Technical Standards for the
Force Modulator System™

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Issued: 2-01-05

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OVERVIEW

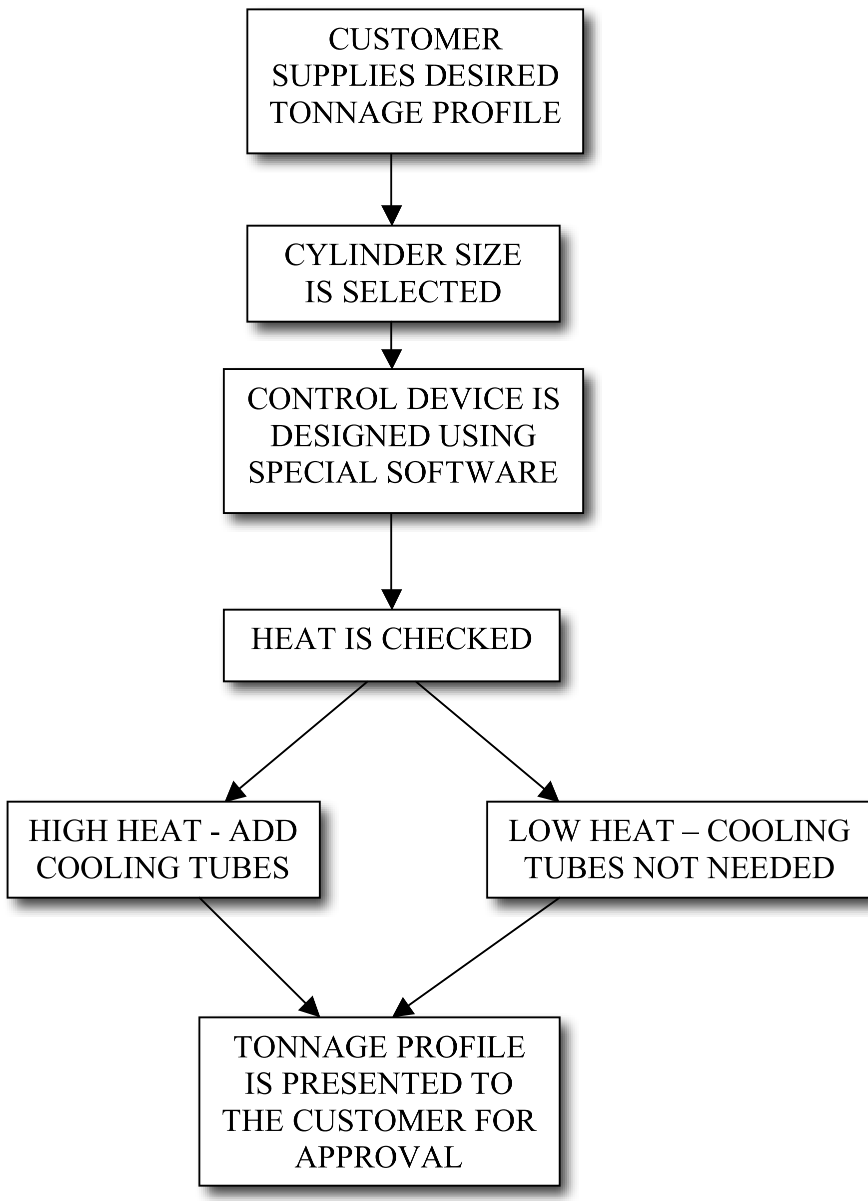
The Force Modulator System™ (FMS™) utilizes pressurized hydraulic fluid to support the binder motion. Although most applications involve the binder, other die motions can be attached to the FMS™. The system is made up of several hydraulic cylinders tied into a series of components that make up the ancillary equipment. As the binder is compressed, the cylinders develop a force profile that follows the position and speed of the ram. The concept utilizes a proprietary orifice technology with a customized control device that guides the piston of the cylinder. Tonnage profiles can include soft initial hits with ramp up, constant, or ramp down tonnage.

The system works with hydraulic fluid and a nitrogen filled accumulator. An air over oil pump provides the pre-charge of the system and only requires typical shop air. Most system configurations do not require any electrical tie in. Although the FMS™ is primarily an engineered system, many of the components of the system are standard. The engineering process integrates the customer's needs with a configuration of these standard components. Several additional system control options, such as a hold on bottom capability, are available and are integrated into the system design as well.

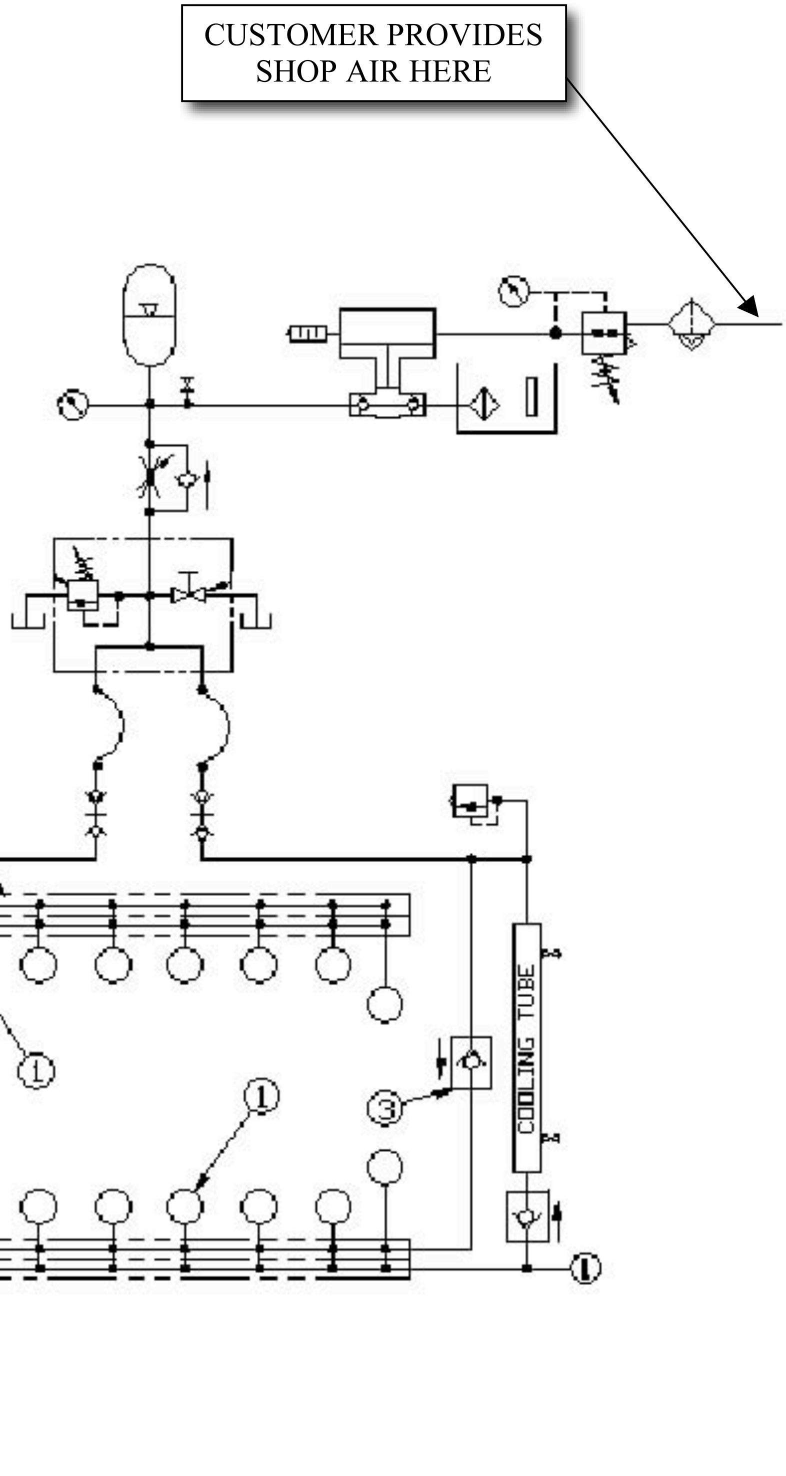
DESIGN PROCEDURE

The development of the FMS^{TM} may require interaction between the die design group, the end user, and the FMS^{TM} design team. Solid models of the die design can be used as a starting point for locating and configuring the FMS^{TM} components.

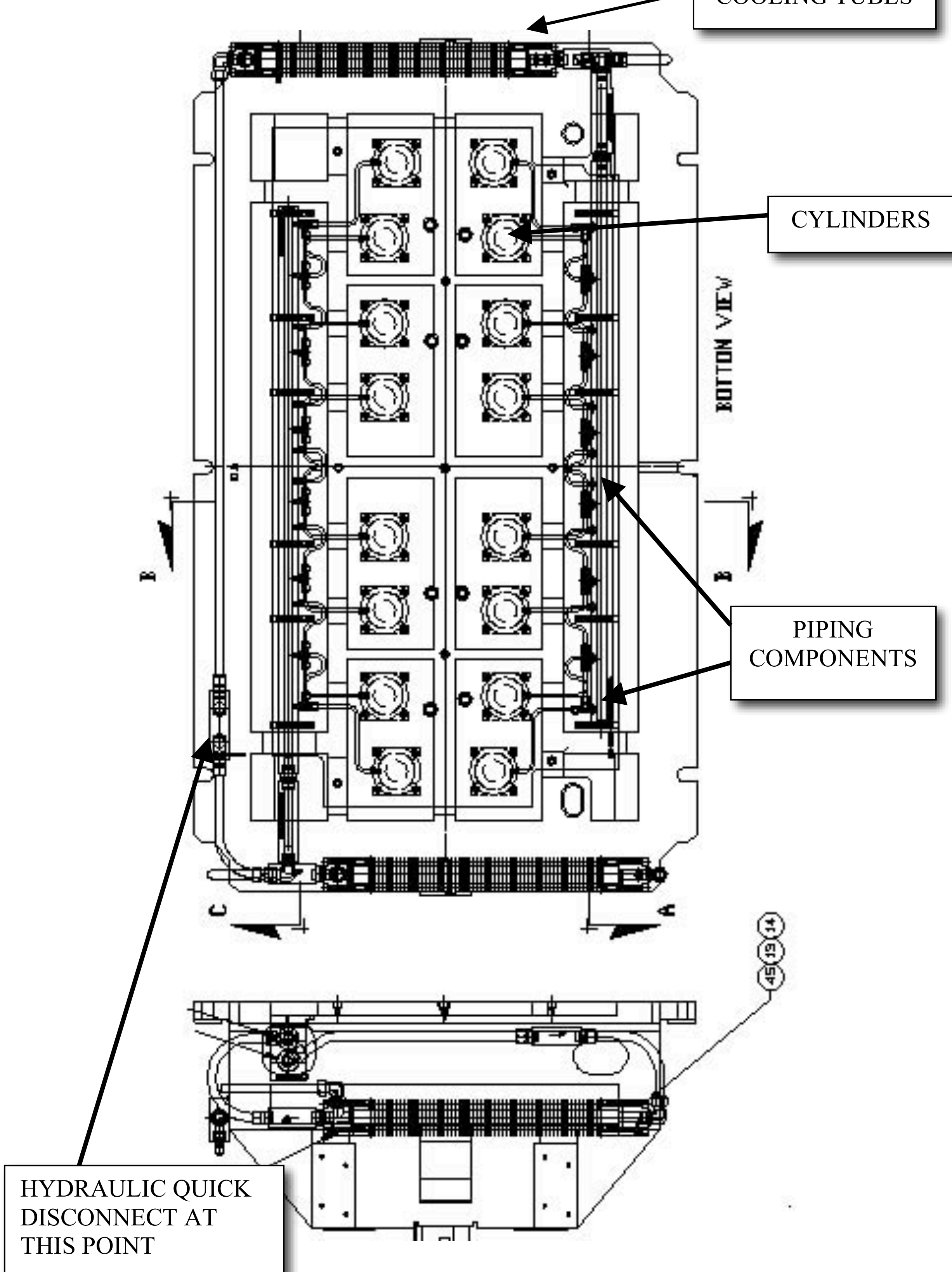
Critical to the entire process, is the design of the cylinder control device. This component is developed and reviewed using special software. The flow chart below highlights the procedure.

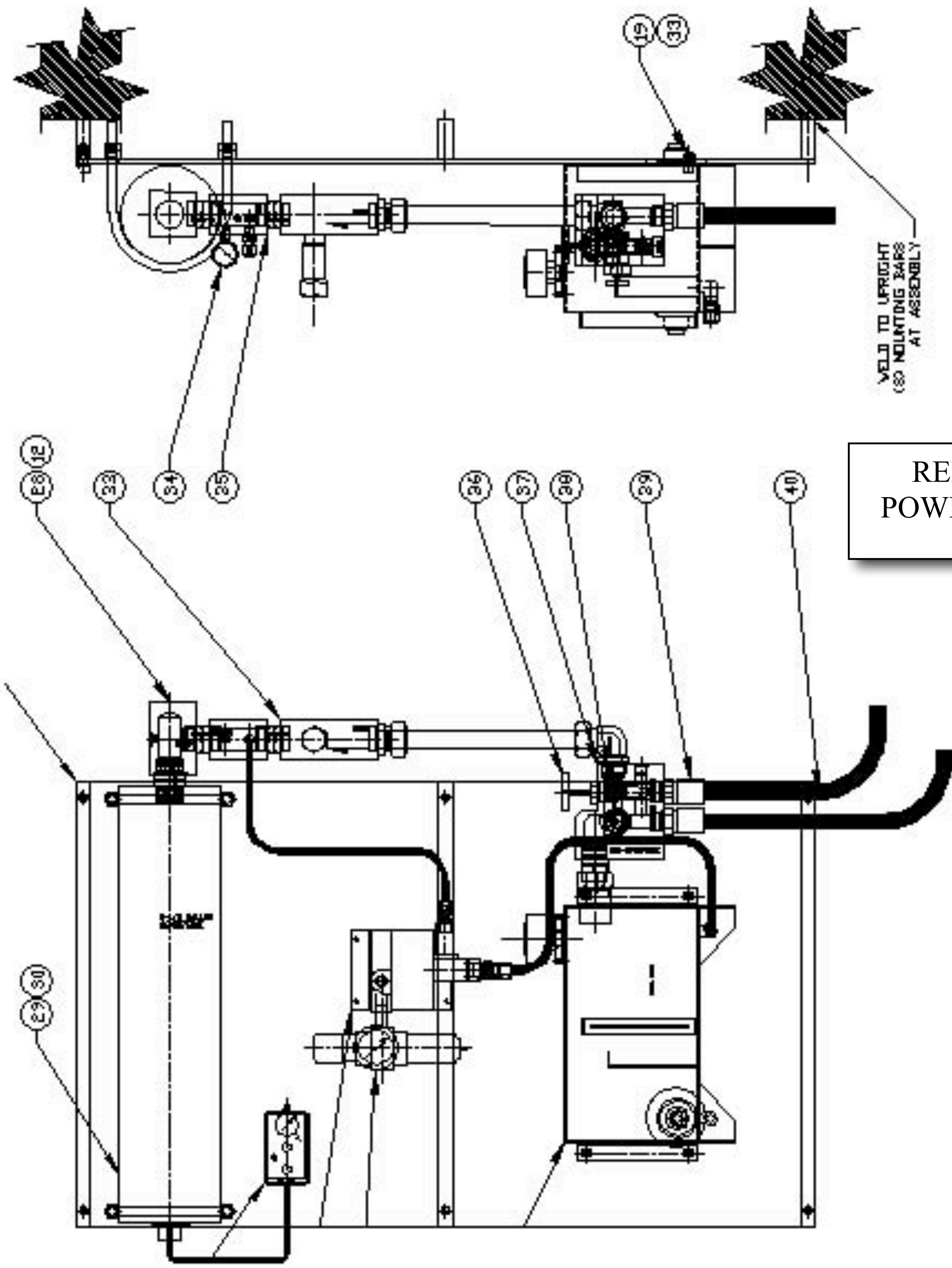


TYPICAL SCHEMATIC



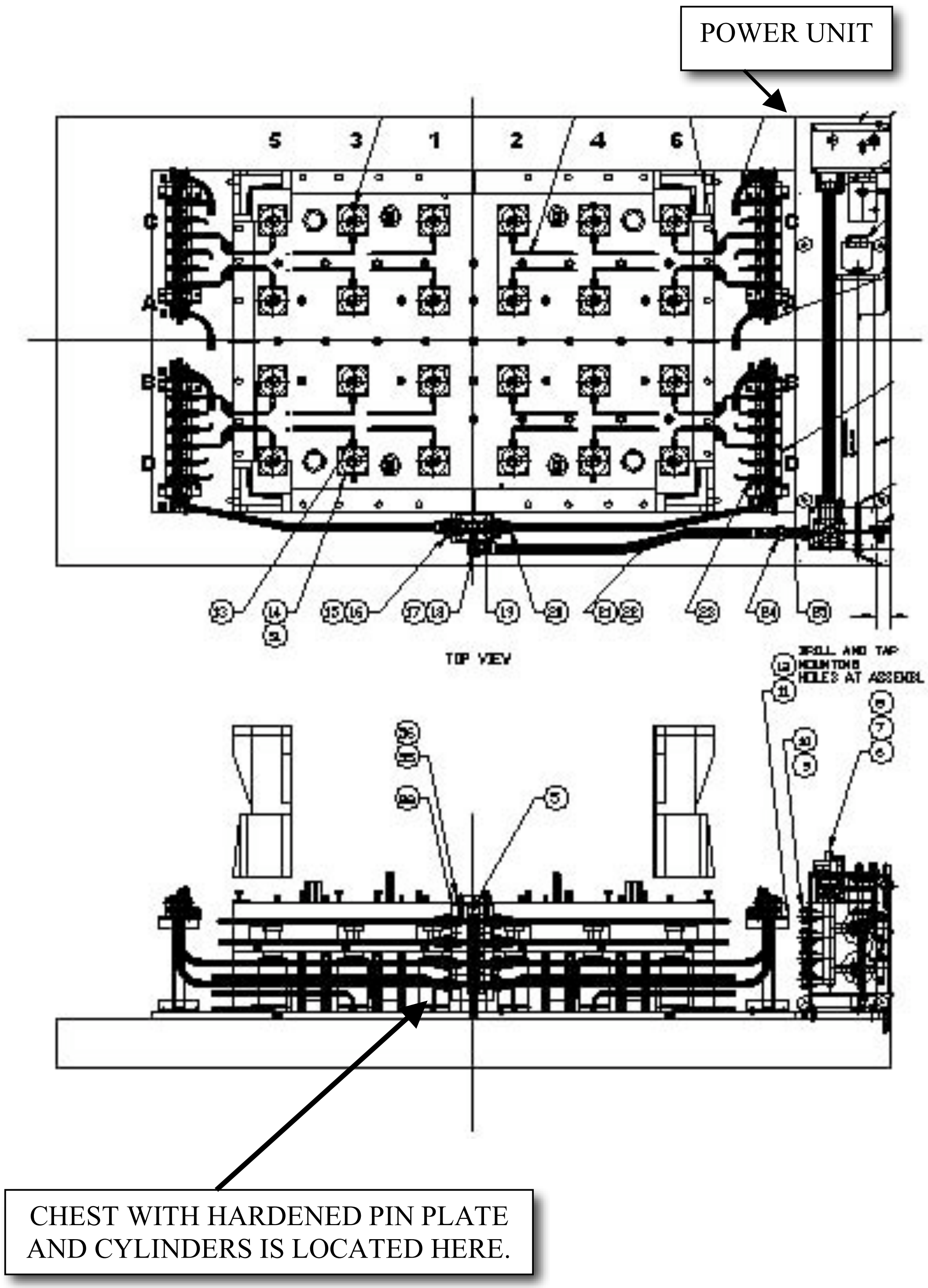
DESIGN TYPE 1 – TYPICAL DESIGN USING 5 TON CYLINDERS WITH A REMOTE POWER UNIT



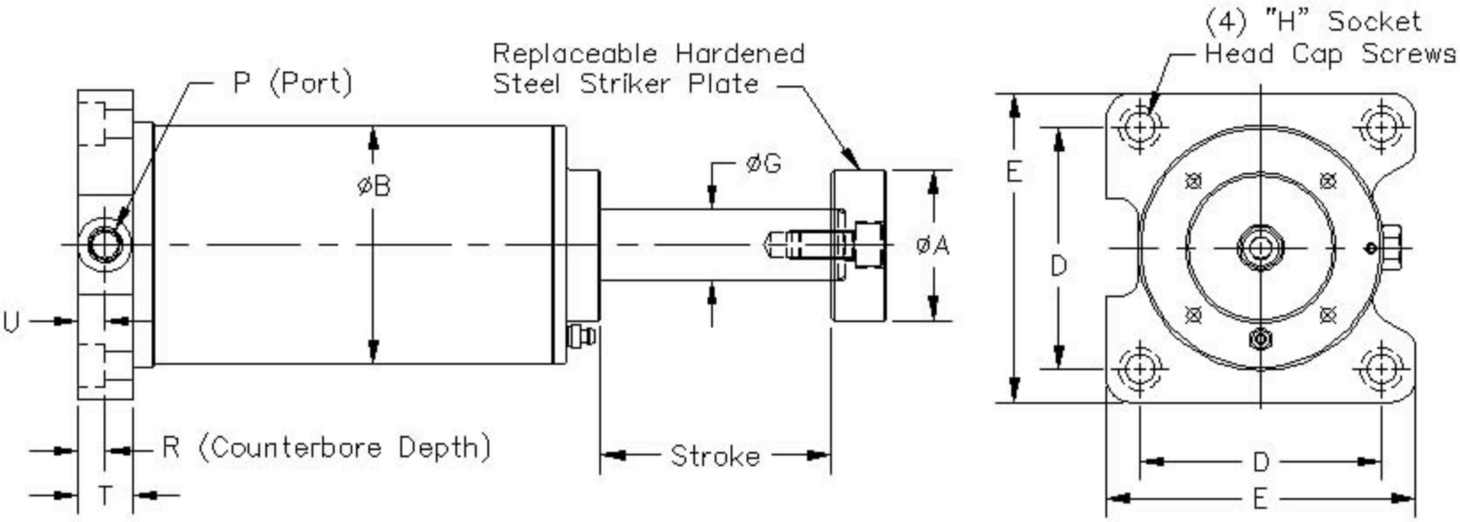


REMOTE
POWER UNIT

DESIGN TYPE 2 – CHEST CONSTRUCTION



STANDARD FORCE MODULATOR™ CLINDERS



Model	A	B	D	E	G	H	R	T	U	P			
5 Ton	2.69	4.25	4.31	5.50	1.25	1/2"	.50	0.984	.50	SAE6			
8 Ton	3.15	5.75	5.43	7.48	1.50	5/8"	.65	1.000	.63	SAE6			
25 Ton	4.38	7.25	6.00	7.25	3.00	5/8"	.65	1.406	.75	SAE12			
40 Ton	4.38	7.25	6.00	7.25	3.00	5/8"	.65	1.406	.75	SAE12			

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OPTIONS

1) Hold Down Feature – The hydraulic circuit will include an additional valve to delay the return of the binder ring.

2) Remote power unit – power unit of ancillary equipment can be mounted on the press. This allows for running several dies with one power unit.

3) External Orifice (currently in development) – provides additional tonnage adjustment.

DESIGN GUIDE

1) Locating manifolds in the bottom plate of the die require consideration for clearance and die loading. These manifolds must be recessed to provide adequate clearance to the bolster plate, such that the tonnage bearing pressure is reacted only by the die shoe. If too much material is removed, the bearing pressure support will be inadequate.

2) Metric Fasteners are required for attaching the manifolds and all ancillary components. American Fasteners can be used within the FMS subassemblies.

3) The piping typical bend radius is shown below.

Size	Tube OD	Typical Bend Radius
4	¼ inch	¾ inch
5	5/16	1
6	3/8	1 ¼
8	½	2
10	5/8	2 1/2
12	¾	3
16	1	4
18	1 1/8	4 ½
20	1 ¼	5
24	1 ½	5