pumps are not subject to the wear problems of regenerative turbine pumps that are frequently chosen to run at 1750 RPM because of this inherent limitation.
5. NPSH requirements are low for the lower capacities and can be further reduced by use of a "propeller" (also referred to as an "inducer") for higher capacities where the NPSH available is unusually low.

Why Are Suction Strainers Not Recommended on Non-Turbine Centrifugal Pumps?

It is often asked whether a pump suction strainer is necessary or recommended. The purpose of a suction strainer is to act as a particulate strainer or filter ahead of the pump. This prevents large particles from entering the pump.

Before the introduction of the low-flow/high-head multi-stage centrifugal type pump, turbine type pumps were used almost exclusively for on/off boiler feed service for steam boilers. Back in the 1920s, a turbine pump was the only pump available for high-pressure pump applications since multi-stage, centrifugal pumps were not yet available. The turbine pump impeller was designed with very close tolerances within the pump. Any grit or sediment that entered the pump would result in accelerated erosion of these close-tolerance areas, leading to premature pump wear and loss of performance. These pump characteristics made the use of a strainer a necessity with a turbine type pump.

During the 1960s, ITT Domestic® and other manufacturers introduced multi-stage, centrifugal pumps into the high-pressure steam market. Then during the 1980s, manufacturers such as Grundfos, Gould, etc., started marketing multi-stage, centrifugal pumps and offering the pumps to boiler manufacturers who make feed tanks but not pumps. This strategy caused the boiler manufacturers to start specifying multi-stage, centrifugal pumps in lieu of turbines because the manufacturers now had a source for pumps.

Centrifugal pumps, by their design, are more durable. A centrifugal pump does not have the same close tolerances of a turbine pump—it has a more robust design that enables grit and sediment to pass through without clogging the impeller volute area. Therefore, the use of a suction strainer is neither mandatory nor recommended. Instead, an inlet basket on the return piping into the receiver and a Wye strainer on the make-up water piping are recommended.

Below is a list of considerations regarding the use of suction strainers with centrifugal pumps:

- **Suction Losses:** The addition of a strainer in the suction line of a pump increases the losses in the suction line, thereby decreasing the NPSH available to the pump. As the strainer fills with particles, the pressure drop across the strainer increases, further reducing the NPSH available. This situation becomes more critical as the temperature of the pumped water increases. When a feed water pump is pumping from a deaerator, the water is already at the flash point, and any increase in the suction losses could lead to a flashing condition and pump cavitations.
- **Increased system maintenance:** Because of the reason stated above, it is important that the strainer screen be checked and cleaned regularly. If the installation is in a remote area and maintenance checks are rare, a clogged strainer will eventually lead to pump failure and a low water condition in the boiler.
- **Can particles get into the pump without a strainer?** SHIPCO® recommends use of inlet strainers on all deaerators and boiler feed tanks to help prevent particles from getting into the pump. In addition the suction piping typically extends 2" to 3" up into the receiver (often referred to as a vortex breaker). This extension helps prevent any sediment and large particles from leaving the tank through the suction opening. In SHIPCO® deaerators, the water entering the deaerator must travel through a series of spray valves, baffles, trays and other restricted flow paths before deaeration is complete and the water is ready for use. The number and size of the particles that will make it through this path and into the storage area is limited.

As the engineering community begins to better understand the functions of centrifugal and turbine pumps, the engineers are starting to remove requirements for suction strainers from specifications.

SHIPCO® believes that any *benefit of a suction strainer on centrifugal pumps is far outweighed by the risks*, which can lead to pump failures and other system problems.

Consequences of Injecting Chemicals into Steam System

Blow down separators are used to remove the residue left from chemicals added to the boiler. However, did you ever consider what the impact of chemicals is on the mechanical seal on a boiler feed pump? The chemicals will scratch and scar the seal facing of the mechanical seal and thus cause premature seal failure. Premature failure will in turn cause the motor bearings to go bad and destroy the pump if not replaced.

The manufacturers of boiler feed pumps state very clearly (check the installation instructions) that chemicals should not be injected directly into a boiler feed tank or deaerator. Chemicals are to be fed into the system after the boiler feed pumps discharged.

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