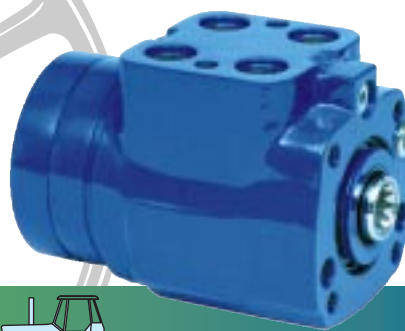


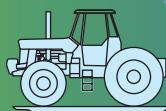
Char-Lynn®

Power Steering

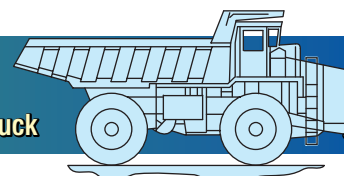
No. 11-872
April, 1999



Ag Tractor



Mining Truck



Articulated Dump Hauler



Roller



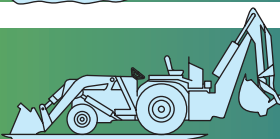
Articulated Loader



Rubber Tire Excavator



Backhoe



Scraper



Combine



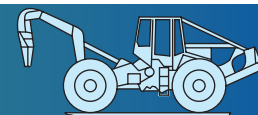
Site Handler



Fork Lift



Skidder



Steering Control Units

Sprayer



Grader



Sweeper



Lawn and Garden



Transporter





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All About Power Steering for that Special Vehicle

B – Product Information

Steering Control Units

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Steering Control Units

Steering System Components

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Steering System Components and System Accessories

Information contained in this information sheet is accurate as of the publication date and is subject to change without notice. Performance values are typical values. Customers are responsible for selecting products for their applications using normal engineering methods.

A – General Information

Description and Advantages

Steering Control Unit

The Char-Lynn steering control unit (SCU) is fully fluid linked. This means there is no mechanical connection between the steering unit, the pump and the steering cylinders. The unit consists of a manually operated directional control servo valve and feedback meter element in a single body. It is used principally for fluid linked power steering systems but it can be used for some servo-type applications or any application where visual positioning is required. The close coupled, rotary action valve performs all necessary fluid directing functions with a small number of moving parts. The manually actuated valve is coupled with the mechanical drive to the meter gear. The control is lubricated and protected by the power fluid in the system and can operate in many environments.

Series 3, 6, 12

Displacement	75 - 740 cm ³ /r	4.5 - 45.1 in ³ /r
Flow	11 - 45 l/min	3 - 12 GPM
Pressure	172 bar	2500 PSI

Series 110, 230, 450

Displacement	75 - 740 cm ³ /r	4.5 - 45.1 in ³ /r
Flow	11 - 76 l/min	3 - 20 GPM
Pressure	172 - 241 bar	2500 - 3500 PSI

Char-Lynn power steering control units offer the following advantages:

- Minimizes steering linkage — reduces cost, provides flexibility in design.
- Provides complete isolation of load forces from the control station — provides operator comfort.
- Provides continuous, unlimited control action with very low input torque.
- Provides a wide selection of control circuits and meter sizes.
- Can work with many kinds of power steering pumps or fluid supply.

Char-Lynn steering control units are covered by one or more of the following U.S. Patents 25,126; 3,905,728; and 3,953,158. Corresponding foreign Patents. pending and issued.

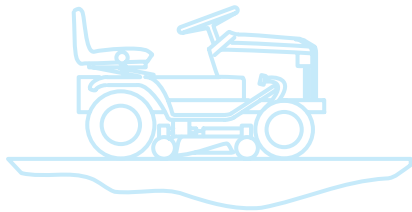
A – General Information

Hydraulic Circuit Explanation

Neutral Circuits: Open Center and Open Center Power Beyond

Open Center:

- Simplest, most economical system
- Uses a fixed displacement pump
- In neutral position pump and tank are connected
- Most suitable on smaller type vehicles



Open Center Power Beyond:

The power beyond steering control unit supplies steering and auxiliary valve functions. The power beyond unit is used on medium pressure, open center (fixed displacement pump) systems.

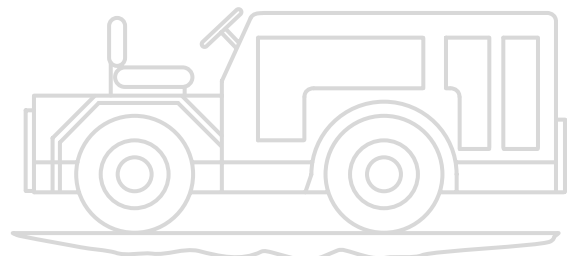
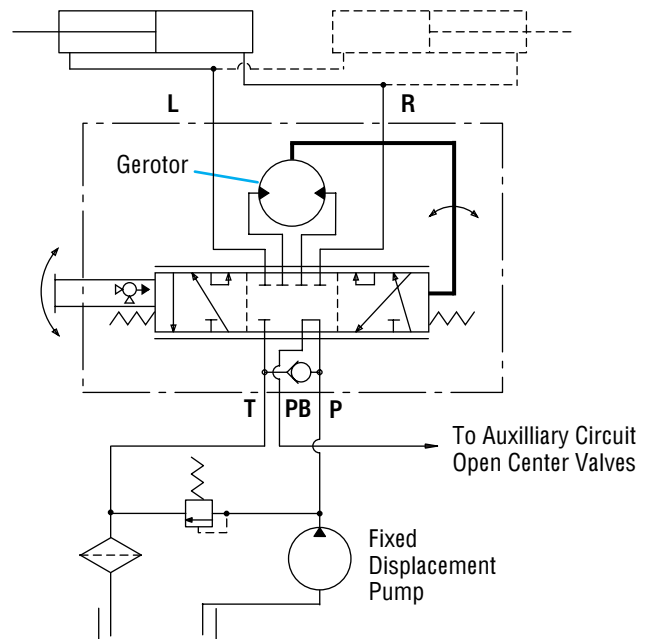
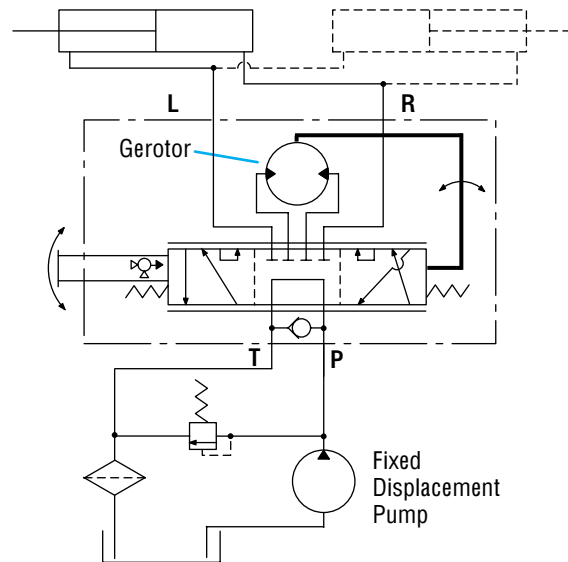
When not steering, the power beyond unit directs all inlet flow to the auxiliary circuit. However once steering is initiated, part of the auxiliary flow is diverted to steering. Since steering has priority, all flow, if required, will be diverted to steering. The tank port of the steering unit has flow only when steering is operated. Thus, flow out of the auxiliary ("PB") port and the tank port will fluctuate or stop depending on steering input.

The following special considerations should be addressed when applying power beyond steering.

- Auxiliary valves (connected to PB) must be open center type. Slight bump or kick may be felt in steering wheel when auxiliary functions are activated during steering operations.
- Pump flow not used for steering is available at power beyond (PB) outlet, except at steering stops where total pump flow goes over the system relief valve. Avoid auxiliary functions that require constant flow while steering.
- Flow is only directed to the tank port when steering is operated. Avoid systems where return flow from tank port is used for auxiliary functions.
- Inlet pressure to the steering unit will be the higher of steering system pressure or auxiliary valve pressure.
- Generally avoid systems where heavy use of auxiliary functions occur while steering.

Applications

- Lawn and Garden Equipment
- Utility Vehicles



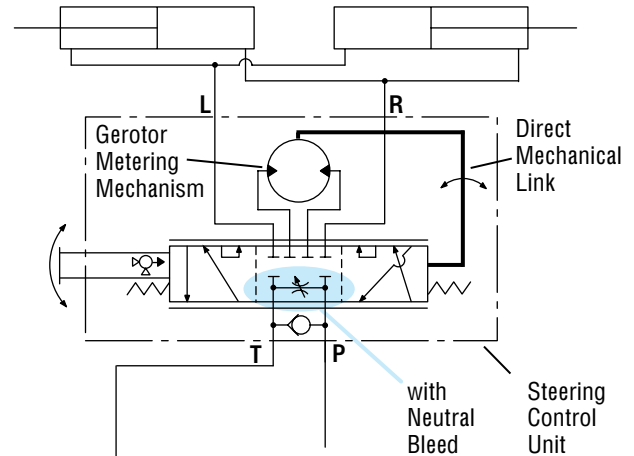
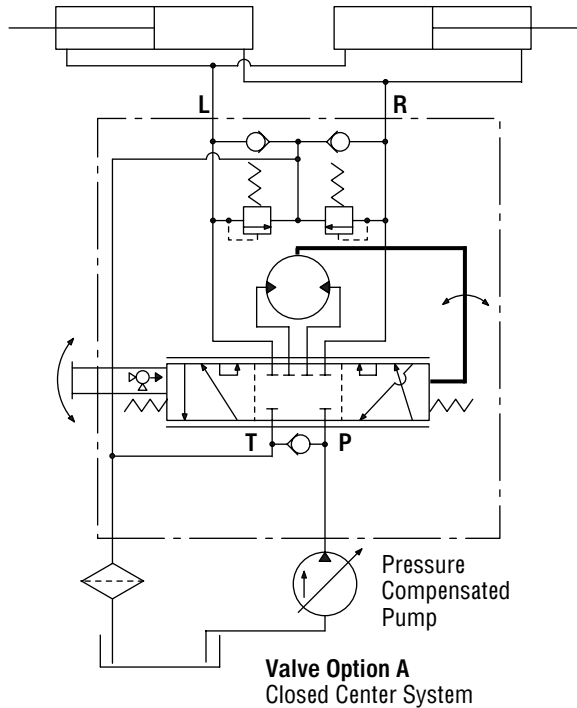
A – General Information

Hydraulic Circuit Explanation

Neutral Circuits: Closed Center

Closed Center:

- Uses a pressure compensated variable displacement pump
- In neutral position pump and tank are disconnected
- Most suitable on large construction equipment



Closed Center with Neutral Bleed

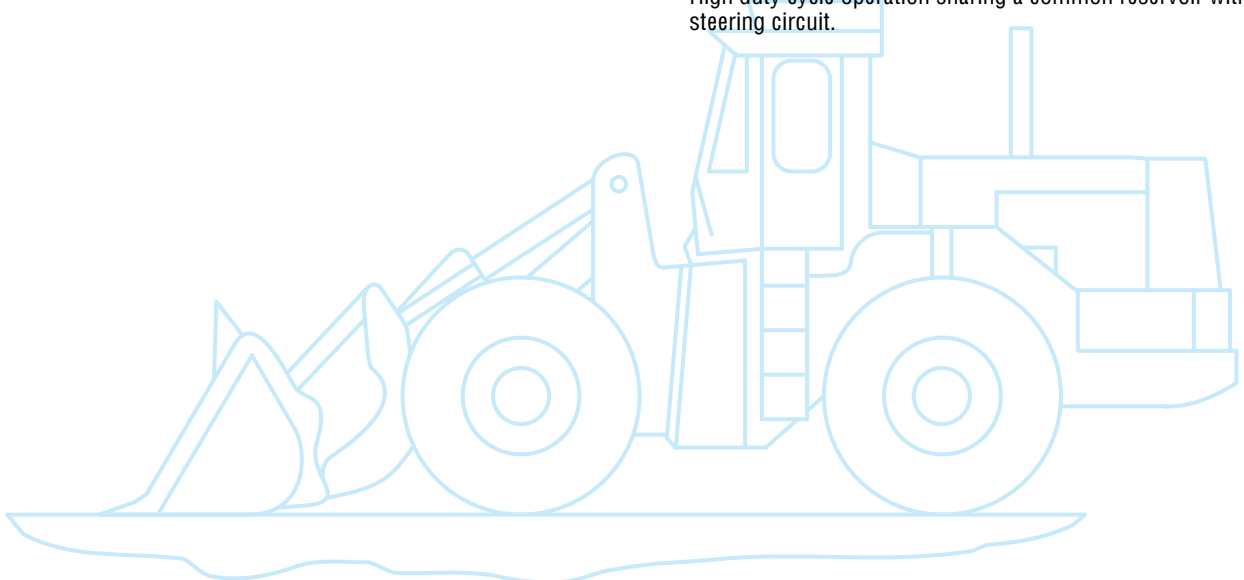
Neutral Bleed Feature

Closed Center Steering Control Units are available with and without neutral bleed feature. Most applications may not require the bleed feature, however, the maximum temperature differential between components within the steering circuit must not exceed specification (50° F or 28° C). Order unit with the bleed feature if the temperature differential may exceed this limit. The neutral bleed feature allows a small flow of fluid to pass through the unit when in neutral to reduce the thermal differential. Typical applications where neutral bleed is required are....

- Remote steering position from power source.
- Extended engine idle operation when vehicle is parked.
- High duty cycle operation sharing a common reservoir with the steering circuit.

Applications

- Construction Industry



A – General Information

Hydraulic Circuit Explanation

Neutral Circuits: Load Sensing Circuits

Char-Lynn load sensing power steering uses conventional or load sensing power supplies to achieve load sensing steering. The use of a load sensing steering unit and a priority valve in a normal power steering circuit offers the following advantages:

- Provides smooth pressure compensated steering because load variations in the steering circuit do not affect axle response or maximum steering rate.
- Provides true power beyond system capability by splitting the system into two independent circuits. Pressure transients are isolated in each circuit. Only the flow required by the steering maneuver goes to the steering circuit. Flow not required for steering is available for use in the auxiliary circuits.
- Provides reliable operation because the steering circuit always has flow and pressure priority.

Char-Lynn load sensing steering control units and priority valves can be used with open center, closed center or load sensing systems. Use in an open center system with a fixed displacement pump or a closed center system with a pressure compensated pump, offers many of the features of a load sensing system. Excess flow is available for auxiliary circuits.

Listed below are the components of a typical load sensing control circuit and a brief application description.

Pump — May be fixed displacement, pressure compensated, or flow and pressure compensated design.

Priority Valve — Sized for design pressure drop at maximum pump output flow rate and priority flow requirements. The minimum control pressure must assure adequate steering flow rate and must be matched with the steering control unit. A dynamic signal priority valve must be used with a dynamic signal steering control unit.

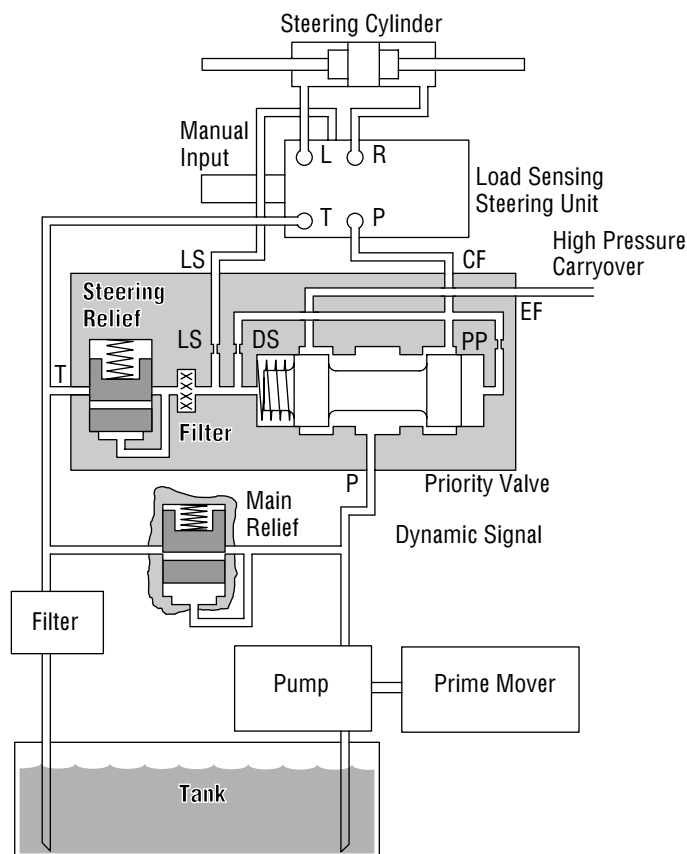
Steering Control Unit — Designed for specific rated flows and control pressures. It must be matched with a control pressure in the priority valve to obtain maximum steering rates. Higher flow rates require higher control pressures. Neutral internal bleed assures component temperature equalization.

LS Line — A LS line is always needed to sense pressure downstream from the variable control orifice in the steering control unit. This is balanced by an internal passage to the opposite side of the priority control spool.

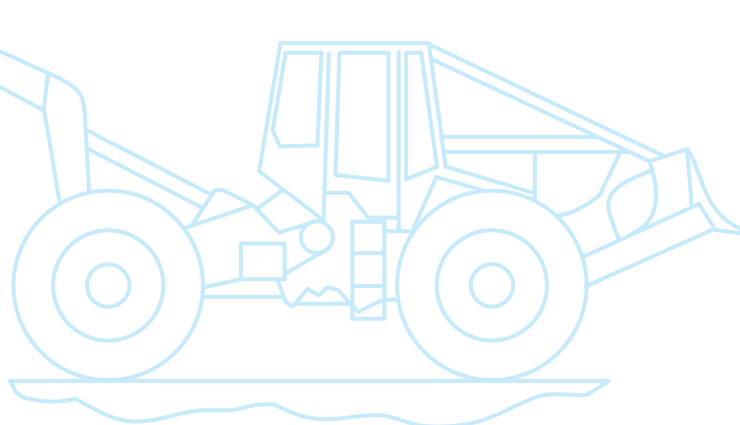
The total system performance depends on careful consideration of the control pressure chosen and pressure drop in the CF line.

Steering Relief Valve — Must be factory set at least 10 bar [145 PSI] above the maximum steering cylinder pressure requirement. Most of the flow will be directed to the auxiliary circuit (EF) when the relief setting is exceeded.

System Main Relief Valve — A pressure relief valve for the auxiliary circuit and or a main safety valve for the protection of the pump is recommended and sized for the maximum pump output flow rate. If a main relief valve is used, it must be set above the priority circuit steering relief valve pressure setting.



LS — Load Sensing
DS — Dynamic Signal
PP — Pilot Pressure
CF — Control Flow
EF — Excess Flow



A – General Information

Hydraulic Circuit Explanation

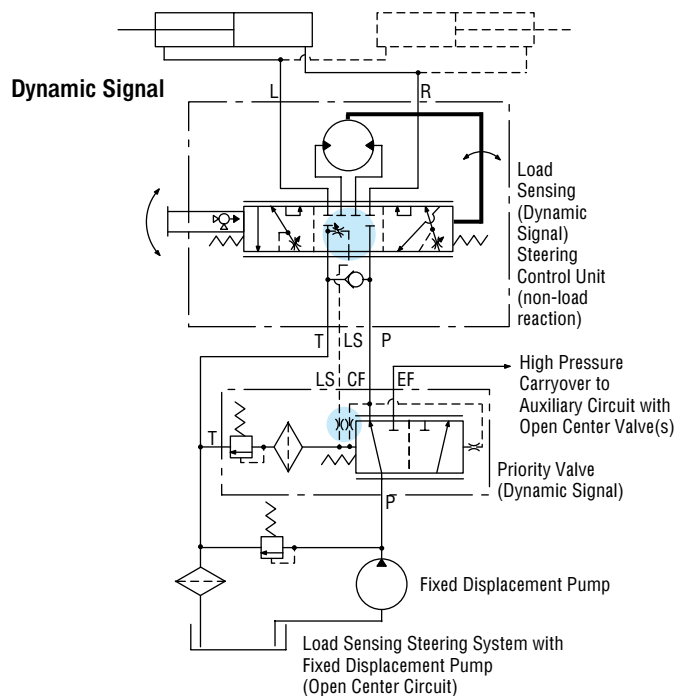
Neutral Circuits: Load Sensing Circuits – Signal Systems

Two types of load sensing signal systems are available — Dynamic and Static.

Dynamic Signal — Used for more difficult applications. The dynamic signal systems offer the following benefits:

- Faster steering response.
- Improved cold weather start-up performance.
- Increased flexibility to solve problems related to system performance and stability.

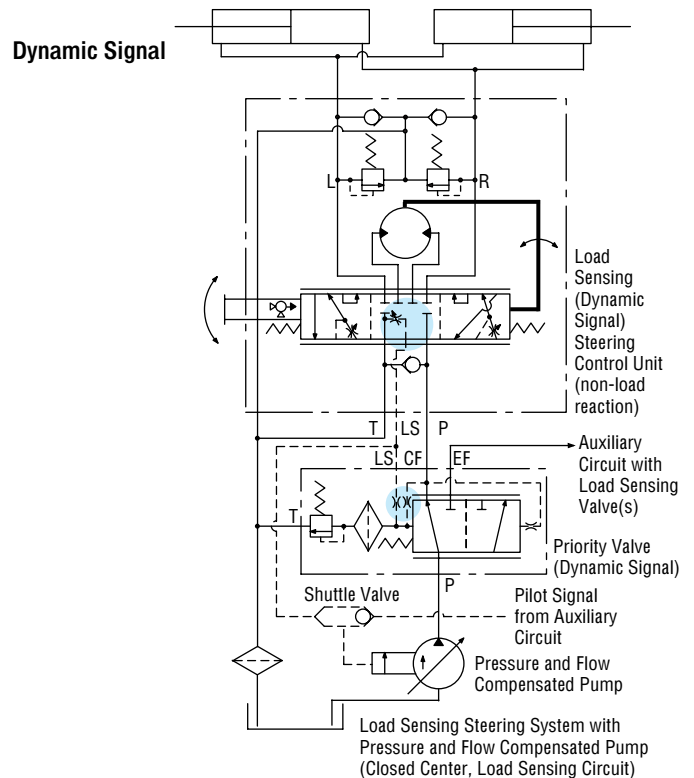
Dynamic Signal – Open Center Pump



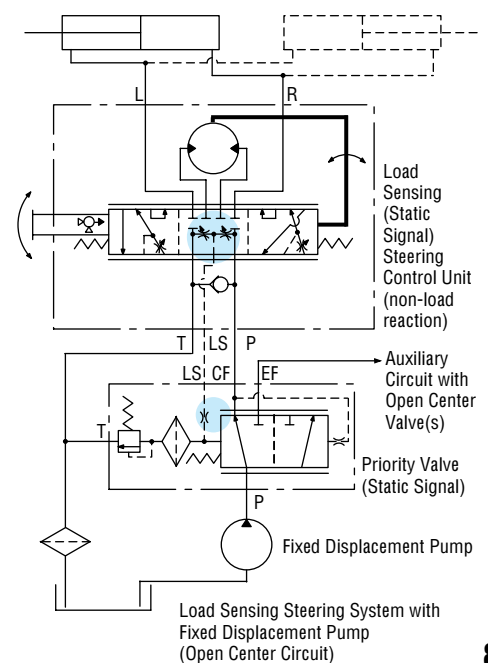
Static Signal – Open Center Pump

Static Signal—Used for conventional applications where response or circuit stability is not a problem. The load sensing pilot line should not exceed 2 meters [6 feet] in length.

Dynamic Signal – Load Sensing Pump



Static Signal



A – General Information

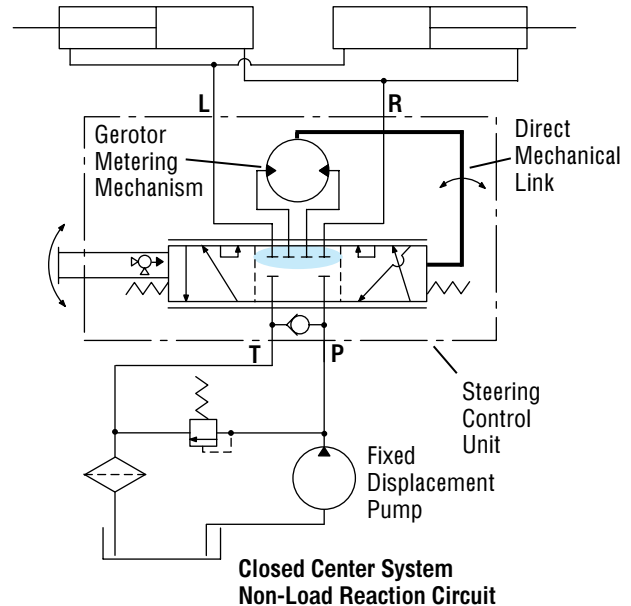
Hydraulic Circuit Explanation

Work Circuits

Non-Load Reaction vs. Load Reaction

Non-Load Reaction

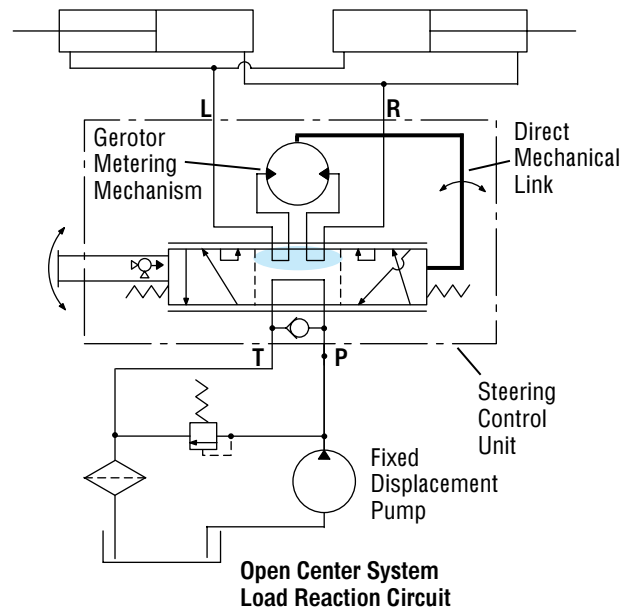
A non-load reaction steering unit blocks the cylinder ports in neutral, holding the axle position whenever the operator releases the steering wheel.



Load Reaction

A load reaction steering unit couples the cylinder ports internally (in the neutral position) with the meter gear set. Axle forces are then allowed to return the steering wheel to its approximate original position. Comparable to automobile steering, gradually releasing the wheel mid turn will allow the steering wheel to spin back as the vehicle straightens.

The cylinder system used with load reaction units **must have equal oil volume** displaced in both directions. The cylinders should be a parallel pair (as shown) or one double rod end unit. **Do not use with a single unequal area cylinder system.**



A – General Information

Steering Units with Integral Valves

Integral valves are available for the Char-Lynn steering control unit. Included are: Inlet Relief Valve, Cylinder Port Shock Valves, LS-Relief Valve, and Anti-Cavitation Valves for cylinder ports. In addition, a Manual Steering Check Valve for limited manual steering is included.

The integral valves eliminate the need for a separate valve block, and provides versatility to meet any steering circuit standard.

Valve Description:

1 Anti-cavitation check valve for cylinder ports—(R & L) protects steering circuit against vacuum (cavitation) conditions.

2 Cylinder Port Relief Valves—(R & L) protects hoses against pressure surge created by ground forces on the steered axle.

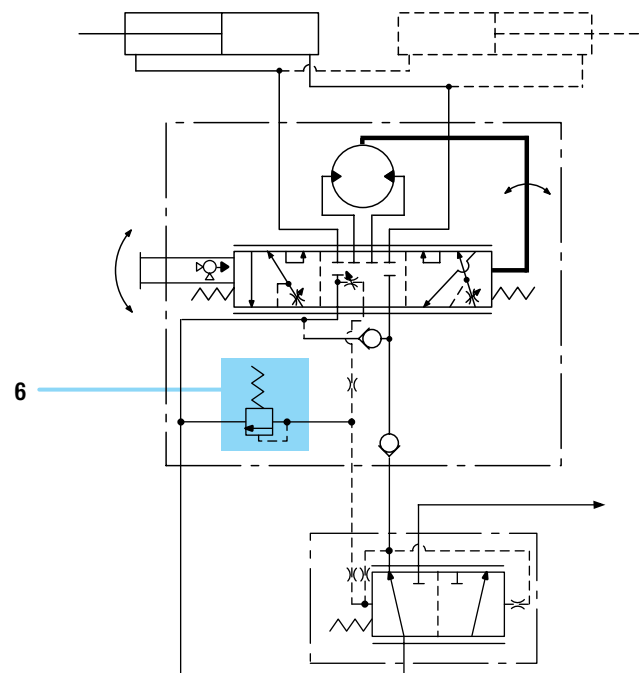
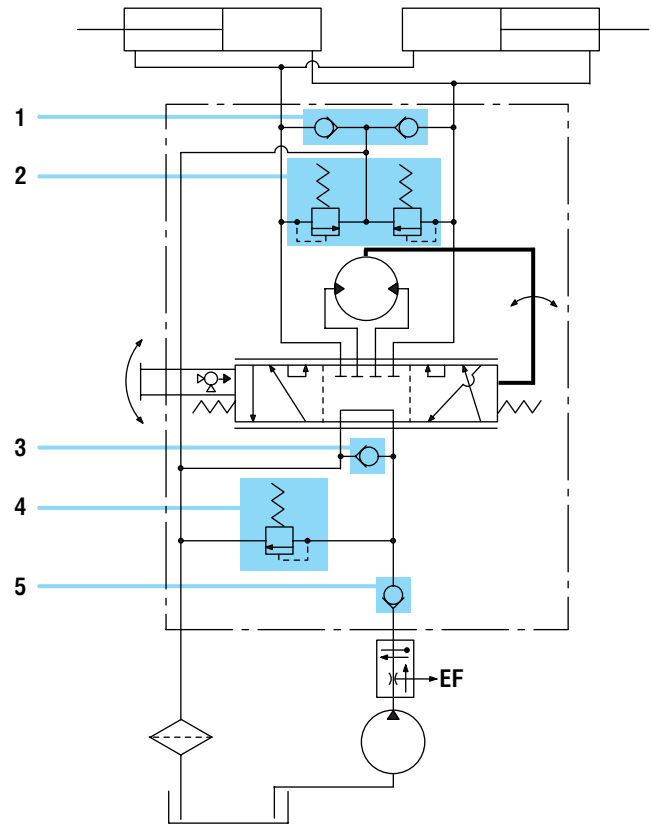
3 Manual Steering Check Valve—converts unit to a hand operated pump for limited manual steering. Included in all units except Series 20, 25, and 40. **

4 Inlet Relief Valve—limits maximum pressure drop across the steering unit protecting the steering circuit.

5 Inlet Check Valve—prevents oil from returning through the steering unit when pressure on the cylinder side is greater than pressure on the inlet side to prevent steering wheel kick.

6 LS-Relief Valve—Limits maximum pressure in the steering circuit (LS units only)

**Steering units with displacements larger than 185 cm³/r [11.3 in³/r] may require a separate power source for limited operation.



A – General Information

Special Features and Application Information

Manual Steering

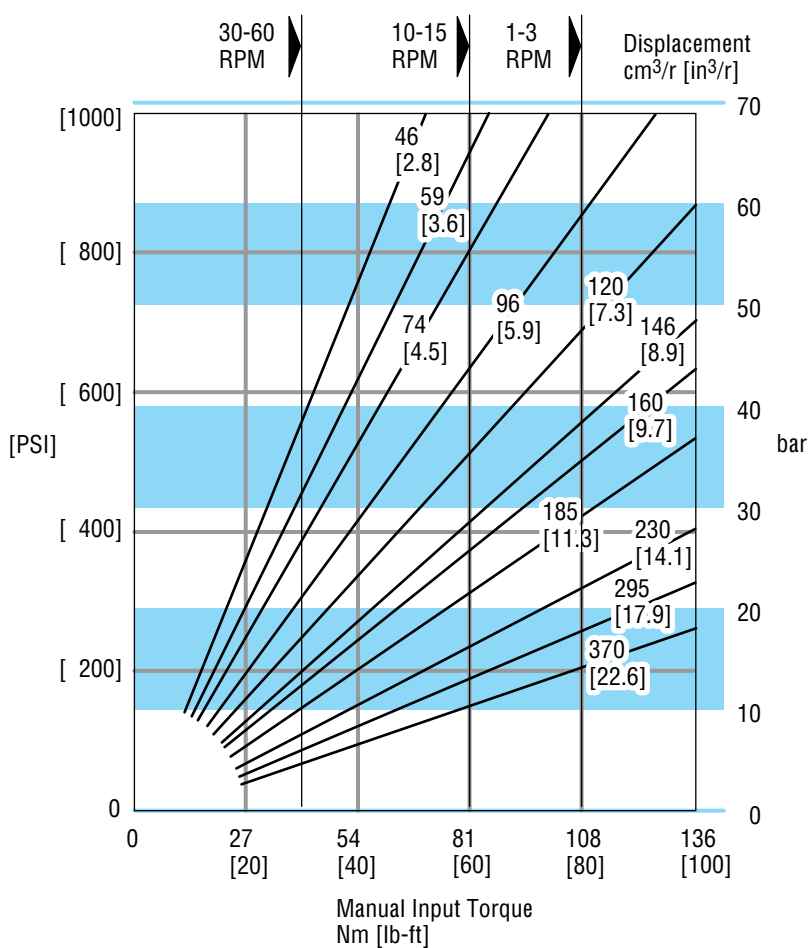
Description

The steering control unit can provide steering flow when the pump or engine fails. It will pump oil through the meter (gerotor) as the operator applies input or torque to the steering wheel which provides limited manual steering.

This feature is available in all steering models except for Series 25 and 40.

Use of Graph

1. Determine steering work port pressure required to perform the desired steering maneuver from vehicle test data. This defines the approximate manual steering pressure level required. Find this value on the vertical axis and construct a horizontal line on the graph.
2. Find the input torque limit on the horizontal axis. Follow this vertically until it crosses the required pressure line of step 1.
3. The maximum steering unit displacement is identified by the first angled line to the left of this intersection.



- 1) Maximum flow less than 7,6 l/min [2 GPM].
- 2) Actual steering pressures required and manual steering capabilities must be verified with vehicle testing.

The above curves are intended as a design guide only.

A – General Information

Special Features and Application Information

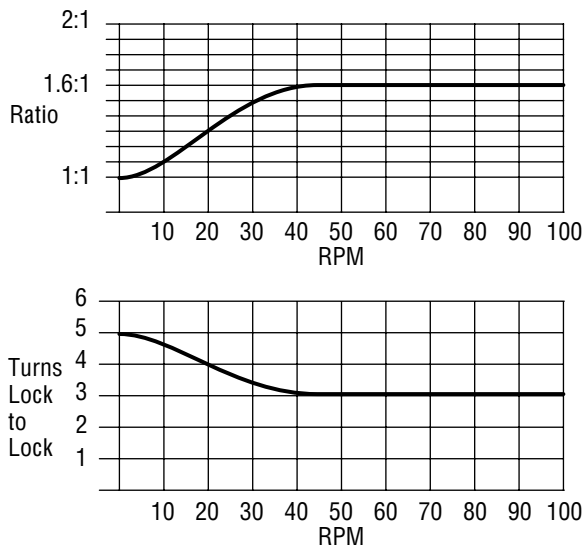
Q-Amp Flow Amplification for Load Sensing Circuits

Description

Q-Amp steering units have built in variable orifices that provide flow directly to the cylinder without going through the gerotor section. The orifices do not open until after the gerotor begins to rotate and then gradually open until the desired flow is achieved which is proportional to the flow going through the gerotor. A typical Q-Amp unit has a ratio of 1.6 : 1 which means the flow of the cylinder is 1.6 times the flow going through the gerotor when turning the steering wheel at medium to fast speeds. (See model code for available ratios.)

Features

- **Variable Ratio:**



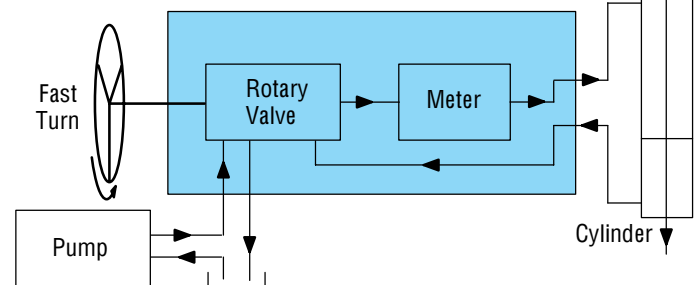
- **Manual Steering:**

Steering a vehicle with loss of engine power may not be possible with a large displacement steering control unit (SCU). Q-Amp with manual feature has the smaller displacement required for manual steering and has the additional flow requirement of the larger displacement SCU for power steering.

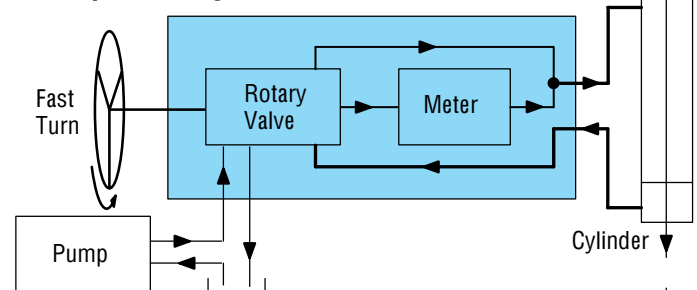
- **Single Cylinder (Unequal area)**

On vehicles with **one single unequal area cylinder** the steering wheel turns lock to lock are more in one direction than the other. When extending the rod one would get more turns than when retracting it. A different Q-Amp ratio while turning in one direction versus the other can be used to give an equal number of turns lock to lock in each direction.

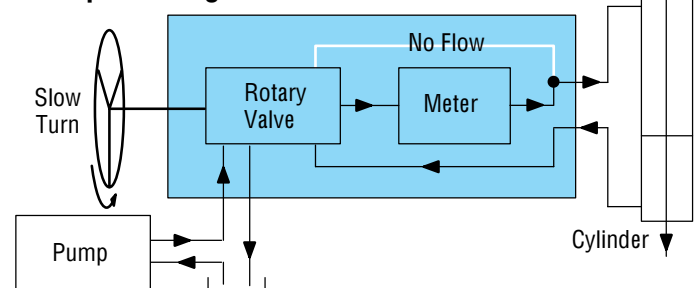
Conventional Steering Control Unit



Q-Amp Steering Control Unit—Fast Turn



Q-Amp Steering Control Unit—Slow Turn



Covered by one or more of the following U.S. and foreign Patents: 4759182, 4862690, 4781219. Unequal area Q-amp Patent pending.

A – General Information

Special Features and Application Information

Q-Amp Flow Amplification for Load Sensing Circuits

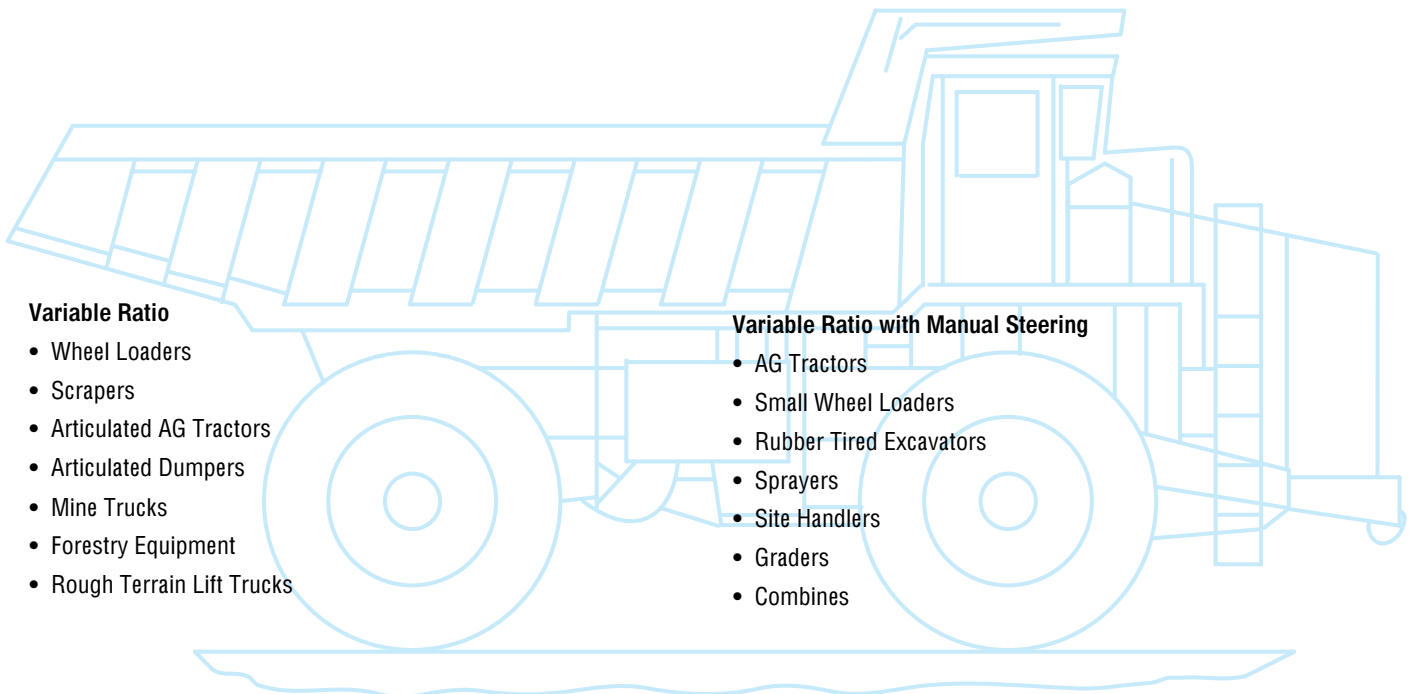
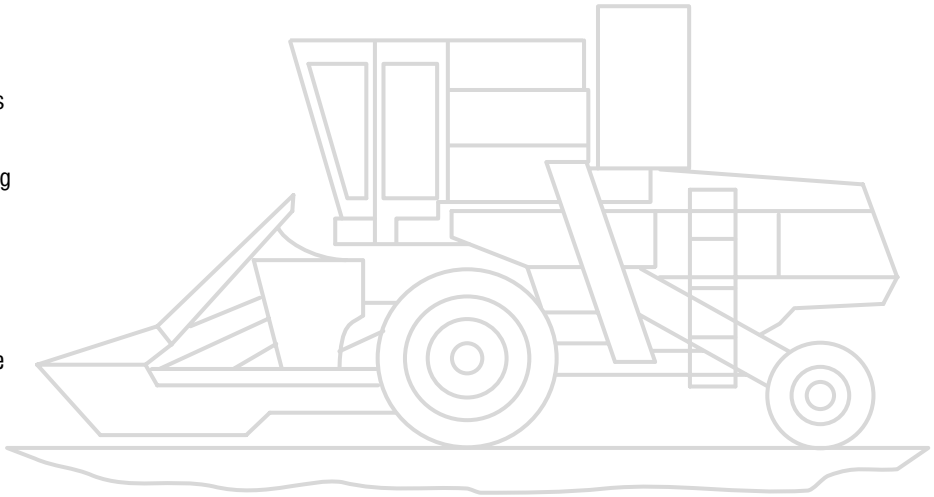
Applications

Articulated vehicles such as wheel loaders, log skidders, scrapers, trucks, and similar vehicles can benefit from this feature.

While roading, a slow movement of the steering wheel (input speed), will not overcorrect steering. Increasing input speed will produce the additional steering flow required to quickly change the vehicles direction.

For example, operating log skidders in the woods requires very quick steering. This same log skidder on the road would be extremely difficult to steer a straight normal course. The variable ratio feature provides good steering in both conditions.

Combines, row crop tractors, and large articulated agricultural tractors also can benefit from this feature when traveling down a field. It will be easier to follow rows or furrows, and still be able to make fast turns at the end of the rows.



Variable Ratio

- Wheel Loaders
- Scrapers
- Articulated AG Tractors
- Articulated Dumpers
- Mine Trucks
- Forestry Equipment
- Rough Terrain Lift Trucks

Variable Ratio with Manual Steering

- AG Tractors
- Small Wheel Loaders
- Rubber Tired Excavators
- Sprayers
- Site Handlers
- Graders
- Combines

A – General Information

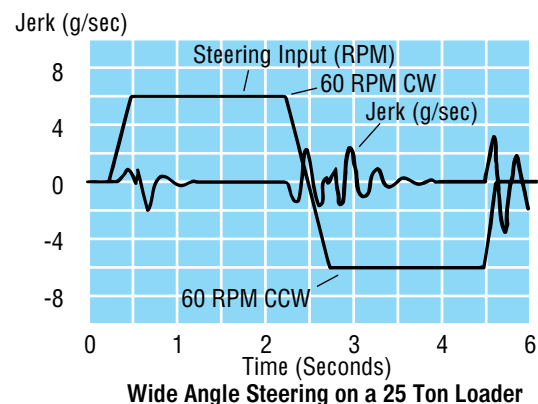
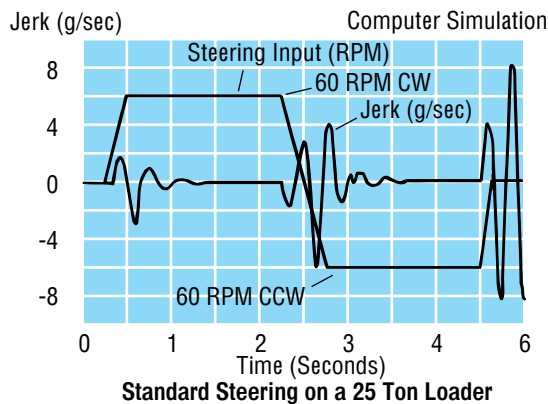
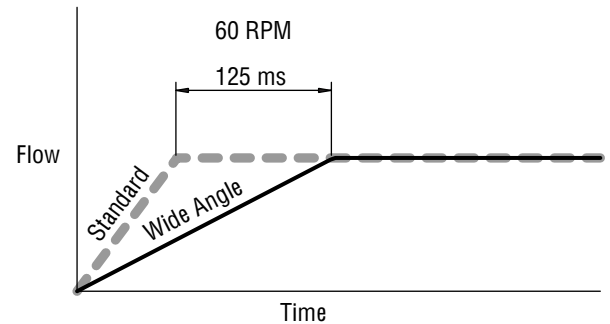
Special Features and Application Information

Wide Angle

Description

Steering units with wide angle features have been developed to significantly reduce or eliminate the jerky motion of vehicles with articulated steering systems. This has been accomplished by increasing the maximum deflection of the spool relative to the sleeve. Increasing the deflection reduces the gain. This in turn reduces acceleration and jerk levels and provides overall smoother vehicle performance.

The steering still responds fast enough so the operator does not notice the reduced gain.



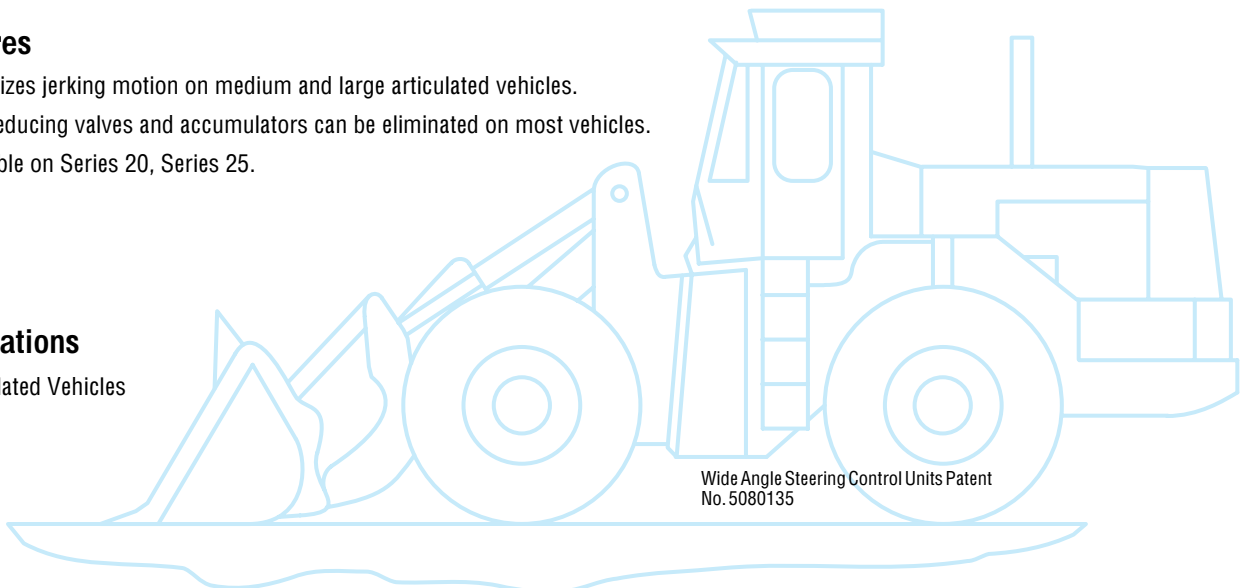
These graphs show a computer simulation of the jerk levels and has been verified by actual vehicle tests.

Features

- Minimizes jerking motion on medium and large articulated vehicles.
- Jerk reducing valves and accumulators can be eliminated on most vehicles.
- Available on Series 20, Series 25.

Applications

- Articulated Vehicles



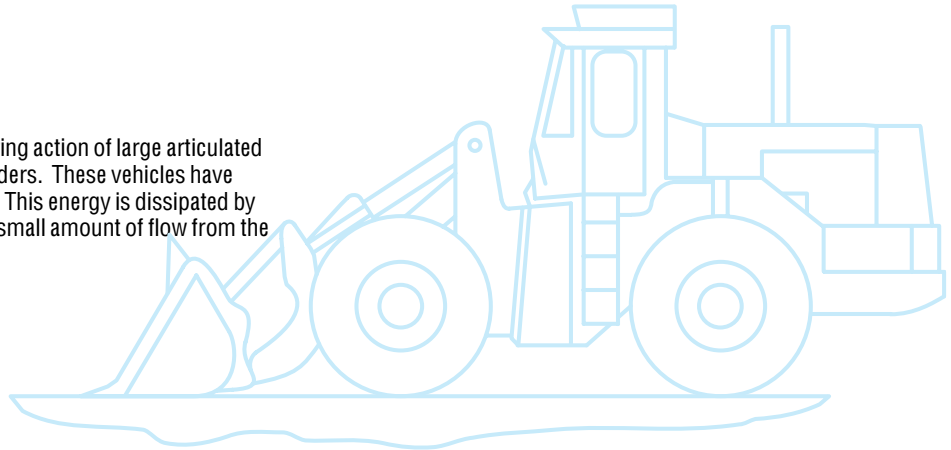
A – General Information

Special Features and Application Information

Cylinder Damping

Description

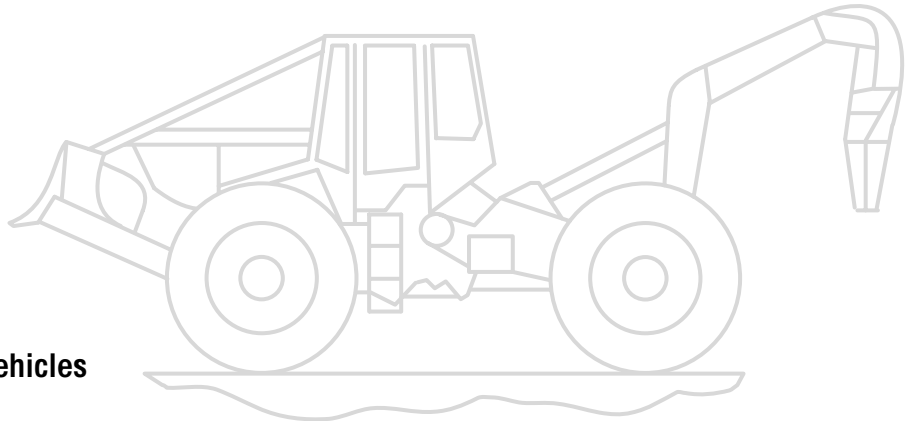
Cylinder damping can help smooth the steering action of large articulated vehicles such as loaders, scrapers, and skidders. These vehicles have overhanging weight with high inertial loads. This energy is dissipated by the cylinder damping orifices which bleed a small amount of flow from the cylinder port to tank.



Steering Control Units with
Cylinder Damping Patent
No. 5080135

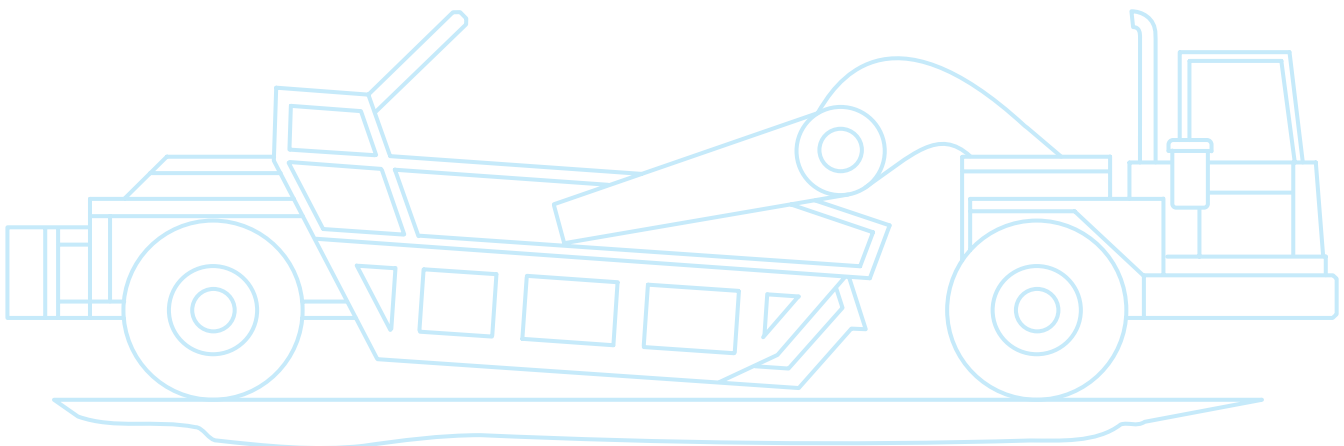
Features

- Reduces jerking motion on medium and large articulated vehicles.
- Available on following steering control units (Series 450, 20, 25, 40).
- Damps or stabilizes unstable systems.



Applications – Large Articulated Vehicles

- Wheel Loaders
- Skidders
- Scrapers



A – General Information

Special Features and Application Information

EMSS – Electric Motor Signal Switch

Description

Designed to conserve energy on fork lifts and other electrically driven vehicles, the EMSS is a pressure signal capable of driving a switch. When the switch receives a pressure pulse, it signals the electric motor driving the steering pump to start. An electric time relay can turn the pump off when steering is not used.

Unlike conventional systems, the open-center EMSS can use added drain ports to detect the pressure signal independently from the back pressure. This allows the lower-pressure switch setting to generate smooth response steering at start up. The EMSS is available for use in open-center, and load-sensing configurations.

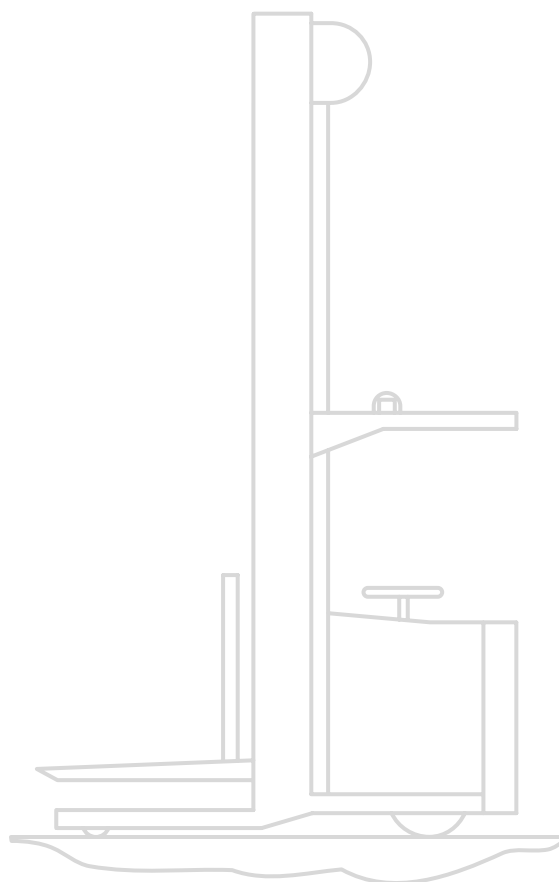
Features

- Helps save energy on battery-driven vehicles.
- Easily and quickly installs on standard SCU configurations.
- Patented design helps provide smooth response at steering start up.
- Can be used in open-center and load-sensing configurations.

Application – Used for Electric Fork Lifts

The response of the EMSS port pressure to the steering input with power off, depends on SCU displacement and initial steering rate. Smaller displacements will generate EMSS pressure more quickly, as will a higher initial steering rate. With a 45,9 cm³/r [2.8 in³/r] gerotor and 60 rpm initial steering rate, EMSS pressure will rise ~7 bar [100 psi] above tank pressure in 40° or less steering motion. Under the same conditions, a 73,7 cm³/r [4.5 in³/r] gerotor takes 60° or less steering wheel motion.

Note: for smooth performance, the pressure switch should be set as low as possible. If the end of steering valve travel is reached before pressure reaches the switch setting, a small "bump" may be felt in the steering wheel.



EMSS – Schematics

A – General Information



B – Product Information

Steering Control Units — Series 3, 6, 12

Product Description

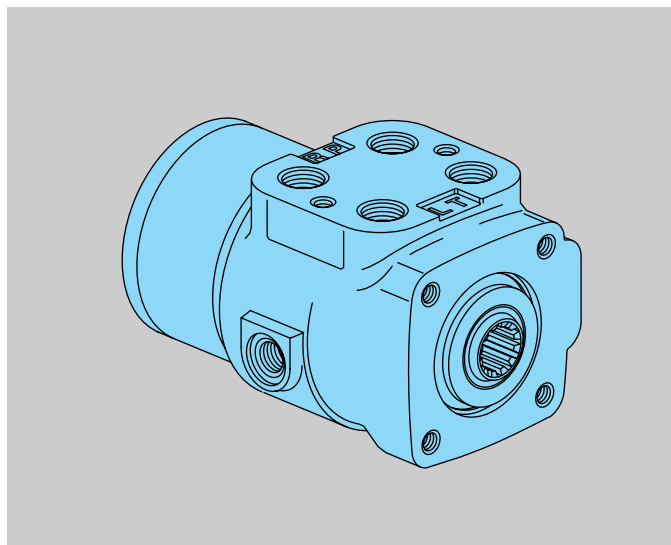
Traditional power steering units are available for applications that don't require integral valve capabilities. Typical application range from mid size lift trucks to large farm tractors.

The Series 3, 6 and 12 steering control units provide the following features...

- Valving—Reduced hydraulic noise level optimum flow gain characteristics on all models.
- 3 basic systems—Open Center, Closed Center, Load Sensing
- 3 flow options—designed for best control in different capacity steering circuits—11 l/min [3 GPM], 23 l/min [6 GPM], 45 l/min [12 GPM] rated flow.
- 2 basic load circuits—load reaction, non load reaction
- Directly interchangeable with past and present applications.
- All models can operate at pressures up to 172 bar [2500 PSI]
- Twelve displacements—increments from 75 to 740 cm³/r [4.5 to 45.1 in³/r].
- Manual Steering check valve for limited manual steering.
- Available with fixed length columns.

Features

- Open Center
- Closed Center
- Load Sensing



Specifications

Max. System Pressure	172 bar [2500 PSI]
Max. Back Pressure	21 bar [300 PSI]
Rated Flow	
Series 3	7,5 - 15 l/min [2 - 4 GPM]
Series 6	15 - 30 l/min [4 - 8 GPM]
Series 12	30 - 60 l/min [8 - 16 GPM]
Max. System	
Operating Temperature	93°C [200° F]
Max. Differential	
Between Steering Unit and System Temperature	28° C 50° F
Input Torque	
Powered	2,8 - 4,0 Nm @ 6,9 bar back pressure† [25 - 35 lb-in @ 100 PSI back pressure] †
Non Powered	136 Nm [100 lb-ft] maximum
Rotation Limits	
Fluid	ATF Type A and most petroleum based fluids
Recommended Filtration	ISO 18/13 cleanliness level

† Low Torque Option Available

B – Product Information

Steering Control Units — Series 3, 6, 12

Standard Product Releases

Example: 211-1001-002
 Product Number Design Code

Series 3

System	Load Circuit	Rated* Flow l/min [GPM]	Port Size	Actual Displacement cm ³ /r [in ³ /r] — Product Number				
				75 [4.5]	95 [5.9]	120 [7.3]	145 [8.9]	160 [9.7]
Open Center	Non Load Reaction	7,5-15 [2-4]	9/16-18	211-1001	211-1002	211-1003	211-1157	—
Closed Center	Non Load Reaction	15 [4]	9/16-18	212-1009	212-1010	212-1011	212-1072	212-1012
	Load Reaction	15 [4]	9/16-18	212-1021	212-1022	212-1023	212-1073	212-1024

Series 6

System	Load Circuit	Rated* Flow l/min [GPM]	Port Size	Actual Displacement cm ³ /r [in ³ /r] — Product Number							
				75 [4.5]	95 [5.9]	120 [7.3]	145 [8.9]	160 [9.7]	185 [11.3]	230 [14.1]	295 [17.9]
Open Center	Non Load Reaction	15-30 [4-8]	3/4-16	211-1007	211-1008	211-1009	211-1137	211-1010	211-1011	211-1012	211-1158
	Load Reaction	15-30 [4-8]	3/4-16	211-1047	211-1048	211-1049	211-1159	211-1050	211-1051	211-1052	—
Closed Center	Non Load Reaction	30 [8]	3/4-16	212-1001	212-1002	212-1003	212-1069	212-1004	212-1005	212-1006	212-1070
Load †† Sensing	Non Load Reaction	30 [8]	3/4-16	213-4001	213-4002	213-4045	213-4042	213-4046	213-4043	213-4047	213-4044

Series 12

System	Load Circuit	Rated* Flow l/min [GPM]	Port Size	Actual Displacement cm ³ /r [in ³ /r] — Product Number			
				370 [22.6]	460 [28.2]	590 [35.9]	740 [45.1]
Open Center	Non Load Reaction	30-60 [8-16]	3/4-16	211-1038	211-1176	211-1160	211-1041
Closed Center	Non Load Reaction	60 [16]	3/4-16	212-1014	212-1015	212-1071	212-1017
Load †† Sensing	Non Load Reaction	60 [16]	3/4-16	213-4051	213-4048	213-4049	213-4050

†† Low Torque Centering Springs

* For closed center unit, rated flow is measured at 70 bar [1000 PSI] pressure drop at full valve deflection. For load sensing unit, rated flow is designed for 4,5 bar [65 PSI] pressure drop between inlet (P) and load sensing (LS) port at full valve deflection.

Steering Control Units — Series 3, 6, 12

Technical Drawing of the 1000 Series Hydraulic Valve

Front View Dimensions:

- Overall Width: 94,0 [3.70] Max.
- Overall Height: 95,3 [3.75] Max.
- Top Flange Width: 47,8 [1.88]
- Top Flange Height: 48,8 [1.92] Max.
- Port Spacing: 56,1 [2.21]*
- Port Diameter: 3,36/2,05 [.132/.081]
- Port Thread: 3/8 - 16 UNC x 15,2 [.60] Deep on 82,5 [3.25] Dia. Bolt Circle
- Port Angle: 45°

Side View Dimensions:

- Overall Length: 82,80 [3.260] Max.
- Port Spacing: 64,3 [2.53]*
- Port Diameter: 44,45/44,34 [1.750/1.746] Dia.
- Port Thread: 3/8 - 24 UNF x 14,7 [.58] Deep (2)
- Port Min. Depth: 10,2 [.40] Min. Depth (7,1 [.28] Max. Mating Spline Depth)
- Port Max. Depth: 7,1 [.28] Max. Mating Spline Depth
- Port Angle: 45°

Detail View Dimensions:

- Overall Width: 8,2 [.32] Max.
- Overall Height: 38,1 [1.50]
- Port Spacing: 19,0 [.75]
- Port Diameter: 7,6 [.30]
- Port Thread: 7/16-20 O-ring Load Sensing Port*

Other Dimensions:

- 12 Tooth Involute Spline
- 16/32 D.P. 30° P.A.
- 14,2 [.56] Deep
- 7,4/5,4 [.29/.21] Spline
- 22,4 [.88]
- 44,5 [1.75]
- 60,0 [2.36]

Labels:

- Left
- Right
- Tank
- Pressure

Displacement cm ³ /r [in ³ /r]	Dimension C mm [in.]	Dimension D mm [in.]
75 [4.5]	10,2 [.40]	127,6 [5.03]
95 [5.9]	13,2 [.52]	130,7 [5.15]
120 [7.3]	16,5 [.65]	134,0 [5.28]
145 [8.9]	20,0 [.79]	137,6 [5.42]
160 [9.7]	21,8 [.86]	139,4 [5.49]
185 [11.3]	25,4 [1.00]	142,9 [5.63]
230 [14.1]	31,8 [1.25]	149,3 [5.88]
295 [17.9]	40,4 [1.59]	157,9 [6.22]
370 [22.6]	50,8 [2.00]	168,3 [6.63]
460 [28.2]	63,5 [2.50]	181,0 [7.13]
590 [35.9]	80,8 [3.18]	198,3 [7.81]
740 [45.1]	101,6 [4.00]	219,1 [8.63]

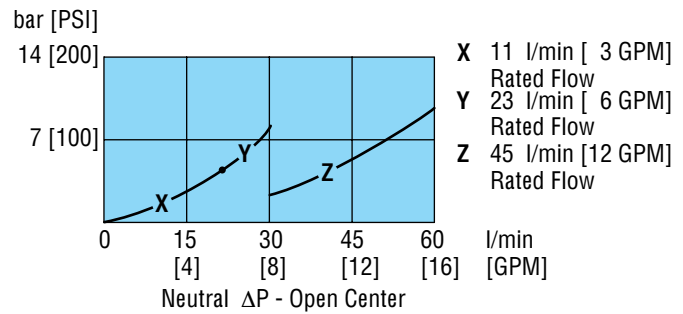
B – Product Information

Steering Control Units — Series 3, 6, 12

Pressure Drop Curves

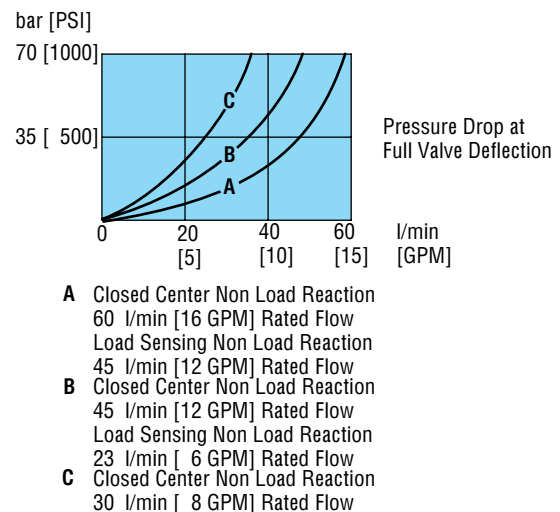
Open Center Systems

In an open center system, a fixed displacement pump delivers fluid to an open center valve. When steering is inactive, the fluid passes through the valve to the return port with relatively low pressure drop. For steering, this bypass closes to build up pressure to deliver flow through the load circuit.

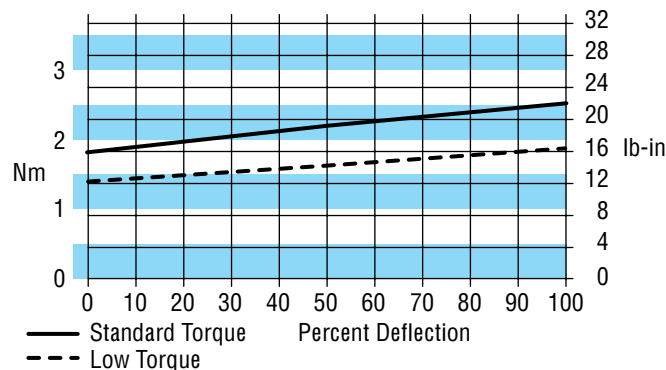


Closed Center and Load Sensing Systems

In a closed center and load sensing system, a pressure compensated variable displacement pump maintains constant pressure supply to a closed center valve. When steering is inactive, the valve is closed to system flow. For steering, the system flow is controlled according to the valve opening and load pressure through the load circuit.



Input Torque Series 3, 6, 12

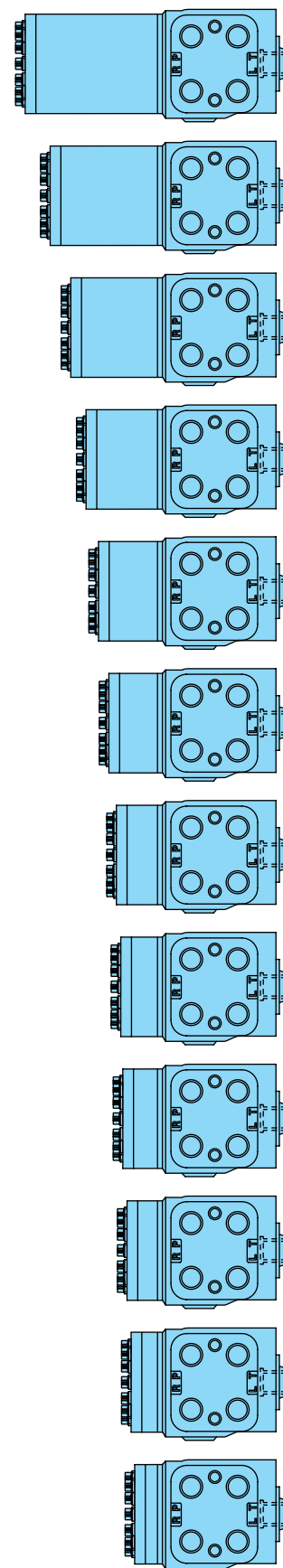
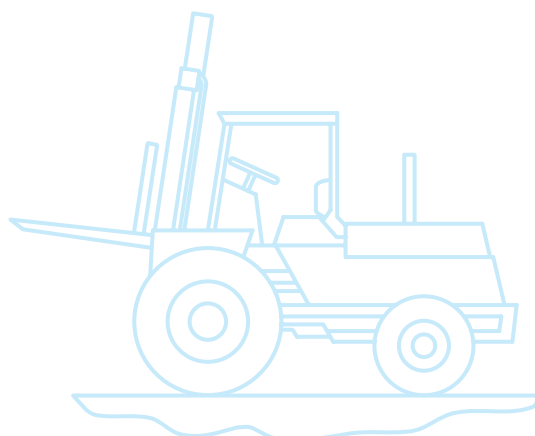
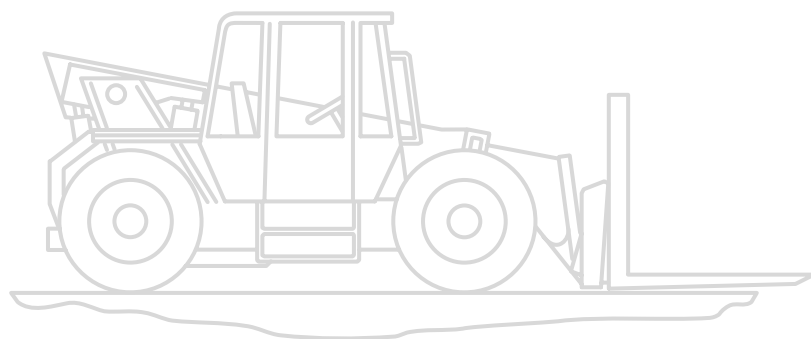
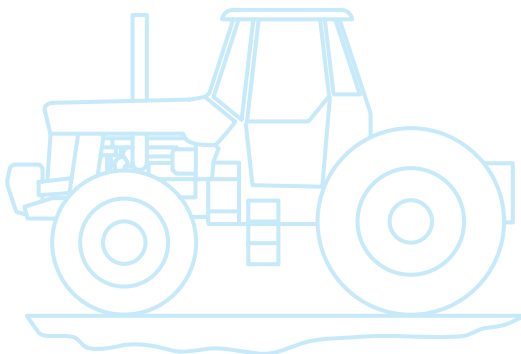


B – Product Information

Steering Control Units — Series 3, 6, 12

Applications

- Agricultural Equipment
- Construction Equipment
- Lawn and Garden Equipment
- Industrial and Material Handling



B – Product Information

Steering Control Units — Series 3, 6, 12

Model Code – Ordering Information

The following 29-digit coding system has been developed to identify all of the configuration options for the Series 3, 6, 12 steering control units. Use this model code to specify a unit with the desired features. All 29-digits of the code must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box.

Model Code — Series 3, 6, 12 Steering Control Units

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
A	B	U		5	A			0			0	1	0	0	0	0						A	0	A	A	1	0	B

Position 1, 2, 3 Product Series

ABU Series 3, 6, 12 Steering Control Unit

Position 4 Nominal Flow Rating

1 11 l/min [3 GPM]

3 23 l/min [6 GPM]

5 45 l/min [12 GPM]

Position 5 Inlet Pressure Rating

5 172 bar [2500 PSI]

Position 6 Tank Pressure Rating

A 10 bar [145 PSI]

Position 7-8 Displacement cm³/r [in³/r]

43 75 [4.5]

45 95 [5.9]

48 120 [7.3]

50 145 [8.9]

51 160 [9.7]

52 185 [11.3]

54 230 [14.1]

57 295 [17.9]

59 370 [22.6]

61 460 [28.2]

64 590 [35.9]

66 740 [45.1]

Series 3 Only

Series 6 Only

Series 12 Only

Position 9 Flow Amplification

0 None

Position 10 Neutral Circuit

A Open Center

C Closed Center

F Load Sensing, Dynamic Signal

Position 11 Load Circuit

A Non-Load Reaction

B Load Reaction (open center Series 3, 6 only)

Position 12, 13 Integral Valve

01 Manual Steering check

Position 14, 15 Integral Inlet Relief Valve Pressure Settings

00 None

Position 16, 17 Cylinder Relief Valve

00 None

Position 18, 19, 20, 21 Ports and Mounting Threads

BAAC 4 x 9/16 SAE Ports, 3/8 inch Mounting Threads
(Use with 11 l/min [3 GPM] Open Center Units Only)

DAAC 4 x 3/4 SAE Ports, with 3/8 inch Mounting Threads
(Use with 23,45 l/min [6,12 GPM] Open Center Units Only)

DACC 4 x 3/4 SAE Ports, with 7/16 SAE Load Sensing Port on Side, 3/8 inch Mounting Threads (Use with Load Sensing Units)

Position 22 Input Torque

1 Low

3 Standard

Position 23 Fluid Type

A See Eaton Technical Bulletin 3-401

Position 24 Special Application

0 None

Position 25, 26 Special Features

AA None

Position 27 Paint

1 Black Primer

Position 28 Identification

0 Eaton Product Number on Nameplate

Position 29 Eaton Assigned Design Code

B Assigned Design Code



B – Product Information

Steering Control Units — Series 110, 230, 450

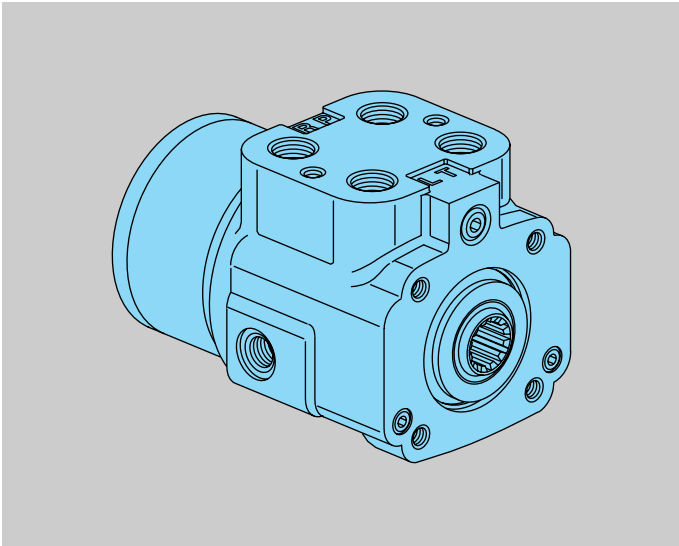
Product Description

Up to six integral valves are available for the Char-Lynn Series 110, 230, and 450 steering control unit. Included are: inlet relief valve, cylinder port shock valves, inlet check valves and anti-cavitation valves for cylinder ports. In addition, an internal check valve for limited manual steering is included. This three group series is available with several combinations of valves as well as three different port and mounting bolt combinations. The charts on page 45, 46, and 47 show the most common combinations of each series.

The integral valves eliminate the need for a separate valve block, and provides versatility to meet any steering circuit standard.

Features

- Open Center
- Closed Center
- Load Sensing
- Integral Valves
- Q-Amp
- EMSS
- Bolt on Priority Valve



Specifications

Max. System Pressure	241 bar [3500 PSI]
Max. Back Pressure	21 bar [300 PSI]
Rated Flow	
Series 110	7,5 - 15 l/min [2 - 4 GPM]
Series 230	15 - 30 l/min [4 - 8 GPM]
Series 450	30 -60 l/min [8 - 16 GPM]
Max. System	
Operating Temperature	93°C [200° F]
Max.Differential	
Between Steering Unit	28° C
and System Temperature	50° F
Input Torque	
Powered	2,8 - 4,0 Nm @ 6,9 bar back pressure†† [25 - 35 lb-in @ 100 PSI back pressure] ††
Non Powered	136 Nm [100 lb-ft] maximum
Rotation Limits	None
Fluid	ATF Type A and most petroleum based fluids
Recommended Filtration	ISO 18/13 cleanliness level

†† Low Torque Option Available

B – Product Information Steering Control Units — Series 110, 230, 450

Standard Product Releases

Select product number from chart or use model code (page 54 and 55) for combinations that differ from features shown below.

Example: **261-1031-0XX**

Product Number

Design Level

The product number (left) describes a Series 110 open center, non-load reaction, 7,5 - 15 l/min [2-4 GPM], 3/4-16 ports, "12" option, 120 cm³/r [7.3 in³/r] 124 bar [1800 PSI] inlet relief pressure, 185 bar [2675 PSI] shock valve pressure.

Series 110

System	Signal	Load Circuit	Rated Flow l/min [GPM]	Port Size	Valve Options (see Chart Below)	Actual Displacement cm ³ /r [in ³ /r] – Product Number		
						75 [4.5]	95 [5.9]	120 [7.3]
Open Center	N/A	Non Load Reaction	7,5-15 [2-4]	3/4-16	12	261-1029-042	261-1408-002	261-1031-042
				G1/2 (BSP)	12	261-1409-002	261-1002-042	261-1003-042
					01	261-1008-002	261-1009-002	261-1010-002
				M18 x 1,5	12	261-1328-002	261-1410-002	261-1411-002
					01	261-1022-002	261-1023-002	261-1024-002

Explanation of valve options

Steering Control with:

- 12**
- Inlet Check Valve
 - Cylinder Port Shock Valves — 235 bar [3410 PSI]
 - Anti-cavitation Valve for Cylinder Ports
 - Inlet Relief Valve — 176 bar [2550 PSI]

01 Steering Control without Integral Valves

Product numbers on this page are steering control units with valve option noted. Use model code on page 54 and 55 when ordering any other valve combinations.

B – Product Information Steering Control Units — Series 110, 230, 450

Standard Product Releases

Select product number from chart or use model code (page 54 and 55) for combinations that differ from features shown below.

Example: **261-1413-0XX**

Product Number

Design Code

The product number (left) describes a Series 230 open center, non-load reaction, 15-30 l/min [4-8 GPM], 3/4-16 ports, "12" option, 295 cm³/r [17.9 in³/r] 124 bar [1800 PSI] inlet relief pressure, 185 bar [2675 PSI] shock valve pressure.

Series 230

System	Signal	Load Circuit	Rated Flow l/min [GPM]	Port Size	Valve Options (see Chart Below)	Actual Displacement cm ³ /r [in ³ /r] – Product Number							
						75 [4.5]	95 [5.9]	120 [7.3]	145 [8.9]	160 [9.7]	185 [11.3]	230 [14.1]	295 [17.9]
Open Center	N/A	Non Load Reaction	15-30 [4-8]	3/4-16	12				261-1412-002	1032-042	1033-042	1034-042	1413-002
				G1/2 (BSP)	12				261-1159-042	1004-042	1005-042	1006-042	1160-042
					01				261-1161-002	1011-002	1012-002	1013-002	1162-002
				M18 x 1,5	12				261-1414-002	1415-002	1416-002	1330-002	1417-002
					01				261-1165-002	1025-002	1026-002	1027-002	1166-002
Load Sensing	Static	Non Load Reaction	30 [8]	3/4-16	10	263-1029-082	1210-002	1211-002	1212-002	1157-002	1213-002	1034-082	1097-082
				G1/2 (BSP)	10	263-1173-002	1002-082	1003-082	1214-002	1004-082	1005-082	1215-002	1098-082
					01	263-1008-002	1009-002	1010-002	1094-002	1011-002	1012-002	1013-002	1099-002
				M18 x 1,5	10	263-1216-002	1217-002	1218-002	1219-002	1220-002	1019-082	1020-082	1221-002
					01	263-1022-002	1023-002	1024-002	1096-002	1025-002	1026-002	1027-002	1101-002
Load Sensing	Dynamic	Non Load Reaction	30 [8]	3/4-16	10	263-4405-002	4406-002	4407-002	4408-002	4409-002	4045-082	4283-002	4410-002
				G1/2 (BSP)	10	263-4047-082	4048-082	4049-082	4411-002	4051-002	4052-082	4053-082	4076-082
					01	263-4054-002	4055-002	4056-002	4057-002	4058-002	4059-002	4060-002	4077-002
				M18 x 1,5	10	263-4412-002	4062-002	4413-002	4414-002	4415-002	4066-082	4067-082	4416-002
					01	263-4068-002	4069-002	4070-002	4071-002	4072-002	4073-002	4074-002	—

†† Low Torque Centering Springs

Explanation of valve options

Steering Control with:

- 10**
 - Inlet Check Valve
 - Cylinder Port Shock Valves — 235 bar [3410 PSI]
 - Anti-cavitation Valve for Cylinder Ports

Steering Control with:

- 12**
 - Inlet Check Valve
 - Cylinder Port Shock Valves — 235 bar [3410 PSI]
 - Anti-cavitation Valve for Cylinder Ports
 - Inlet Relief Valve — 176 bar [2550 PSI]

01 Steering Control without Integral Valves

Product numbers on this page are steering control units with valve option noted. Use model code on page 54 and 55 when ordering any other valve combinations, or pressure settings

The part number prefix 261- (open center units) or 263- (load sensing units) needs to be applied in front of every part number in the table, when ordering.

B – Product Information Steering Control Units — Series 110, 230, 450

Standard Product Releases

Select product number from chart or use model code (page 54 and 55) for combinations that differ from features shown below.

Example: **261-1420-0XX**

Product Number

Design Code

The product number (left) describes a Series 450 open center, non-load reaction, 30-60 l/min [8-16 GPM], 3/4-16 ports, "12" option, 740 cm³/r [45.1 in³/r] 124 bar [1800 PSI] inlet relief pressure, 185 bar [2675 PSI] shock valve pressure.

Series 450

System	Signal	Load Circuit	Rated Flow l/min [GPM]	Port Size	Valve Options (see Chart Below)	Actual Displ. cm ³ /r [in ³ /r] – Product Number			
						370 [22.6]	460 [28.2]	590 [35.9]	740 [45.1]
Open Center	N/A	Non Load Reaction	30-60 [8-16]	3/4-16	12	261-1226-042	1418-002	1419-002	1420-002
				G1/2 (BSP)	12	261-1421-002	1422-002	1423-002	1424-002
					01	261-1425-002	1426-002	1427-002	1428-002
				M18 x 1,5	12	261-1234-042	1429-002	1313-002	1430-002
Load Sensing	Static	Non Load Reaction	60 [16]		01	261-1431-002	1432-002	1433-002	1434-002
				3/4-16	09	263-1103-002	1222-002	1159-002	1223-002
				G1/2 (BSP)	01	263-1047-002	1048-002	1111-002	1112-002
					09	263-1224-002	1225-002	1226-002	1227-002
Load Sensing	Dynamic	Non Load Reaction	60 [16]	M18 x 1,5	01	263-1053-002	1054-002	1117-002	1118-002
					09	263-1228-002	1229-002	1230-002	1231-002
				3/4-16	09	263-4417-002	4418-002	4082-082	4419-002
				G1/2 (BSP)	01	263-4088-002	4089-002	4090-002	4091-002
Load Sensing	Dynamic	Non Load Reaction	60 [16]		09	263-4084-082	4085-082	4086-082	4087-082
				M18 x 1,5	01	263-4096-002	4097-002	4098-002	4099-002
					09	263-4420-002	4421-002	4422-002	4423-002

†† Low Torque Centering Springs

The part number prefix 261- (open center units) or 263- (load sensing units) needs to be applied in front of every part number in the table, when ordering.

Explanation of valve options

- 12** Steering Control with:
- Inlet Check Valve
 - Cylinder Port Shock Valves — 235 bar [3410 PSI]
 - Anti-cavitation Valve for Cylinder Ports
 - Inlet Relief Valve — 176 bar [2550 PSI]

01 Steering Control without Integral Valves

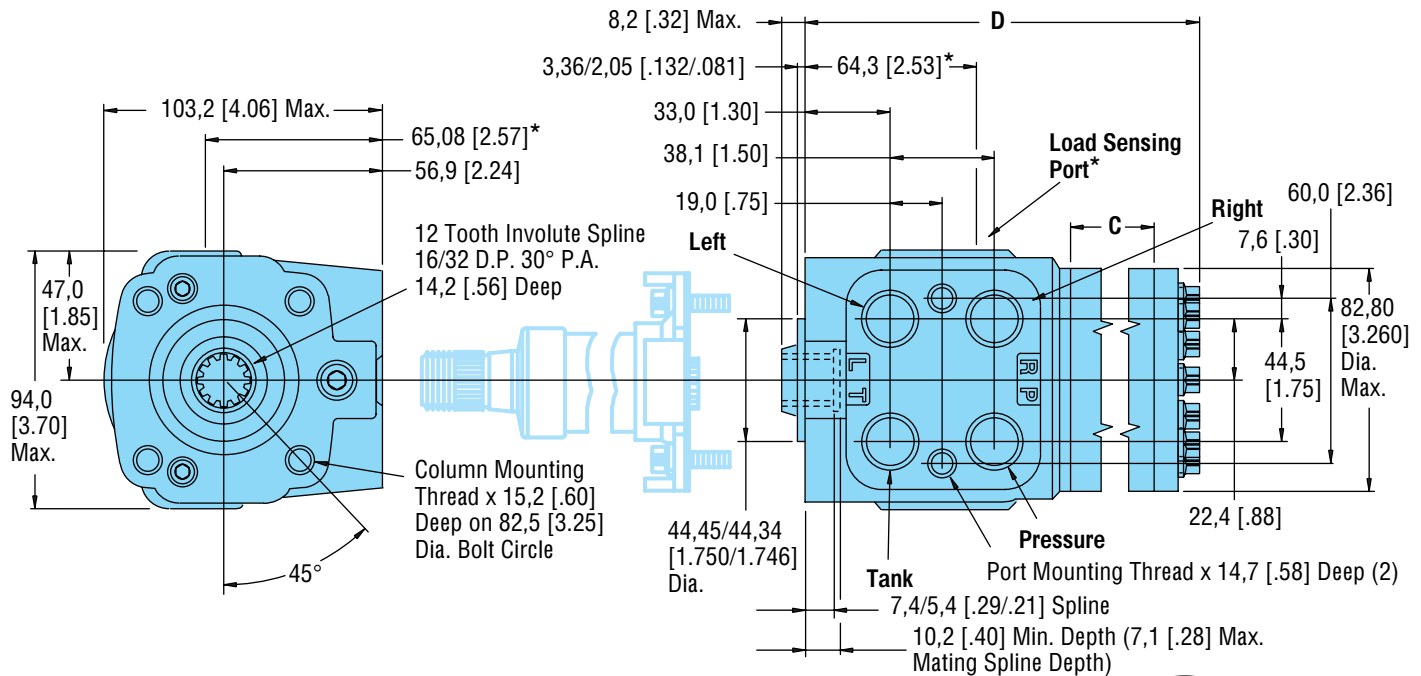
- Steering Control with:
- 09**
- Cylinder Port Shock Valves — 235 bar [3410 PSI]
 - Anti-cavitation Valve for Cylinder Ports

Product numbers on this page are steering control units with valve option noted. Use model code on page 54 and 55 when ordering any other valve combinations.

B – Product Information

Steering Control Units — Series 110, 230, 450

Installation Drawing



Displacement cm ³ /r [in ³ /r]	Dimension C mm [in.]	Dimension D mm [in.]
75 [4.5]	10,2 [.40]	127,6 [5.03]
95 [5.9]	13,2 [.52]	130,7 [5.15]
120 [7.3]	16,5 [.65]	134,0 [5.28]
145 [8.9]	20,0 [.79]	137,6 [5.42]
160 [9.7]	21,8 [.86]	139,4 [5.49]
185 [11.3]	25,4 [1.00]	142,9 [5.63]
230 [14.1]	31,8 [1.25]	149,3 [5.88]
295 [17.9]	40,4 [1.59]	157,9 [6.22]
370 [22.6]	50,8 [2.00]	168,3 [6.63]
460 [28.2]	63,5 [2.50]	181,0 [7.13]
590 [35.9]	80,8 [3.18]	198,3 [7.81]
740 [45.1]	101,6 [4.00]	219,1 [8.63]

Port and Mounting Thread Combinations

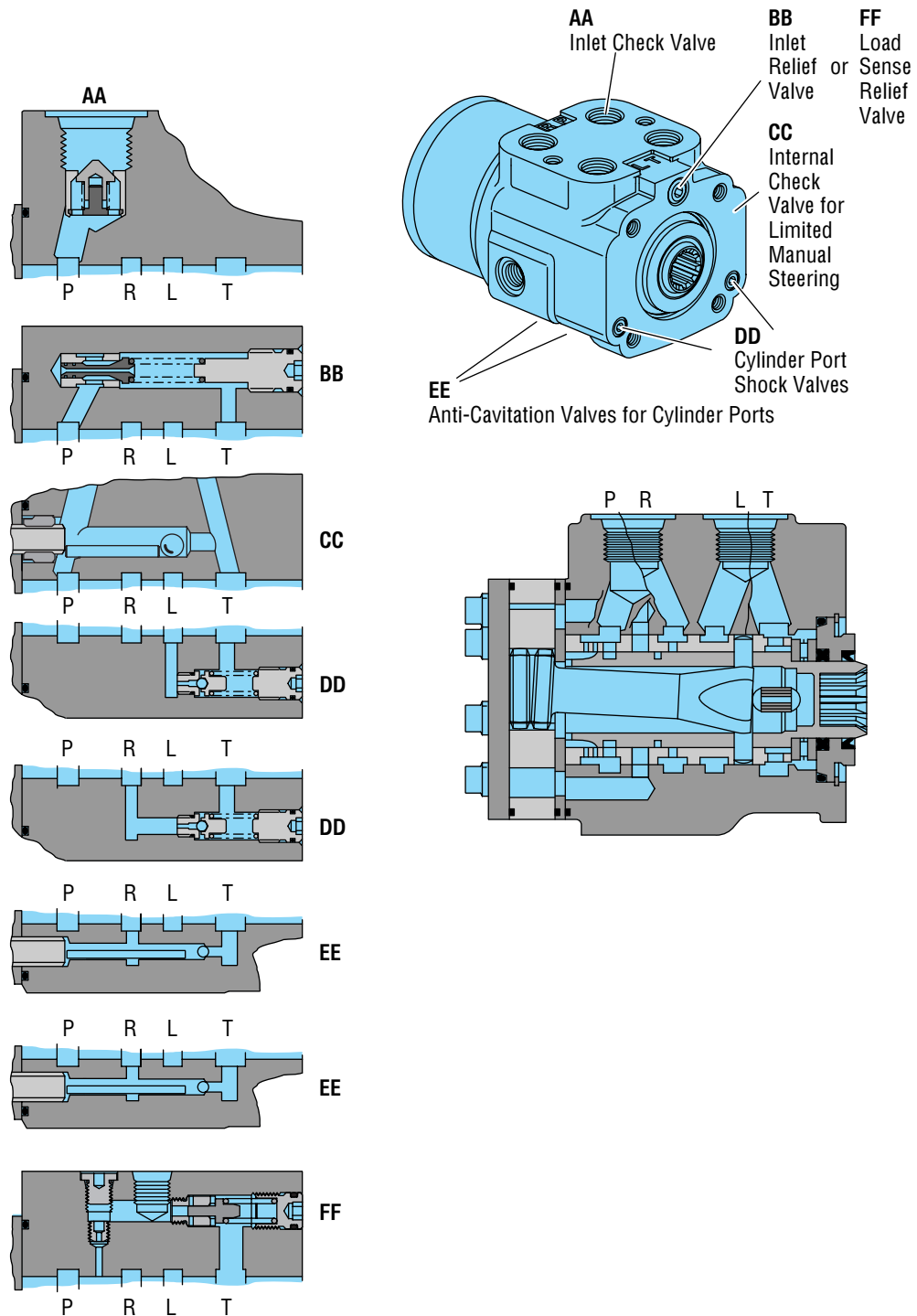
Port	Column Mounting Thread	Load Sensing* Port	Port Mounting Thread
3/4 -16	3/8 - 16	7/16 - 20	3/8 - 24
G1/2 (BSP)	M10 x 1,5	G1/4 (BSP)	M10 x 1,0
M18	M10 x 1,5	M12	M10 x 1,0

*Load Sensing Units Only.

B – Product Information

Steering Control Units — Series 110, 230, 450

Section Drawing and Integral Valves

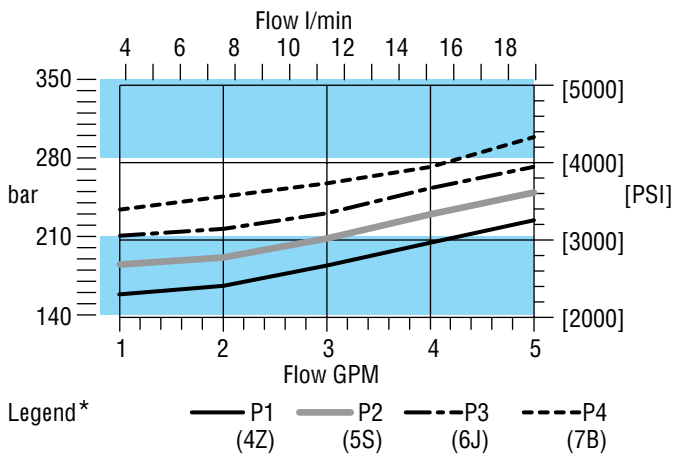


B – Product Information

Steering Control Units — Series 110, 230, 450

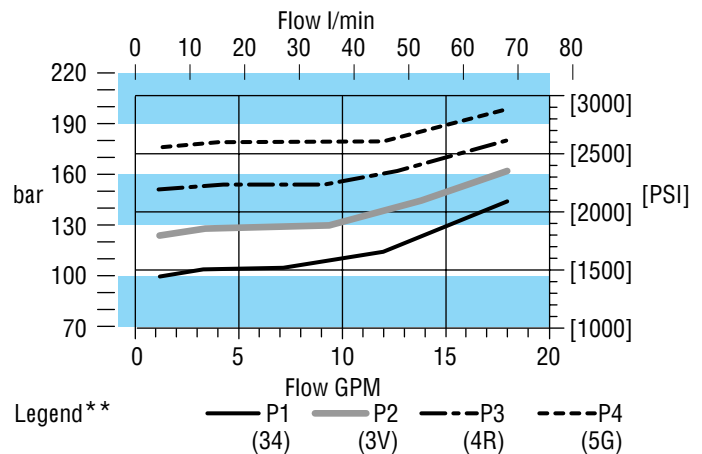
Performance Data

Cylinder Relief Valve Pressure Drop versus Flow



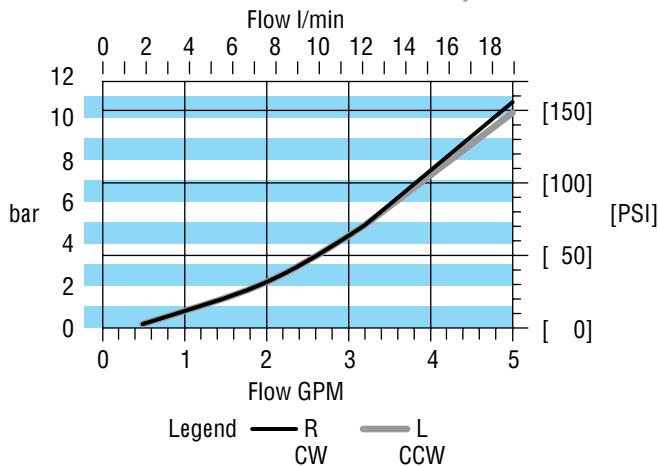
*The examples above are 4 of 22 pressure settings shown in model code page 55 [Position 16, 17](#)

Inlet Relief Valve Pressure Drop versus Flow

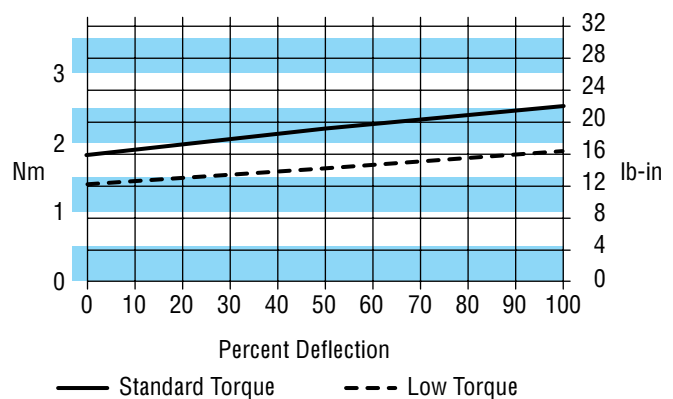


**The examples above are 4 of 31 pressure settings shown in model code page 55 [Position 14, 15](#)

Anti-Cavitation Valve Pressure Drop versus Flow



Input Torque Series 110, 230, 450



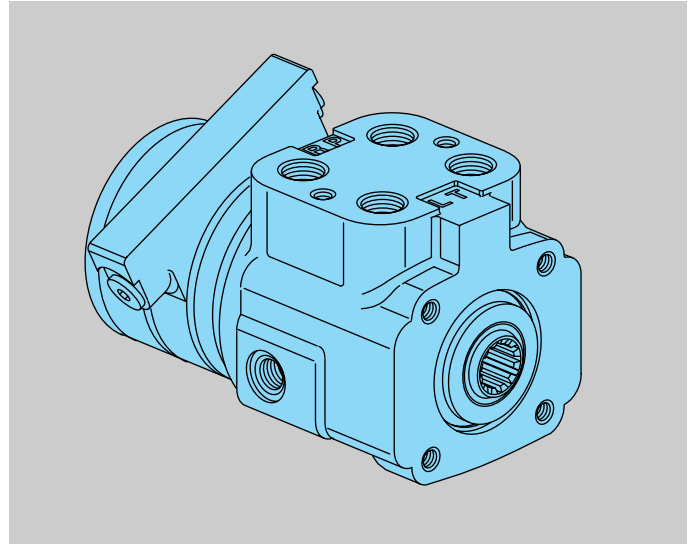
B – Product Information

Steering Control Units — Dual Displacement

Product Description and Features

The dual displacement steering control unit allows manufacturers of off road vehicles to retain manual steering capabilities while reducing the number of components in their system. By using two displacements in one unit we offer a better solution to manually steer a vehicle in an unpowered mode without the need of a back-up power system – resulting in a more economical machine.

The dual displacement steering unit uses two gerotors and a pressure controlled logic valve. The logic valve switches between two displacements, one displacement for manual steering and the total of both displacements for powered operation. The logic valve is spring returned to the smaller manual displacement when inlet pressure falls below 8 bar [120 psi]. Above 8 bar [120 psi] the logic valve connects both gerotors to provide full powered displacement.



Manual steering capabilities in unpowered mode

- Eliminates the need of a back-up emergency system.
- Engages the small displacement in an unpowered mode and allows manual steering.
- Allows vehicles to meet ISO/TUV road regulations without the need of the currently used emergency system.

Performance in powered mode

- Both gerotors are engaged to steer the vehicle.
- Same performance as other Char Lynn steering units.

Additional Features

Steering circuit: Load Sensing Dynamic Signal

Max. system pressure: 240 bar [3500 psi]

Valve options and other features: same as available on Series 230 units

Displacement chart:

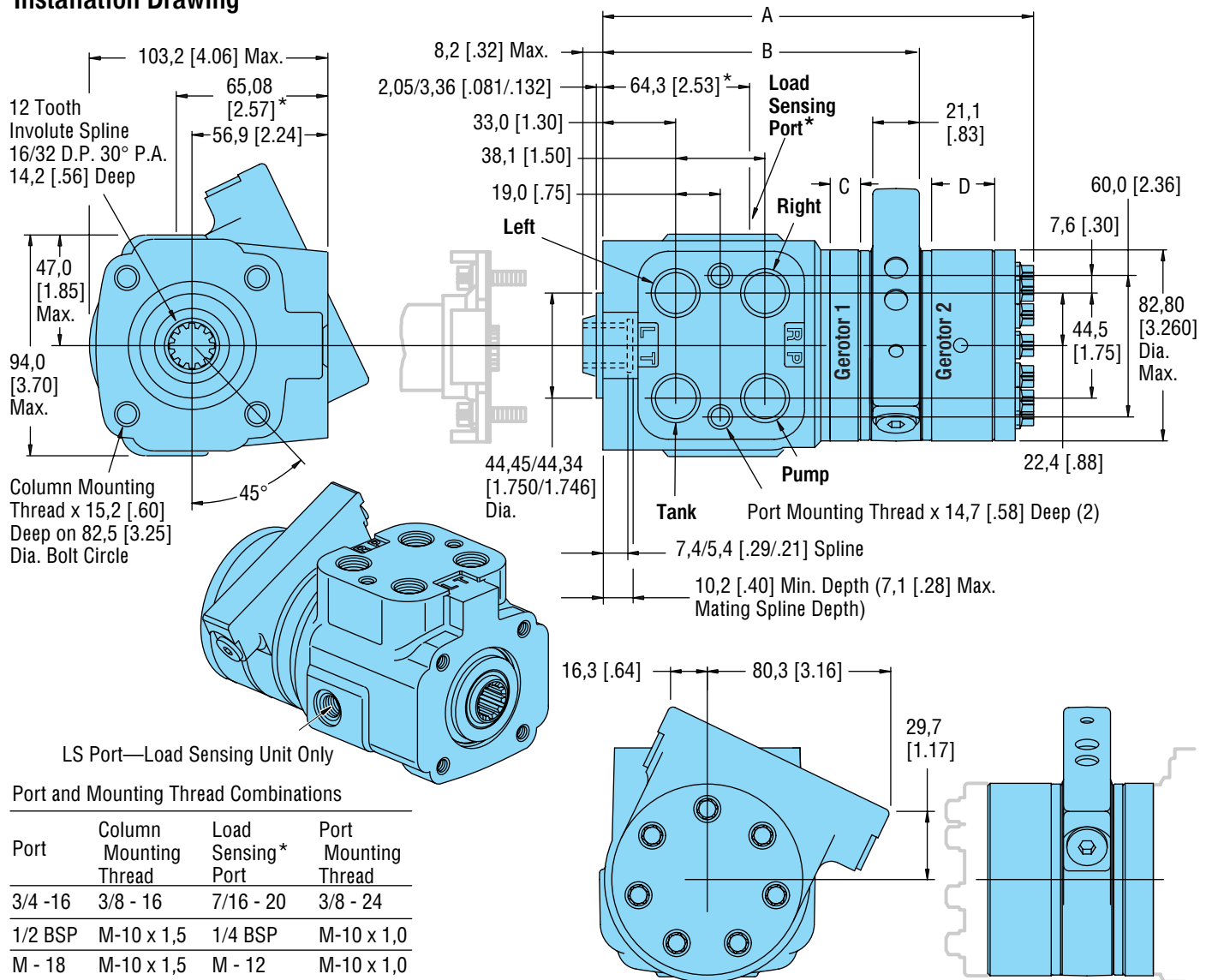
Gerotor 1 Manual displ.	Gerotor 1 and 2 Powered displ.	Gerotor 1 Manual displ.	Gerotor 1 and 2 Powered displ.
in ³ /rev	in ³ /rev	cm ³ /rev	cm ³ /rev
3.6	9.5	60	156
3.6	10.9	60	179
3.6	12.5	60	205
3.6	13.3	60	218
3.6	14.9	60	244
4.5	10.4	75	170
4.5	11.8	75	193
4.5	13.4	75	220
4.5	14.2	75	233

For any other displacement please see your Eaton representative

B – Product Information

Steering Control Units — Dual Displacement

Installation Drawing



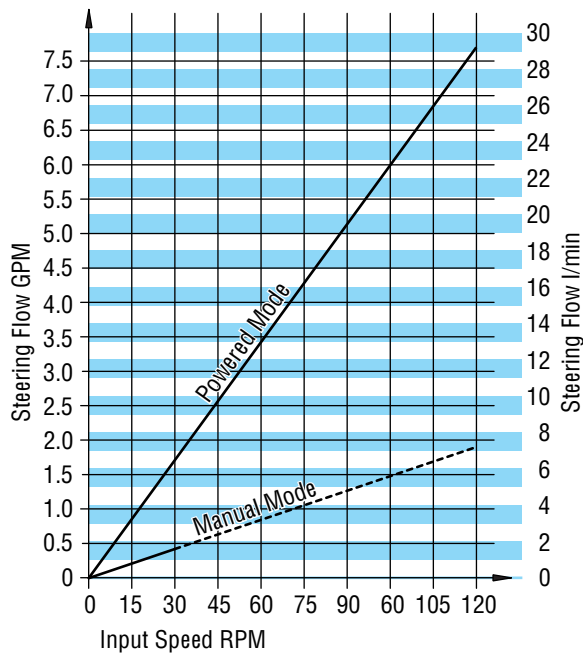
Manual Displacement cm ³ /r [in ³ /r]	Dimension C mm [in.]	Displacement cm ³ /r [in ³ /r]	Dimension D mm [in.]	Powered Displacement cm ³ /r [in ³ /r]	Dimension B mm [in.]	Dimension A mm [in.]
Gerotor 1		Gerotor 2		Gerotor 1 and 2		
60 [3.6]	10,2 [.40]	95 [5.9]	13,2 [.52]	156 [9.5]	136,1 [5.36]	172,5 [6.79]
60 [3.6]	10,2 [.40]	120 [7.3]	16,5 [.65]	179 [10.9]	136,1 [5.36]	175,8 [6.92]
60 [3.6]	10,2 [.40]	145 [8.9]	20,0 [.79]	205 [12.5]	136,1 [5.36]	179,3 [7.06]
60 [3.6]	10,2 [.40]	160 [9.7]	21,8 [.86]	218 [13.3]	136,1 [5.36]	181,1 [7.13]
60 [3.6]	10,2 [.40]	185 [11.3]	25,4 [1.00]	244 [14.9]	136,1 [5.36]	184,7 [7.27]
75 [4.5]	10,2 [.40]	95 [5.9]	13,2 [.52]	170 [10.4]	136,1 [5.36]	172,5 [6.79]
75 [4.5]	10,2 [.40]	120 [7.3]	16,5 [.65]	193 [11.8]	136,1 [5.36]	175,8 [6.92]
75 [4.5]	10,2 [.40]	145 [8.9]	20,0 [.79]	220 [13.4]	136,1 [5.36]	179,3 [7.06]
75 [4.5]	10,2 [.40]	160 [9.7]	21,8 [.86]	233 [14.2]	136,1 [5.36]	181,1 [7.13]

B – Product Information

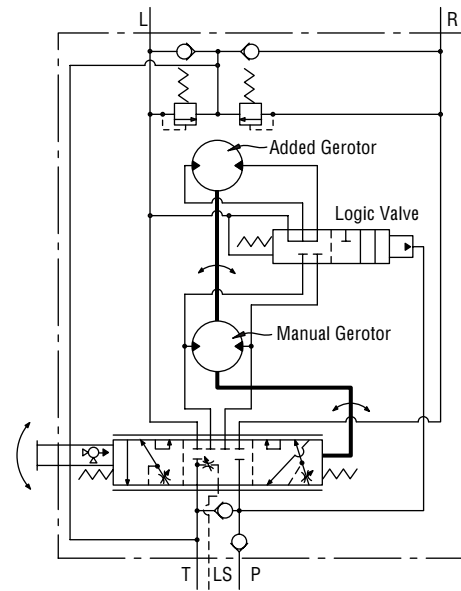
Steering Control Units — Dual Displacement

Performance Data (Example)

Manual 60 cm³/r [3.6 in³/r]
 Powered 244 cm³/r [14.9 in³/r]

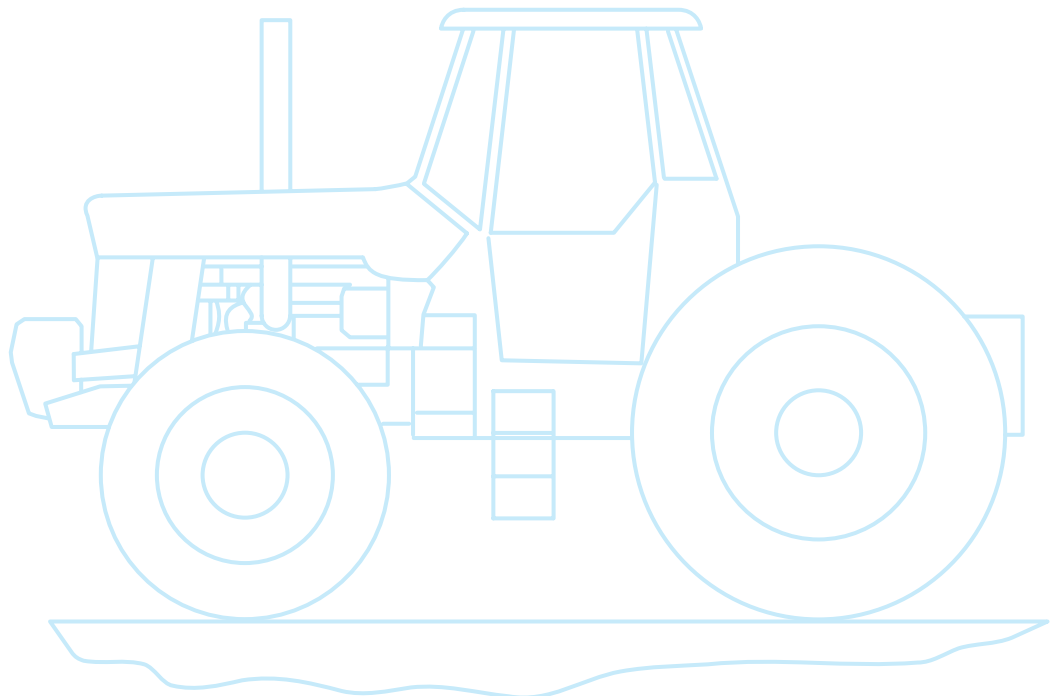


Flow vs RPM (for each operating mode)



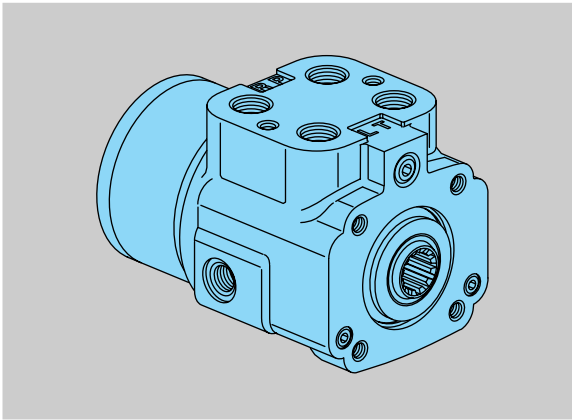
Applications:

- Tractors
- Constuction Equipment
 - Motor Graders
 - Backhoe Loaders

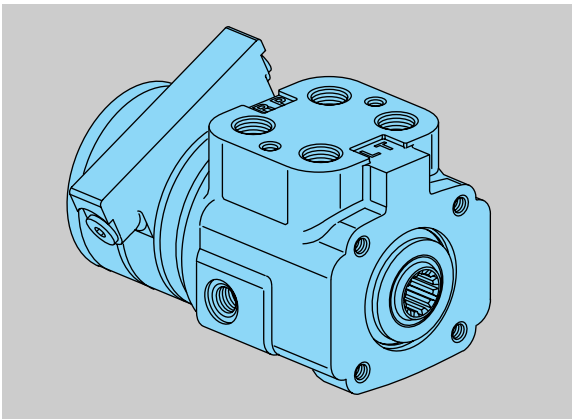


B – Product Information

Ordering Information



**Series 110, 230, 450
Steering Control Unit**



**Dual Displacement
Steering Control Unit**

Model Code Ordering Information

The following 29-digit coding system has been developed to identify all of the configuration options for the Series 110, 230, 450 steering control units. Use this model code to specify a unit with the desired features. All 29-digits of the code must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box.

Model Code — Series 110, 230, 450 Steering Control Units

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
A	B	V						0			0	1	0	0	0	0						A		A	A	1	0	B

Position 1, 2, 3 Product Series

ABV Series 110, 230, 450 Steering Control Unit

Position 4 Nominal Flow Rating

- 1 11 l/min [3 GPM] (Series 110)
 3 23 l/min [6 GPM] (Series 230)
 5 45 l/min [12 GPM] (Series 450)
 4 38 l/min [10 GPM] (Series 230 Flow Amplification Only)
 6 76 l/min [20 GPM] (Series 450 Flow Amplification Only)

Position 5 Inlet Pressure Rating

- 5 172 bar [2500 PSI]
 6 241 bar [3500 PSI] (Not available with open center)

Position 6 Tank Pressure Rating

- A** 10 bar [145 PSI]
B 21 bar [300 PSI]

Position 7-8 Displacement cm³/r [in³/r]

- 03** 244 [14.9] / 60 [3.6]
04 177 [10.9] / 60 [3.6]
05 218 [13.3] / 60 [3.6]

For any other displacement
see your Eaton representative

Position 7-8 Displ. cm³/r [in³/r] (continued –next page)

Dual
Displacement

Power Steering

B – Product Information

Model Code Ordering Information Continued — Series 110, 230, 450

Position 7-8 Displacement cm³/r [in³/r]

43	75 [4.5]	Series 110 Only	Series 230 Only	
45	95 [5.9]			
48	120 [7.3]			
50	145 [8.9]			
51	160 [9.7]			
52	185 [11.3]	Series 450 Only		
54	230 [14.1]			
57	295 [17.9]			
59	370 [22.6]			
61	460 [28.2]			
64	590 [35.9]			
66	740 [45.1]			

Position 9 Flow Amplification

0	None	Use with Closed Center or Load Sensing Only
1	1.6 : 1.0 Ratio	
2	1.6 : 1.0 Ratio with Manual Steering	
5	1.3 : 1.0 Ratio with Manual Steering	
4	2.0 : 1.0 Ratio with Manual Steering	

Position 10 Neutral Circuit

A	Open Center
C	Closed Center
F	Load Sensing, Dynamic Signal

Position 11 Load Circuit

A	Non-Load Reaction
B	Load Reaction (open center 110, 230 Series only)

Position 12, 13 Integral Valve

	Manual Steering Check	Load Sensing Relief	Inlet Check Valve	Cylinder Relief Valve	Anti- Cavitation Valve	Inlet Relief Valve
01	•					
04	•		•			
05	•					•
06	•		•			•
07	•				•	
08	•		•		•	
09	•			•	•	
10	•		•	•	•	
11	•			•	•	•
12	•		•	•	•	•
13	•	•	•	•	•	
15	•	•				

Position 14, 15 Inlet or Load Sense Relief Valve — bar [PSI]

00	None	3E	110 [1600]	4A	138 [2000]
1Y	62 [899]	3K	115 [1670]	4C	140 [2030]
25	69 [1000]	3S	121 [1750]	4H	145 [2100]
2C	76 [1100]	3V	124 [1800]	4N	150 [2180]
2G	80 [1160]	42	130 [1890]	4R	152 [2200]
2T	90 [1310]	46	134 [1940]	Continued	
34	100 [1450]	48	136 [1970]		

Position 14, 15— Continued (Inlet or Load Sense Relief Valve) — bar [PSI]

52	162 [2350]	5C	172 [2490]	5S	185 [2680]
54	164 [2380]	5G	176 [2550]	5Y	190 [2760]
55	165 [2390]	5L	180 [2610]	6J	210 [3050]
59	169 [2450]	5R	184 [2670]	7K	243 [3520]

Position 16, 17 Cylinder Relief Valve — bar [PSI]

00	None	5S	185 [2680]	71	225 [3260]
37	103 [1490]	5Y	190 [2760]	7B	235 [3410]
3E	110 [1600]	65	197 [2860]	7M	245 [3550]
42	130 [1890]	68	200 [2900]	7V	252 [3650]
4C	140 [2030]	6F	207 [3000]	83	259 [3760]
4N	150 [2180]	6J	210 [3050]	8G	272 [3950]
4Z	159 [2310]	6P	215 [3120]	9C	300 [4350]
59	169 [2450]	6W ...	221 [3210]		

Position 18, 19, 20, 21 Ports and Mounting Threads

DAAC	4 x 3/4 SAE Ports, 3/8 inch Mounting Threads
DACC	4 x 3/4 SAE Ports, with 7/16 SAE Load Sensing Port on Side, 3/8 inch Mounting Threads
DAMC	4 x 3/4 SAE Ports, with 7/16 SAE Load Sensing Port on Side, 7/16 SAE EMSS port on Port Face, 3/8 inch Mounting Threads
FAAK	(4) M18 O-ring Ports with M10 Mounting threads
FAFK	(4) M18 O-ring Ports with M12 O-ring Load Sensing Port on Side, and M10 Mounting threads
AAAK	(4) G1/2 (BSP) Ports with M10 Mounting threads
AABK	(4) G1/2 (BSP) Ports with G1/4 (BSP) Load Sensing Port on Side, and M10 Mounting threads
AAZK	(4) G1/2 (BSP) Ports with G1/4 (BSP) Load Sensing Port on Side G1/4 (BSP) EMSS Port on port Face and M10 Mounting threads
AAUK	(4) G1/2 (BSP) Ports with G1/8 (BSP) Drain Port on Port Face, G1/4 (BSP) EMSS Port on Side and M10 Mounting threads
FAYK	Use with Bolt-on Priority Valve (see page 85)

Position 22 Input Torque

1	Low
3	Standard

Position 23 Fluid Type

A	See Eaton Technical Bulletin 3-401
---------	------------------------------------

Position 24 Special Application

0	None
2	Bolt-on Priority Valve (see page 85)
3	EMSS
4	EMSS with drain

Position 25, 26 Special Features

AA	None
----------	------

Position 27 Paint

1	Black Primer
---------	--------------

Position 28 Identification

0	Eaton Product Number on Nameplate
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Position 29 Eaton Assigned Design Code

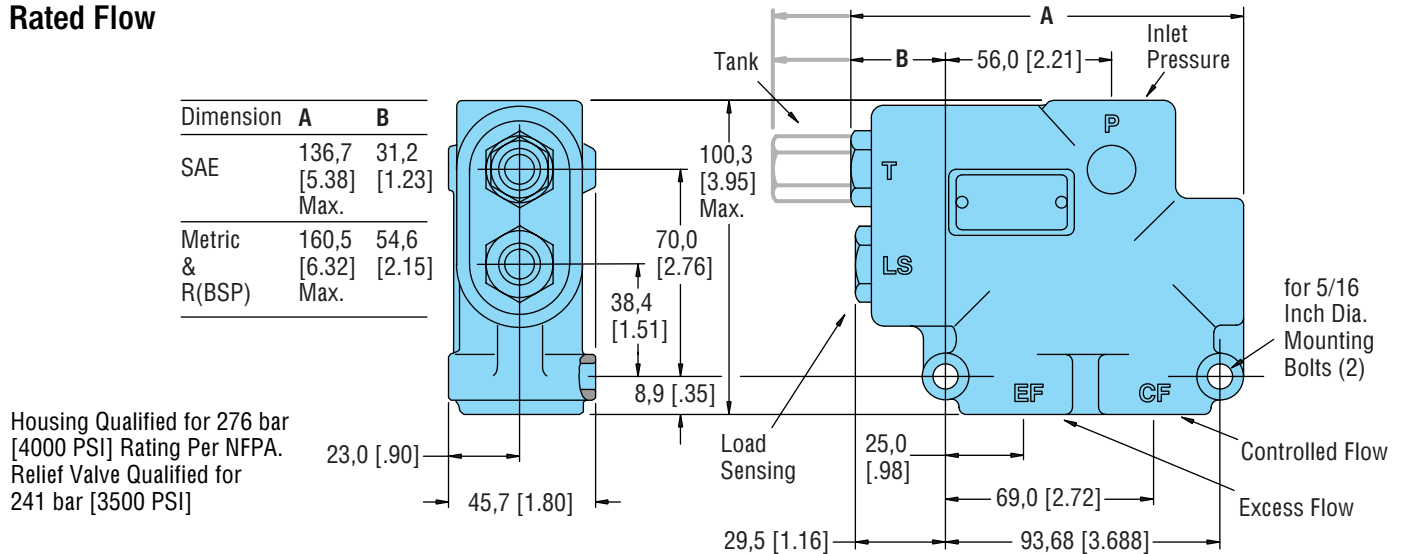
B	Assigned Design Code
---------	----------------------

B – Product Information

Steering System Components

VLC In-Line Priority Valves

60 l/min [16 GPM]
Rated Flow



Control Pressure - bar [PSI] / Product Number

Ports (5)	Port Size	Static Signal 3,5 [50]	Dynamic Signal 5,2 [75]	Static Signal 5,2 [75]	Dynamic Signal 7,6 [110]	Static Signal 6,9 [100]	Dynamic Signal 10,0 [145]
P & EF	7/8 - 14	606-1217	606-1232	606-1218	606-1314	606-1219	606-1315
CF	3/4 - 16						
LS & T	7/16 - 20						
P & EF	3/4 - 16	606-1214	606-1327	606-1215	606-1278	606-1216	606-1328
CF	9/16 - 18						
LS & T	7/16 - 20						
P & EF	M22 X 1,5	606-1329	606-1330	606-1331	606-1332	606-1333	606-1334
CF	M18 X 1,5						
LS & T	M12 X 1,5						
P & EF	R 1/2 - 14	606-1335	606-1336	606-1337	606-1338	606-1339	606-1340
CF	R 1/2 - 14						
LS & T	R 1/4 - 19						

Code Number	System Pressure bar [PSI]
DD	83 [1200]
HE	120 [1725]
LA	138 [2000]
MC	150 [2175]
NC	160 [2300]
QA	172 [2500]
UA	207 [3000]
VD	230 [3325]
VK	240 [3475]

Example: 606-1218-00X-QA

Product Number

X = Design Level — **NOT** part of Order Number.

**System Pressure
Code Number**

The above product number describes a VLC Series with 5,2 bar [75 PSI] control pressure, static signal, 7/8-14 P and EF ports, 3/4-16 CF port, 7/16-20 LS and T ports, 172 bar [2500 PSI] relief valve setting.

B – Product Information

Steering System Components

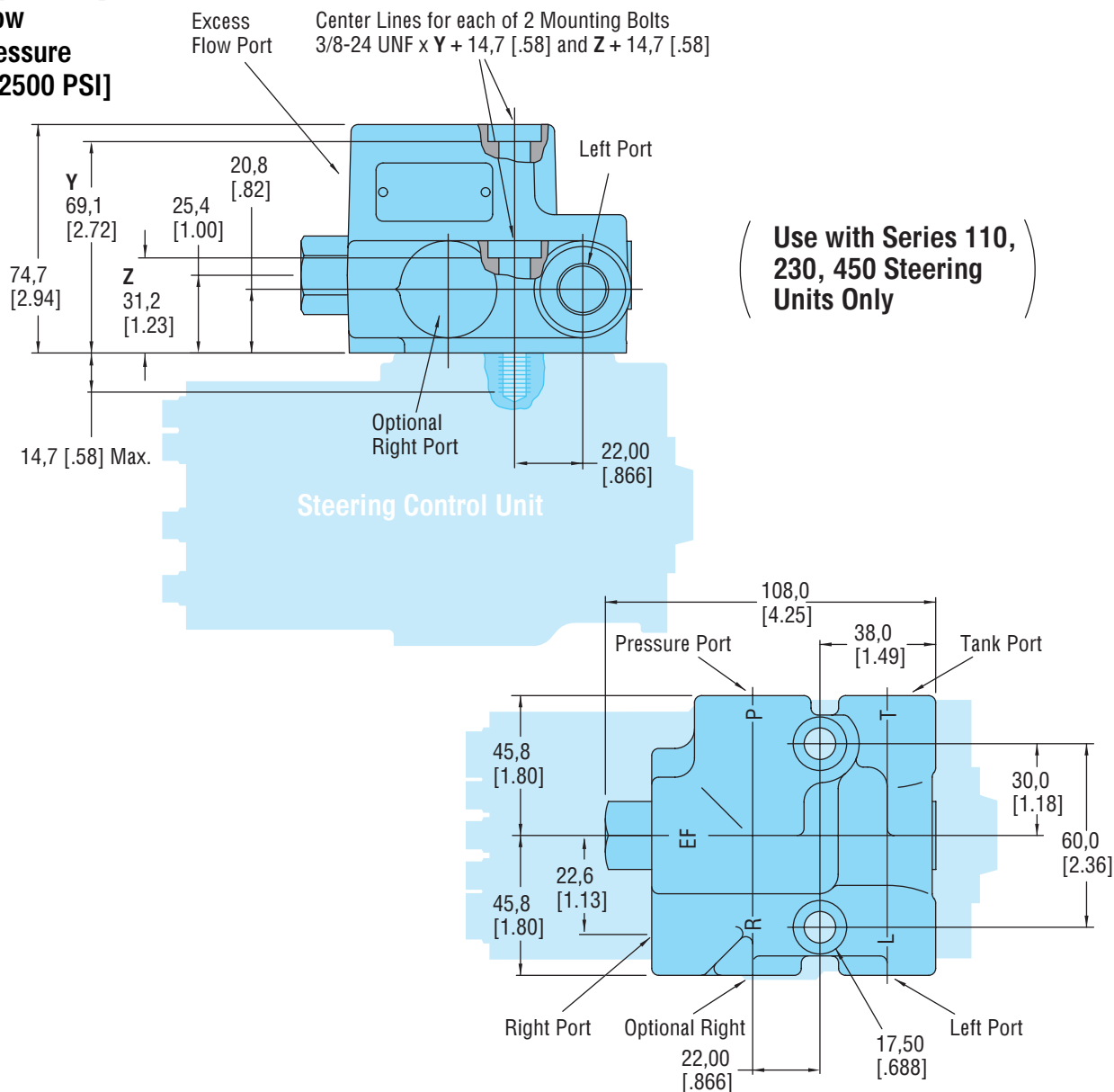
VLC Bolt on Priority Valves (BoPV)

60 l/min [16 GPM]

Rated Flow

Rated Pressure

172 bar [2500 PSI]



		Control Pressure - bar [PSI] / Product Number					
Ports (5)	Port Size	Static Signal 3,5 [50]	Dynamic Signal 5,2 [75]	Static Signal 5,2 [75]	Dynamic Signal 7,6 [110]	Static Signal 6,9 [100]	Dynamic Signal 10,0 [145]
P & EF	G 1/2	612-0003		612-0001		612-0005	
CF	G 3/8						
LS & T	G 3/8						
P & EF	G 1/2						
T, L, & R	G 3/8						

For comprehensive information for all steering system components "Valves" see Eaton catalog 11-508.

B – Product Information

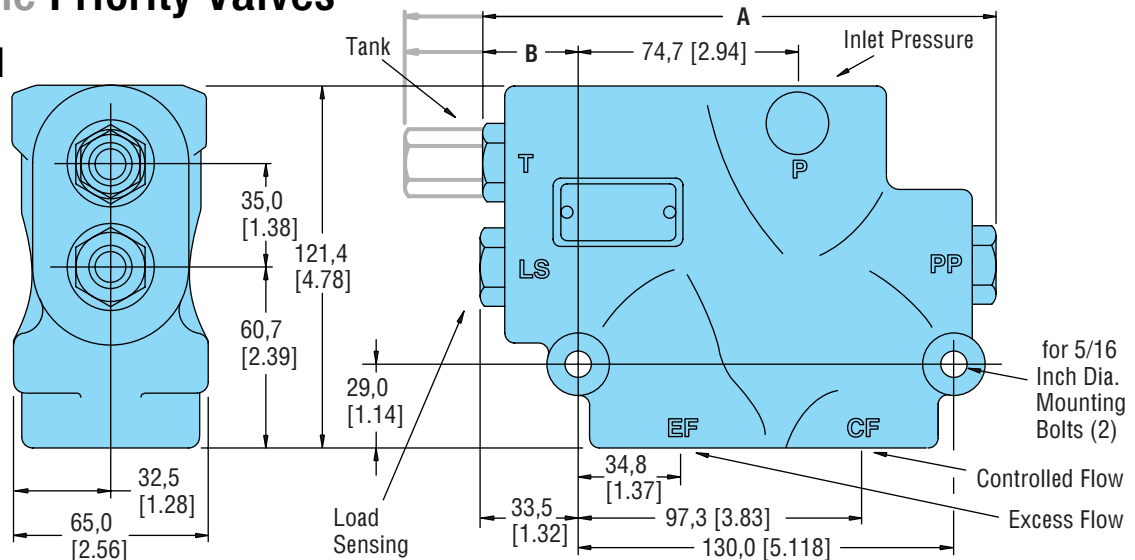
Steering System Components

VLE In-line Priority Valves

150 l/min [40 GPM]
Rated Flow

	Dimension	
	A*	B*
SAE	179,3 [7.06] Max.	32,8 [1.29]
Metric & R(BSP)	203,2 [8.00] Max.	56,2 [2.21]

* Note: Add 9,9 [.39] to A and B Dimensions for High Pressure Models



Control Pressure - bar [PSI] / Product Number

Ports (5)	Port Size	Static Signal 4,5 [65]	Dynamic Signal 5,5 [80]	Static Signal 6,9 [100]	Dynamic Signal 8,6 [125]	Static Signal 10,3 [150]	Dynamic Signal 12,8 [185]
P & EF CF LS & T	1 1/16 - 12 3/4 - 16 7/16 - 20	606-1093	606-1294	606-1094	606-1295	606-1095	606-1296
P & EF CF LS & T	1 1/16 - 12 7/8 - 14 7/16 - 20	606-1046	606-1341	606-1047	606-1342	606-1048	606-1343
P & EF CF LS & T	1 5/16 - 12 7/8 - 14 7/16 - 20	606-1058	606-1344	606-1059	606-1345	606-1060	606-1346
P & EF CF LS & T	1 5/16 - 12 1 5/16 - 12 7/16 - 20	606-1141	606-1347	606-1142	606-1348	606-1143	606-1349
P & EF CF LS & T	1 5/16 - 12 1 1/16 - 12 7/16 - 20	606-1350	606-1282	606-1351	606-1281	606-1352	606-1283
P & EF CF LS & T	M27 X 2 M18 X 1,5 M12 X 1,5	606-1353	606-1354	606-1355	606-1356	606-1357	606-1358
P & EF CF LS & T	R 3/4 - 14 R 1/2 - 14 R 1/4 - 19	606-1359	606-1360	606-1361	606-1362	606-1363	606-1364
High Pressure*							
P & EF CF LS & T	1 5/16 - 12 1 1/16 - 12 7/16 - 20	606-1365	606-1321	606-1366	606-1322	606-1367	606-1323

Housing Qualified for 262 bar [3800 PSI] Rating Per NFPA
Relief Valve Qualified for 172 bar [2500 PSI] Max.

High Pressure
Relief Valve Qualified for 241 bar [3500 PSI] Max.

Code Number	System Pressure bar [PSI]
DD	83 [1200]
HE	120 [1725]
LA	138 [2000]
MC	150 [2175]
NC	160 [2300]
QA	172 [2500]
UA	207 [3000]
VD	230 [3325]
VK	240 [3475]

Example: 606-1094-00X-QA

High
Pressure*

System Pressure
Code Number

Product Number

X = Design Level — NOT part of order number

The product number (left) describes a VLE Series with 6,9 bar [100 PSI] control pressure, static signal, 1 1/16-12 P and EF ports, 3/4-16 CF port, 7/16-20 LS and T ports, 172 bar [2500 PSI] relief valve setting.

B – Product Information

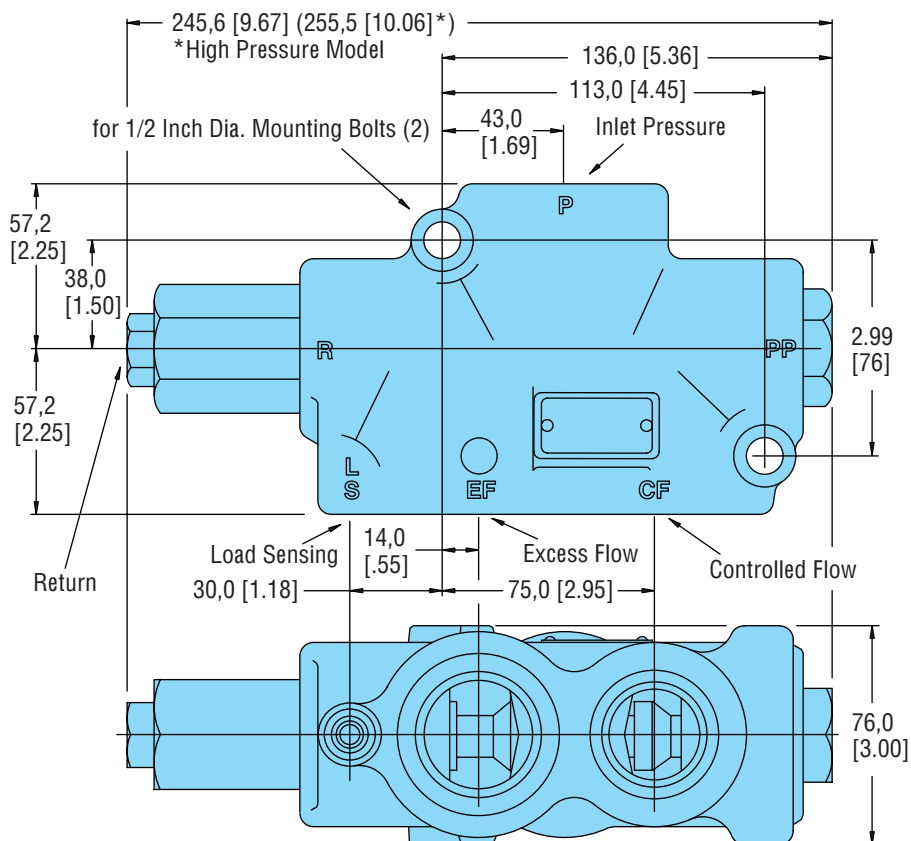
Steering System Components

VLH In-line Priority Valves

240 l/min [63 GPM]
Rated Flow

Housing Qualified for 207 bar [3000 PSI] Rating Per NFPA
Relief Valve Qualified for 172 bar [2500 PSI] Max.

High Pressure
Relief Valve Qualified for 241 bar [3500 PSI] Housing
Qualified for 262 bar [3800 PSI] Max.



Code Number	System Pressure bar [PSI]
DD	83 [1200]
HE	120 [1725]
LA	138 [2000]
MC	150 [2175]
NC	160 [2300]
QA	172 [2500]
UA	207 [3000]
VD	230 [3325]
VK	240 [3475]

High Pressure

		Control Pressure - bar [PSI] / Product Number					
Ports (5)	O-ring Port Size	Static Signal 5,2 [75]	Dynamic Signal 5,9 [85]	Static Signal 6,9 [100]	Dynamic Signal 7,6 [110]	Static Signal 10,3 [150]	Dynamic Signal 11,4 [165]
P & EF	1 5/8 - 12	606-1201	606-1288	606-1202	606-1289	606-1203	606-1290
CF	1 5/16 - 12						
LS & R	7/16 - 20						
P & EF	1 5/8 - 12	606-1368	606-1284	606-1369	606-1285	606-1370	606-1286
CF	1 1/16 - 12						
LS & R	7/16 - 20						
P & EF	1 5/8 - 12	606-1189	606-1371	606-1190	606-1372	606-1191	606-1373
CF	3/4 - 16						
LS & R	7/16 - 20						
High Pressure*							
P & EF	1 5/8 - 12	606-1374	606-1316	606-1375	606-1317	606-1376	606-1318
CF	1 1/16 - 12						
LS & R	7/16 - 20						

Example: 606-1202-00X-QA

System Pressure Code Number

Product Number

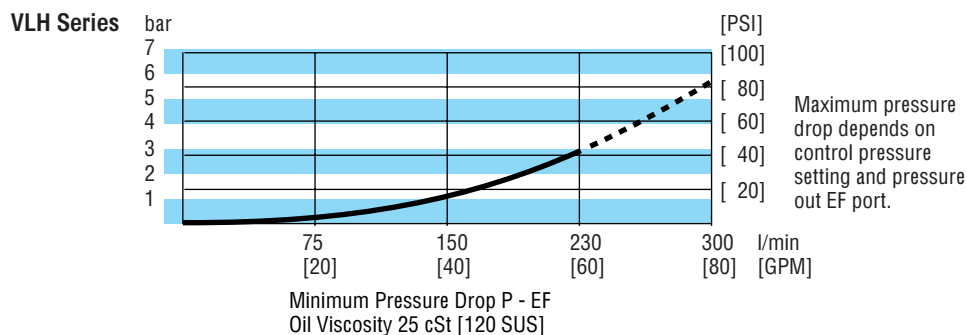
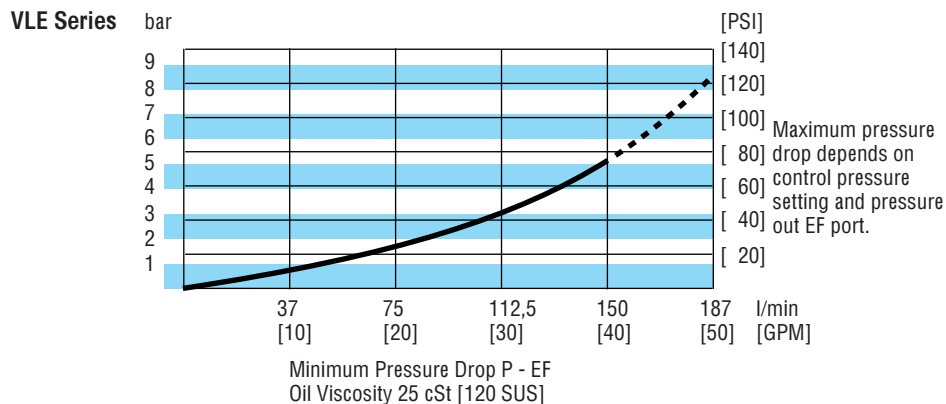
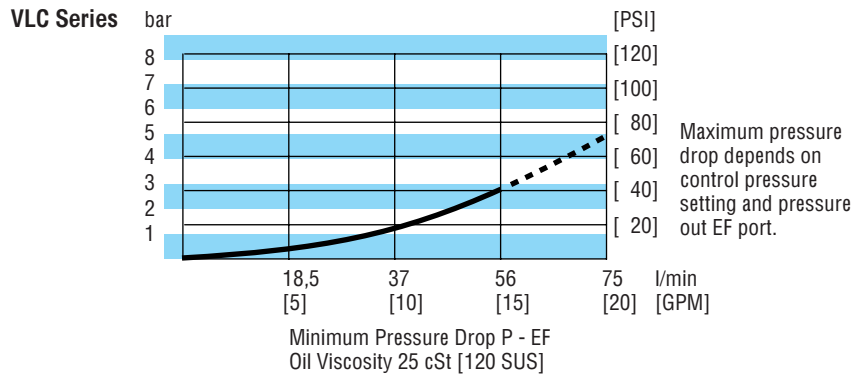
X = Design Level — **NOT** part of Order Number.

The product number (left) describes a VLH Series with 6,9 bar [100 PSI] control pressure, static signal, 1 5/8-12 P and EF ports, 1 5/16-12 CF port, 7/16-20 LS and R ports, 172 bar [2500 PSI] relief valve setting.

For comprehensive information for all steering system components "Valves" see Eaton catalog 11-508.

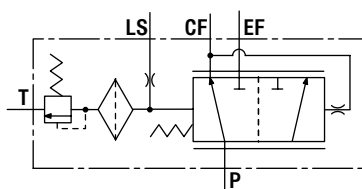
B – Product Information

Pressure Drop Curves for VLC, VLE, and VLH Priority Valves

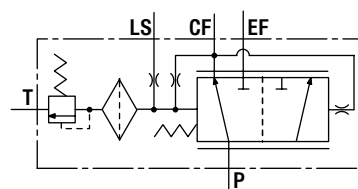


U.S. patents. Re 26,338; 3,455,210 and 4,043,419 cover circuits using these priority valves. Corresponding foreign patents. pending and issued.

Symbols



Static Signal



Dynamic Signal

For comprehensive information for all steering system components "Valves" see Eaton catalog 11-508.

B – Product Information

Steering System Components

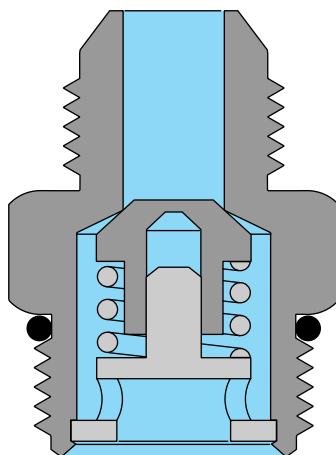
Check Valves

Product Description and Features

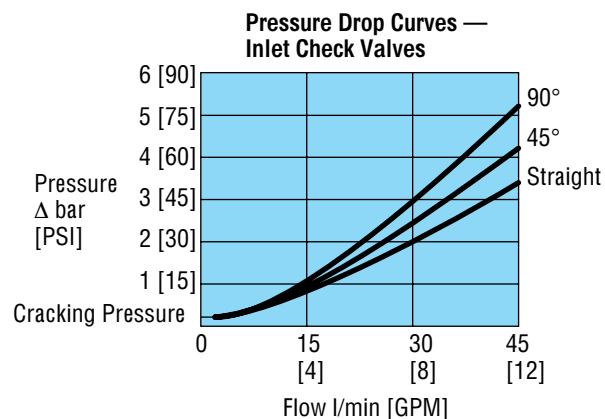
These check valves are designed specifically to withstand the rugged duty cycles of a steering system and perform their functions reliably to prevent kickback in the steering wheel.

The check valve is installed directly into the pressure port of Char-Lynn steering control unit. Connection of the hose assembly is either a male 37° end or o-ring face seal (ORS).

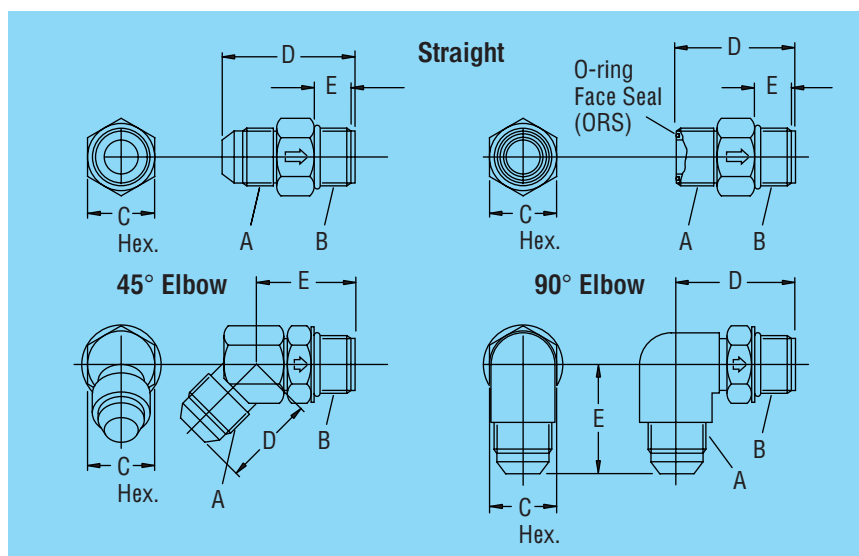
Straight, 45° and 90° elbow configurations are available (see installation drawing below).



Performance Data

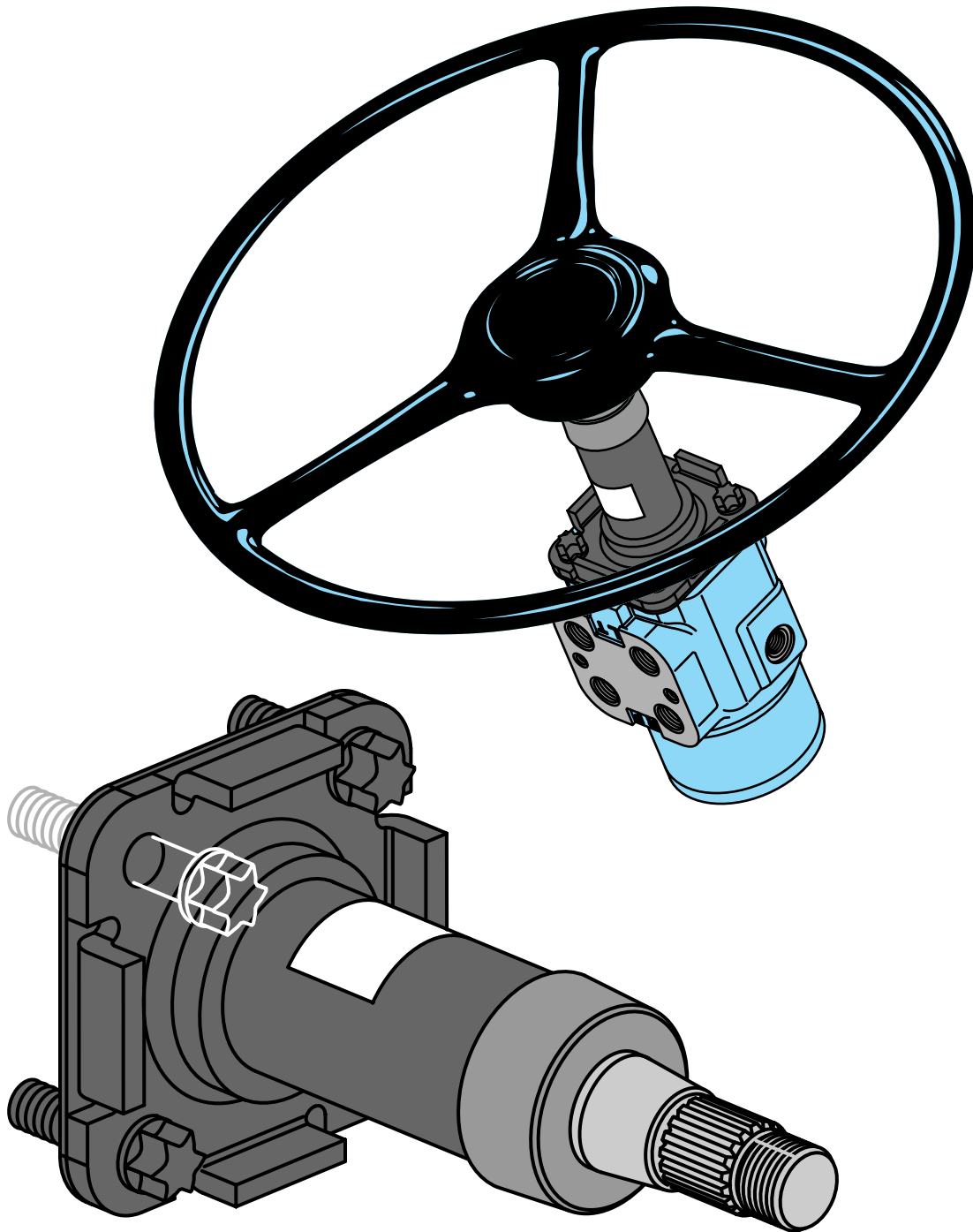


Installation Drawing



Configuration	Product Number	Check Valve Dimensions — mm [in.]					
		A	B	C	D	E	
Straight	37° 608-1003	3/4-16	3/4-16	22,23/21,97 [.875/.865]	38,1/36,5 [1.50/1.44]	10,0/ 8,8 [.39/ .35]	
	37° 608-1004	9/16-18	3/4-16	22,23/21,97 [.875/.865]	35,6/34,0 [1.40/1.34]	10,0/ 8,8 [.39/ .35]	
	ORS 608-1007	13/16-16	3/4-16	22,23/21,97 [.875/.865]	37,4/35,3 [1.47/1.39]	12,7/11,6 [.50/ .46]	
	ORS 608-1009	11/16-16	3/4-16	22,23/21,97 [.875/.865]	35,9/33,7 [1.41/ .95]	12,7/11,6 [.50/ .46]	
90°	37° 608-1005	9/16-18	3/4-16	22,23/21,97 [.875/.865]	37,6/35,5 [1.48/1.40]	30,0/28,1 [1.18/1.11]	
	ORS 608-1013	11/16-16	3/4-16	22,23/21,97 [.875/.865]	41,4/39,4 [1.63/1.55]	26,9/24,9 [1.02/ .94]	
45°	37° 608-1006	9/16-18	3/4-16	22,23/21,97 [.875/.865]	21,9/20,3 [.86/ .80]	33,8/31,7 [1.33/1.25]	
	37° 608-1016	3/4-16	3/4-16	22,23/21,97 [.875/.865]	25,7/24,1 [1.01/ .95]	33,8/31,7 [1.33/1.25]	

B – Product Information
Steering System Components
Steering Columns



B – Product Information

Steering System Components

Steering Columns

Description

Char-Lynn columns can be custom built to your exact specifications. The column and mounting flange is of a sturdy single weldment design. These columns have high thrust and side load capacity with low shaft torsional friction. Columns are painted with low gloss black finish and the shafts are phosphate coated and oil dipped for corrosion protection.

Features

- Low friction bearings to carry thrust and side loads
- Available dust boot to protect against dirt and moisture
- Four jacket types are available
- Two lower ends and ten upper ends are available
- Two different horn wire configurations
- Length available from 56 to 825 mm [2.2 to 32.5 inch]
- Columns can be pre-assembled to steering units per your request

Specifications

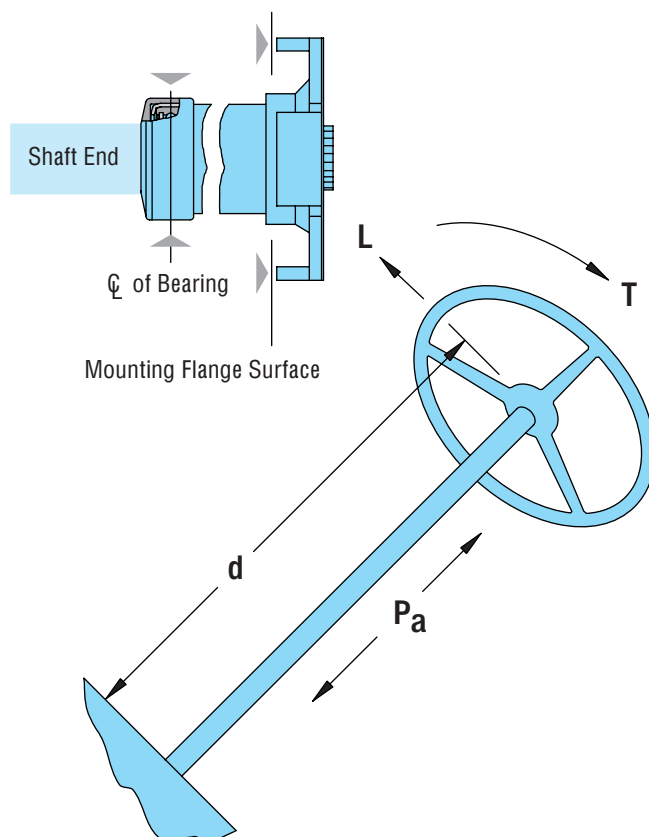
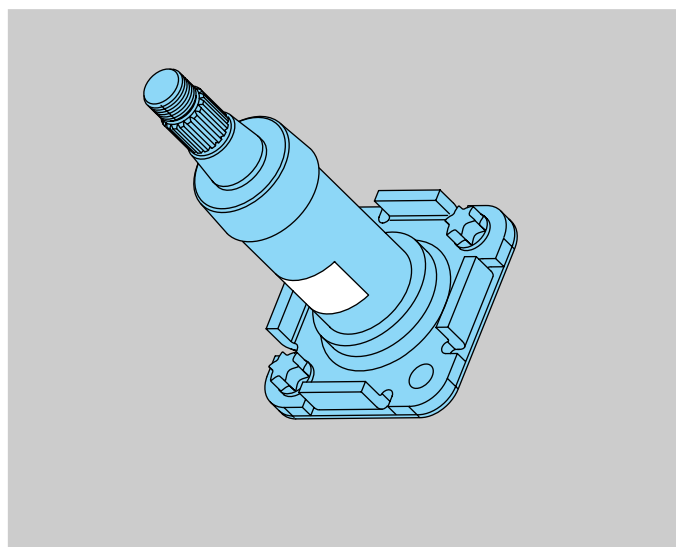
Rated Torsional	81Nm [60 lb-ft]
Rated Bending Moment*	136 Nm [100 lb-ft]
Rated Radial Load**	86 kg [150 lb]
Rated Axial Load	86 kg [150 lb]
Torsional Friction Drag	0,23 kg [2 lb-in]
Recommended Wheel Nut Torque	47 Nm [35 lb-ft]

* Bending moments are taken about the plane of the column mounting surface.

** Radial load at the bearing centerline must not exceed the horizontal bending moment rating.

Five Steps for “How to Order Your Column”

- 1 Select Jacket/Base Type
 - 2 Select Lower Shaft Type
 - 3 Select Upper Shaft End Type
 - 4 Select Length (use suggested standard length)
 - 5 Select Add-On Features
 - a) Horn Wire
 - b) Wire Ends
- Please contact your Eaton representative if any request differs from our catalog offerings.



B – Product Information Column

Example — see model code page 100

Position 4-5

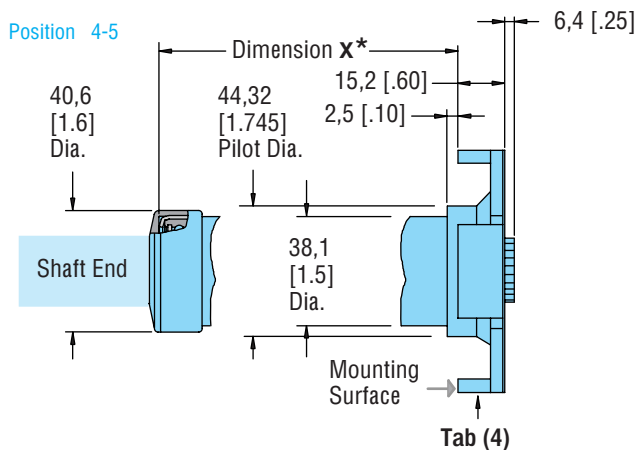
SH Standard with flat flange (No Tabs)

Position 9, 10, 11

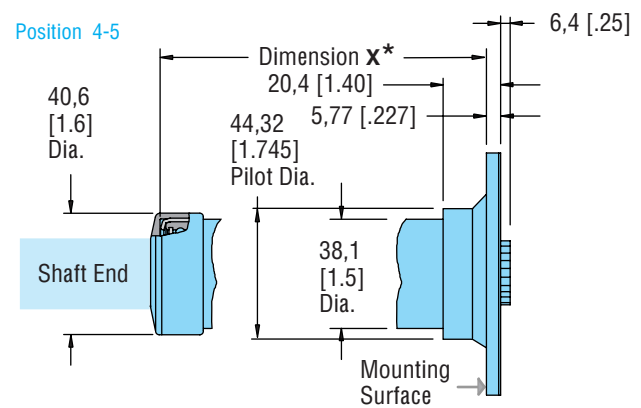
026 66,1 [2.60] (Dimension X)

Jacket/Base Type *Dimension X — see model code page 100 Position 9, 10, 11 (Jacket Length)

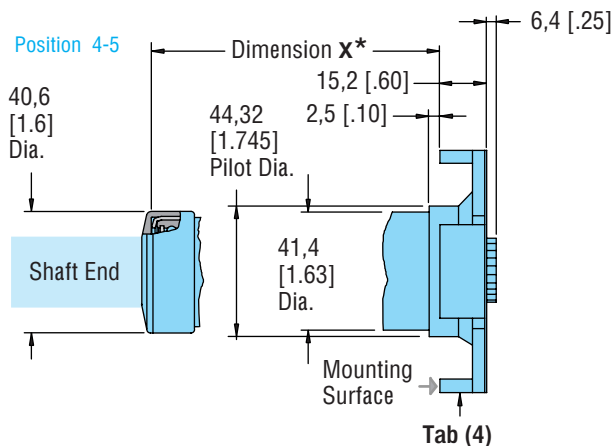
SJ Standard Wall



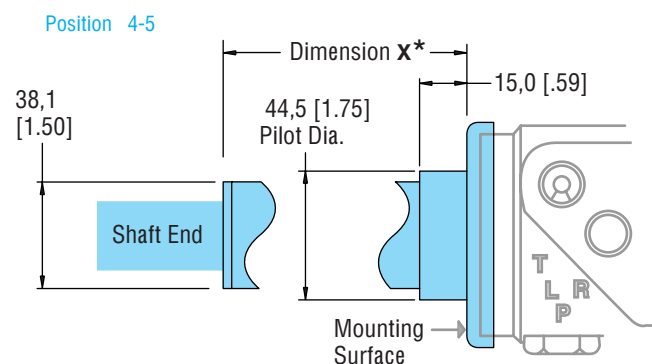
SH Standard Wall



HG Heavy Wall



MM 2 Series



B – Product Information Column

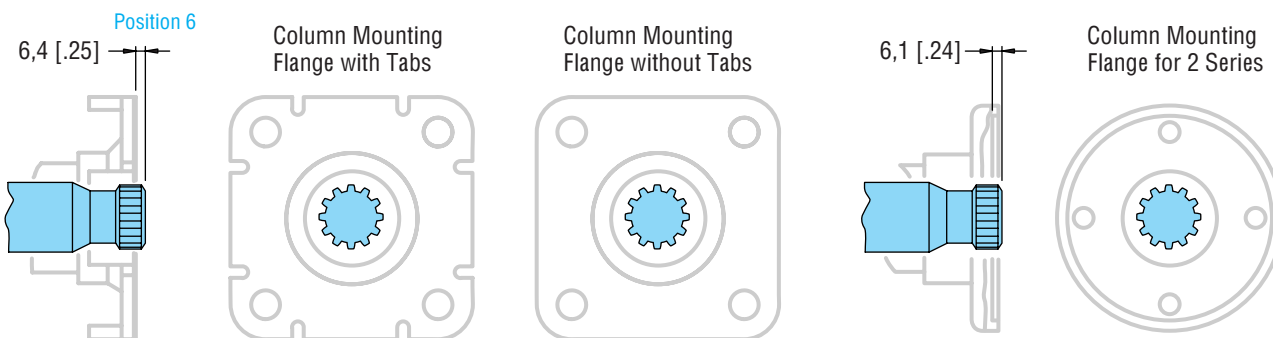
Example — see model code page 100

Position 6

1 12 Tooth Spline for Steering Unit

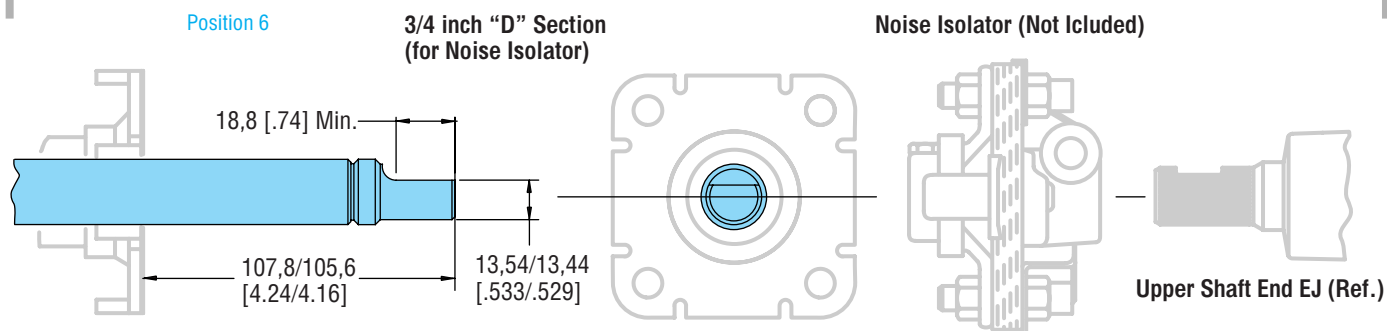
Lower End Type

1

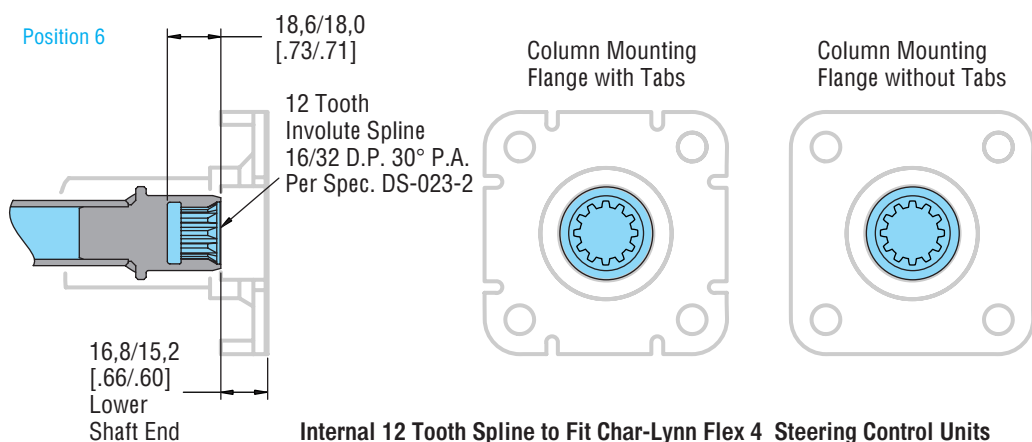


12 Tooth Spline to Fit Char-Lynn Steering Control Units

3



8



Internal 12 Tooth Spline to Fit Char-Lynn Flex 4 Steering Control Units

B – Product Information Column

Example — see model code page 100

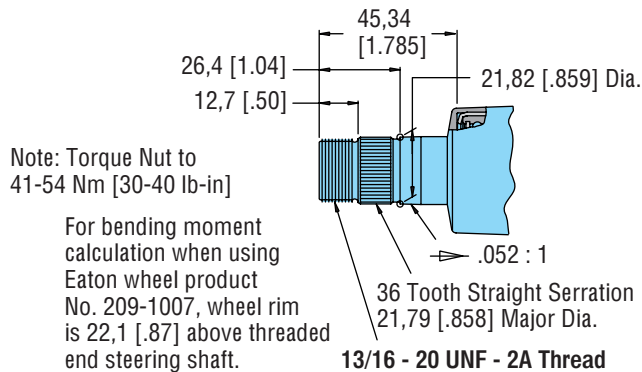
Position 7-8

EJ (36 Tooth Straight Serration)
Not available with horn wire

Upper Shaft End

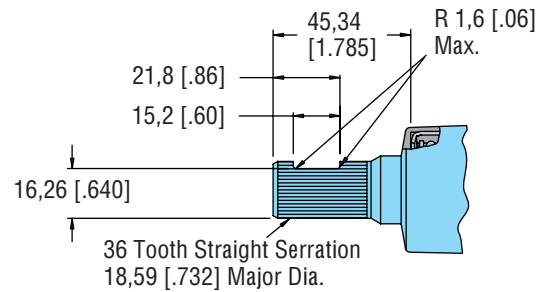
AJ

Position 7-8



EJ

Position 7-8



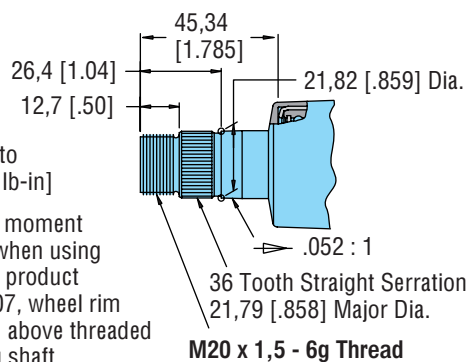
MJ

Position 7-8

Also Available
on Series 2
Column as **MK**
(see page 95)

Note: Torque Nut to 41-54 Nm [30-40 lb-in]

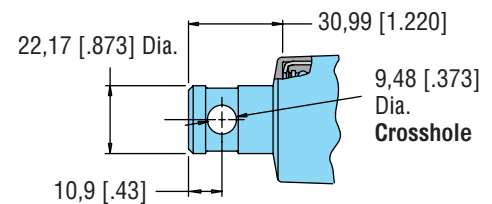
For bending moment calculation when using Eaton wheel product No. 209-1007, wheel rim is 22,1 [.87] above threaded end steering shaft.



GC

Position 7-8

Not Available
with Horn
Wire

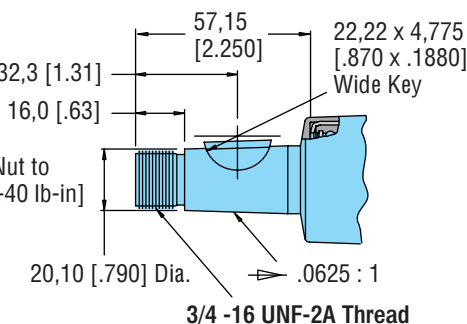


DN

Position 7-8

Not Available
with Horn
Wire

Note: Torque Nut to 41-54 Nm [30-40 lb-in]



B – Product Information Column

Example — see model code page 100

Position 7-8

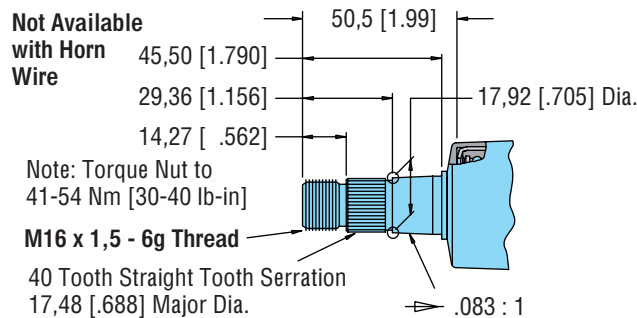
YM (.050 : 1 Taper **M18 x 1,5 - 6g Thread**)
Not available with horn wire

Upper Shaft End Continued

CL

Position 7-8

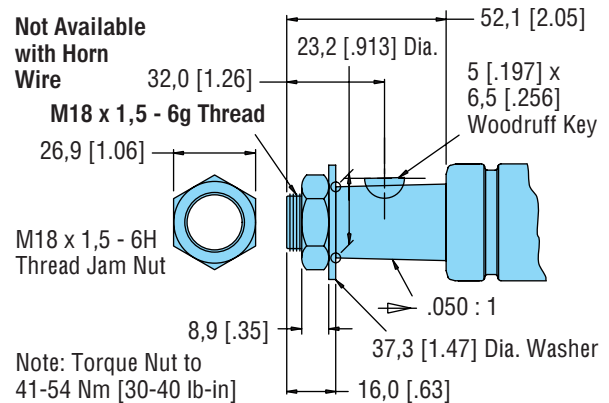
Not Available
with Horn
Wire



YM

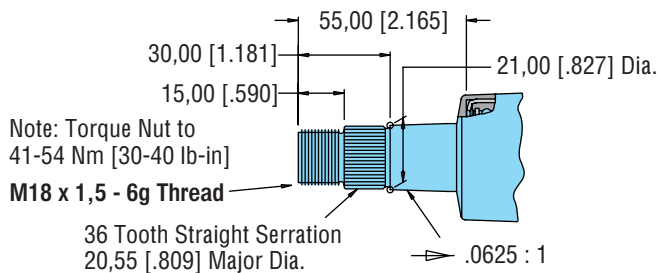
Position 7-8

Not Available
with Horn
Wire



PT

Position 7-8

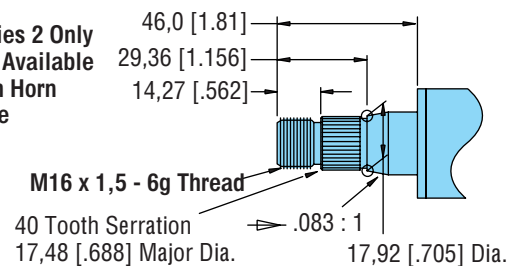


CK

Position 7-8

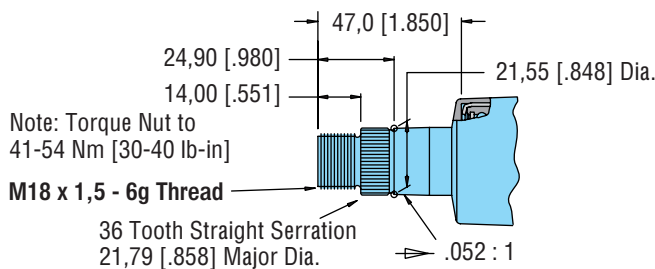
(Similar
to CL)

Series 2 Only
Not Available
with Horn
Wire



SV

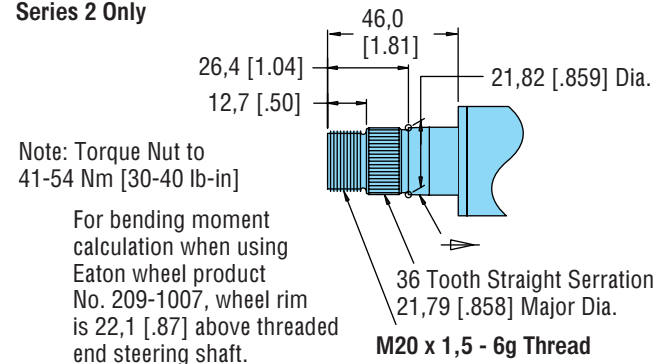
Position 7-8



MK

Position 7-8

Series 2 Only



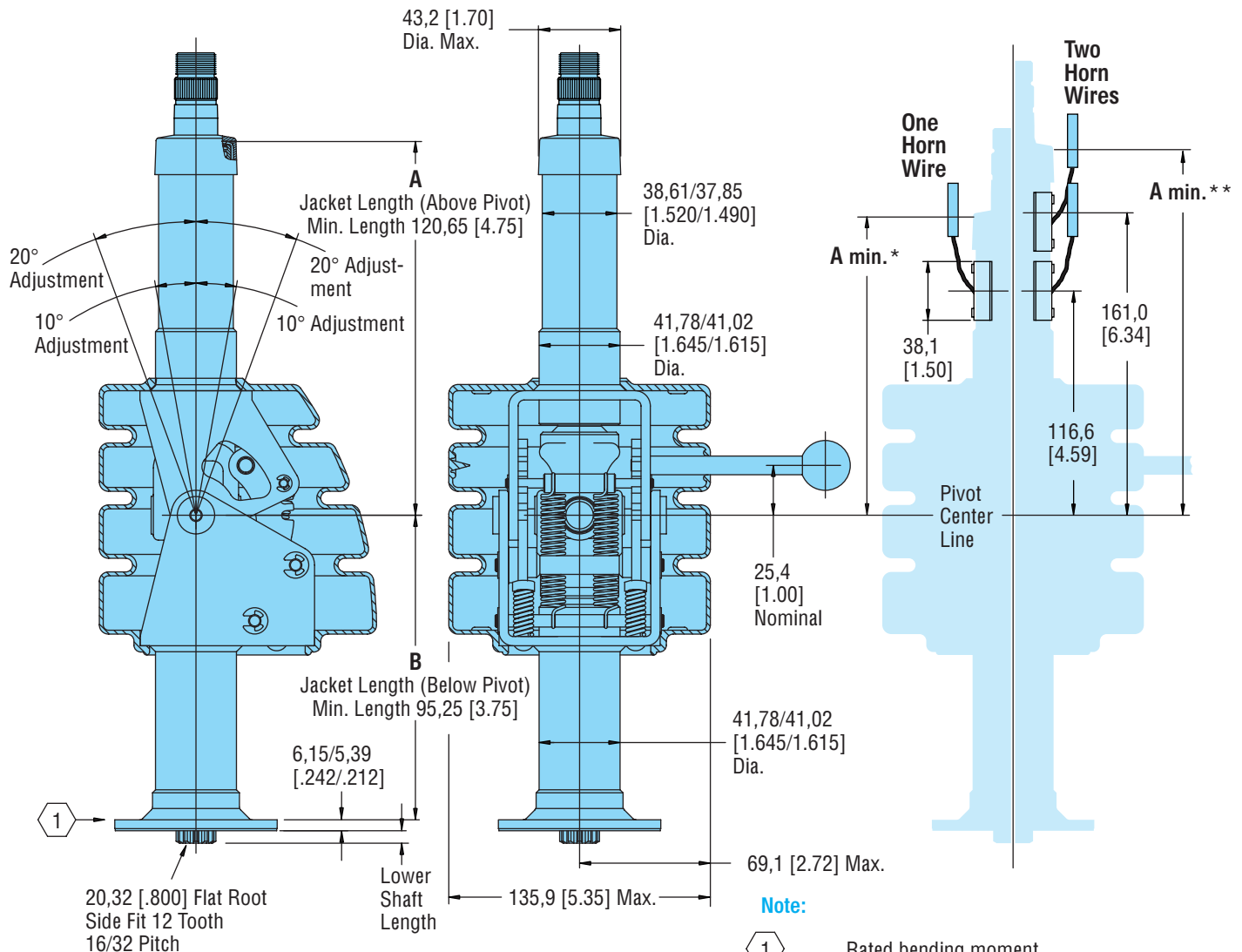
B – Product Information Tilt Column

Tilt Column — Standard jacket lengths mm [inch]

Dim. A Above Pivot	Dim. B Below Pivot
127,0 [5.00]	127,0 [5.00]
190,5 [7.50]	101,6 [4.00]
190,5 [7.50]	546,4 [21.51]

Select add-on features (Position 6 - 21)
from the standard column model code (see page 100).

Please contact your Eaton
representative if any request
differs from our catalog offerings.



Note:

1

Rated bending moment calculated about point indicated or about centerline of lower column support is 136 Mn [100 lb-ft]. Lever arm for this calculation shall be the distance from point indicated to centerline of radial load.

2 Rated steering shaft torque is 81 Nm [60 lb-ft].

How to Order your Tilt Column:

Model Code — Steering Columns

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	C	K	T	A		A	J														A

Position	9	10	11	Dim. A Above Pivot	Dim. B Below Pivot
	A	A	C	127,0 [5.00]	127,0 [5.00]
	A	A	B	190,5 [7.50]	101,6 [4.00]
	A	A	A	190,5 [7.50]	546,4 [21.51]

* Dim. A (minimum) above pivot is 165,1 [6.5] (with one horn wire)

** Dim. A (minimum) above pivot is 203,2 [8.0] (with two horn wires)

B – Product Information

Column — Horn Wire Electrical

Example — see model code page 100

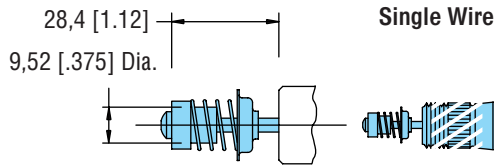
Position 12-16

1A045Column with one horn wire

Single Wire

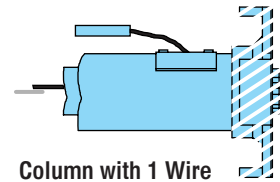
01

Position 18-19



1A045

Position 12-16



08

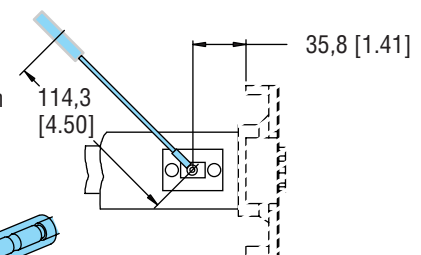
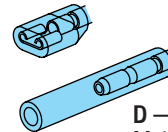
Position 18-19



K or D

Position 17

K — Blade Receptacle Insulated — Compatible with 6,4 [.25] Blade Per SAE J858a



D — SAE J928 Type I 3,96 [.156] . Pin Type Male Wire End with Double End Female Connector

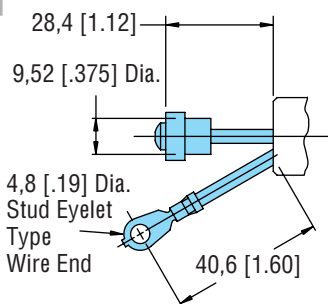
Two Wire

02

Position 18-19

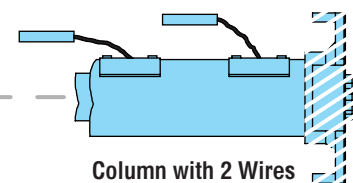
Two Wires

One Horn Button with Wire Eyelet (Select with Two Horn Wires)



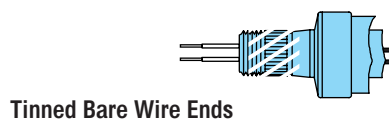
2B045

Position 12-16



08

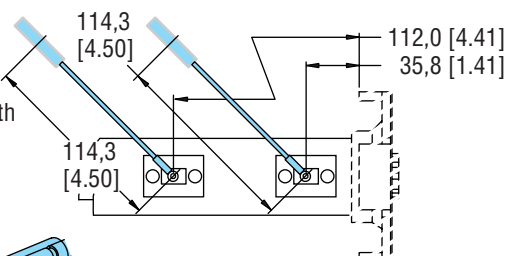
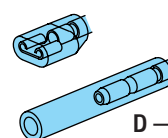
Position 18-19



K or D

Position 17

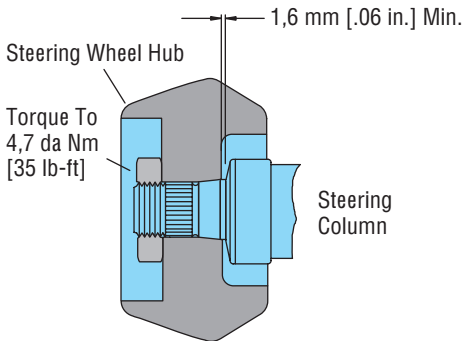
K — Blade Receptacle Insulated — Compatible with 6,4 [.25] Blade Per SAE J858a



D — SAE J928 Type I 3,96 [.156] Dia. Pin Type Male Wire End with Double End Female Connector

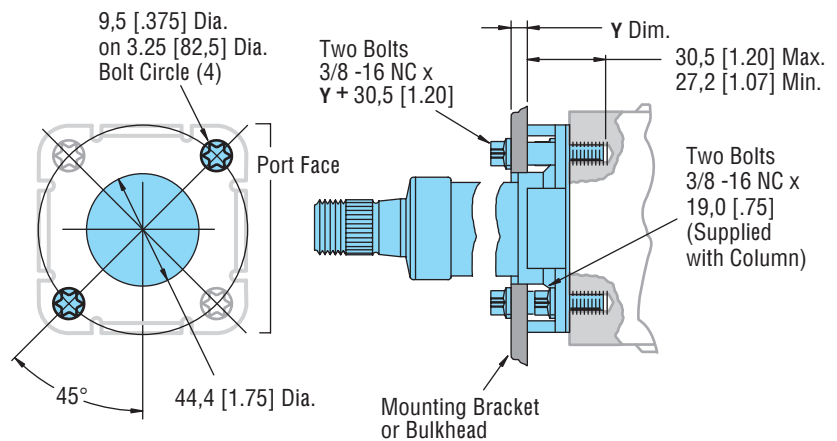
B – Product Information Column and Wheel Mounting

Inspect for Minimum Clearance at Assembly



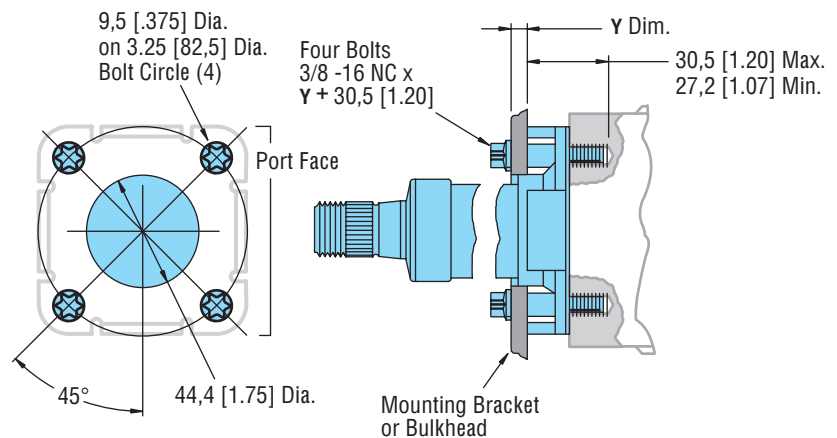
Series 3, 6, 12 and Series 110, 230, 450

Must use two bolts thru mounting bracket or bulkhead and two bolts thru just the steering column or four bolts thru mounting bracket or bulkhead.



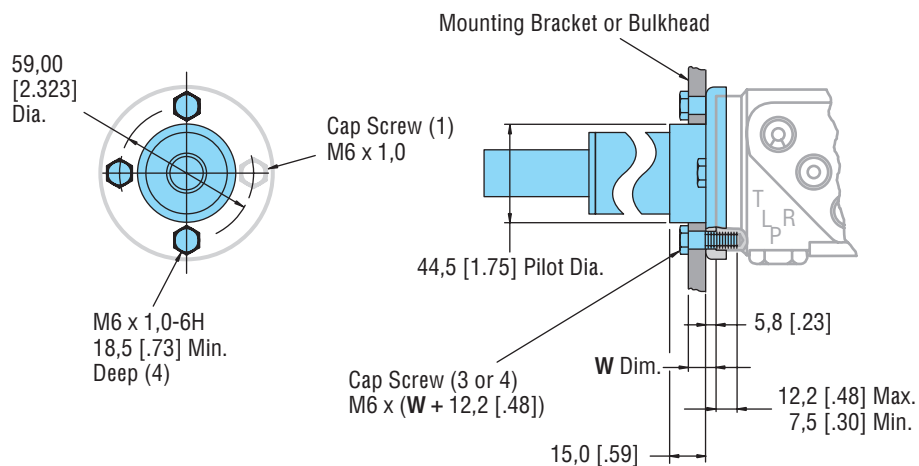
Series 20, 25

Must use four bolts thru mounting bracket or bulkhead.

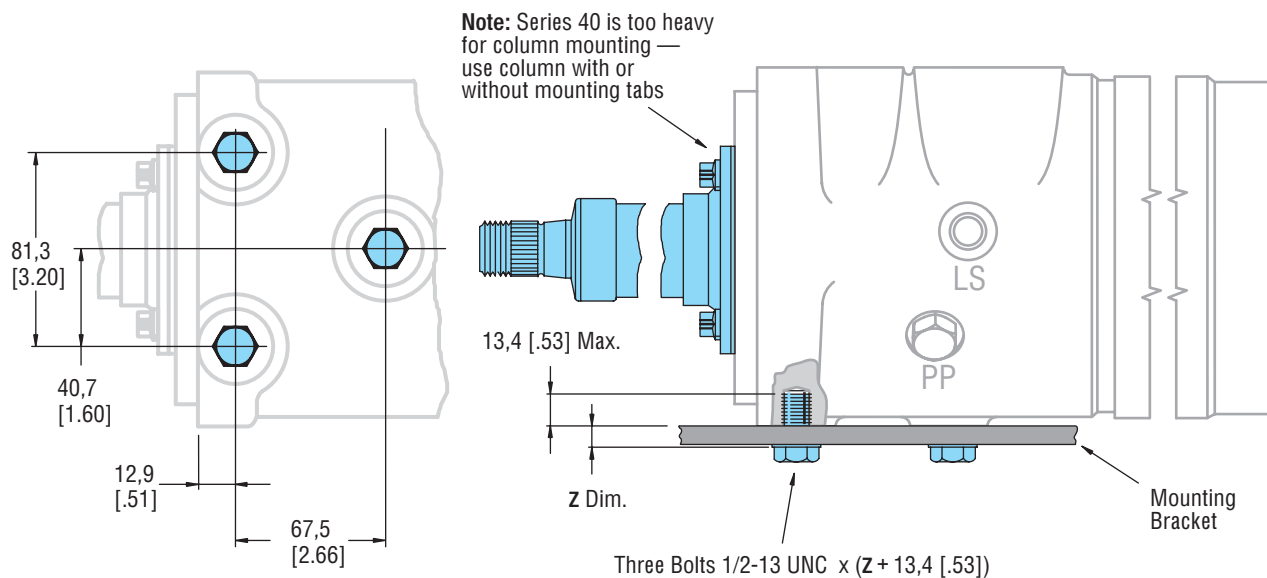


B – Product Information Column Mounting

Series 2 Must use three bolts minimum.



Series 40 Must use three bolts into steering control unit mounting bosses opposite port face.



B – Product Information Steering Columns

Model Code Ordering Information

The following 22-digit coding system has been developed to identify all of the configuration options for steering columns. Use this model code to specify a steering column with the desired features. All 22-digits of the code must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box.

Model Code — Steering Columns

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	C	K																	0	0	

Position 1,3 Product Series

ACK Steering Column

Position 4, 5 Jacket/Base Type (see page 92)

SJ Standard (38 mm [1.50 inch] O.D.)

MM Series 2 SCU (38 mm [1.50 inch] O.D.)

HG Heavy Wall (41,4 [1.63 inch] O.D.) Tabbed Flange

SH Standard With flat Flange (38mm [1.50 inch] O.D.) (No Tabs)

TA Tilt Column with Flat Flange

Position 6 Lower Shaft End (see page 93)

1 12 Tooth Spline for Steering Unit

3 3/4 inch "D" Section (for Noise Isolator)

8 Recessed Internal 12 Tooth Spline (for Flex 4 Steering Unit)

Position 7, 8 Upper Shaft End (see illustrations and specifications — page 94, 95)

AJ Standard for all rigid and tilt columns
Available with or without Horn Wire

MJ Available with or without Horn Wire

DN Not Available with Horn Wire

EJ Not Available with Horn Wire

GC Not Available with Horn Wire

CL Not Available with Horn Wire

PT Available with or without Horn Wire

SV Available with or without Horn Wire

YM Not Available with Horn Wire

CK Not Available with Horn Wire

MK Available with or without Horn Wire

Standard
Column
and
Tilt Column

Series 2

Position 9, 10, 11 Jacket Length - mm [in.] (Suggested Std. Dim.) — page 92

022 56,6 [2.23]

033 82,8 [3.26]

058 147,8 [5.82]

078 197,1 [7.76]

099 250,7 [9.87]

108 273,3 [10.76]

118 298,7 [11.76]

157 399,8 [15.74]

178 451,6 [17.78]

253 642,1 [25.28]

273 692,4 [27.26]

298 756,4 [29.78]

325 826,3 [32.53]

060 152,4 [6.00]

080 203,2 [8.00]

100 254,0 [10.00]

120 304,8 [12.00]

140 355,6 [14.00]

160 406,4 [16.00]

Standard
Column
with
Tabs

2 Series
Column

026 66,1 [2.60]

036 92,3 [3.63]

062 157,3 [6.19]

081 206,6 [8.13]

103 260,2 [10.24]

111 282,8 [11.13]

121 308,2 [12.13]

162 409,3 [16.11]

182 461,1 [18.15]

257 651,6 [25.65]

276 701,9 [27.63]

302 765,9 [30.15]

329 835,7 [32.90]

AAA 190,5 [7.50] Above Pivot

546,4 [21.51] Below Pivot

AAB 190,5 [7.50] Above Pivot

101,6 [4.00] Below Pivot

AAC 127,0 [5.00] Above Pivot

127,0 [5.00] Below Pivot

Standard
Column
without
Tabs

Tilt
Column
page 96

Position 12-16 Horn Wire Feature — page 97

00000 No Horn Wire

1A045 Single Horn Wire

2B045 Two Horn Wires

Position 17 Horn Brush Wire Terminal End — p 97

0 None—Select When No Horn Wire
Used

D SAE J928 Pin and Double End
Connector

K Blade Receptacle — Insulated
(Compatible with SAE J858a)

Position 18, 19 Shaft End Wire Terminal — p 97

00 None

01 One Horn Button (Only with One Horn
Wire)

02 One Horn Button with Wire Eyelet
(Select with Two horn Wire)

08 Tinned Bare Wire End

Position 20, 21 Special Feature

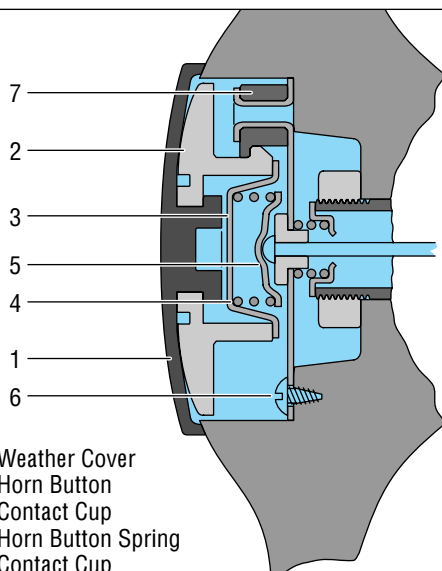
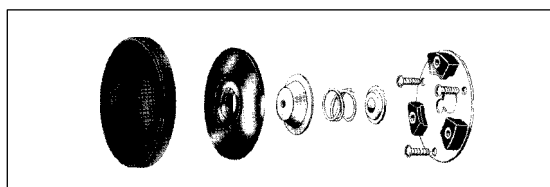
00 None

Position 22 Eaton Assigned Design Code

B – Product Information

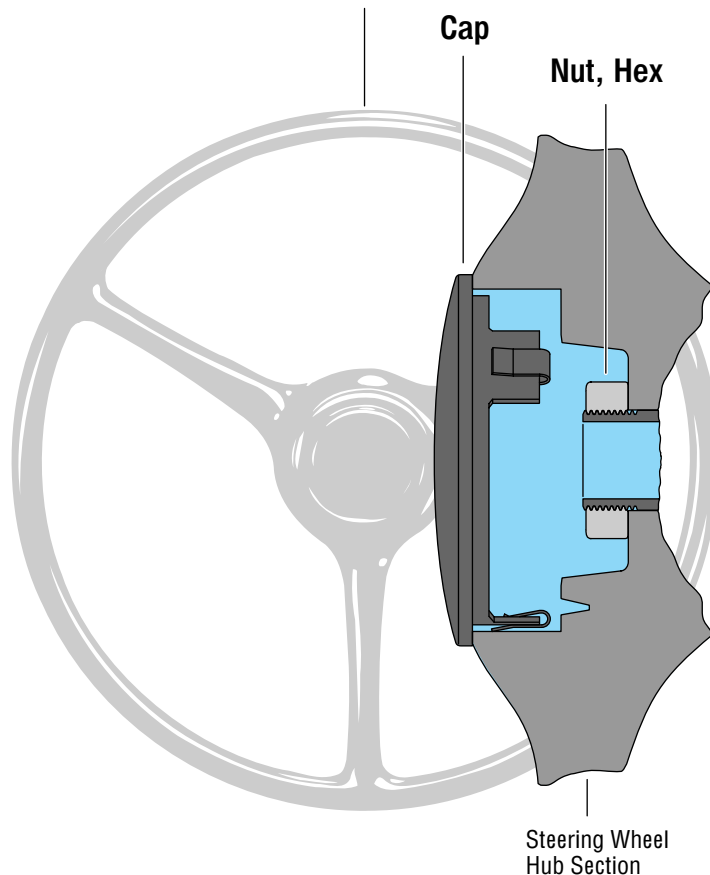
Auxiliary Column Equipment

Horn Button Kit



- 1 Weather Cover
- 2 Horn Button
- 3 Contact Cup
- 4 Horn Button Spring
- 5 Contact Cup
- 6 Screw
- 7 Base Plate Assembly

Steering Wheel



Steering Wheel No. 209-1007

Molded black wheel with three equally spaced spokes, (relatively flat, without recessed hub) diameter 430 mm [17 inch] for column with upper shaft end **AJ** or **MJ**.

Note: Steering wheel hub has tapped holes for wheel puller.

Horn Button Kit No. 208-1013

For Char-Lynn steering column with serrated upper shaft end **AJ** or **MJ** and CharLynn 430 mm [17 inch] steering wheel.

Cap No. 209-1005

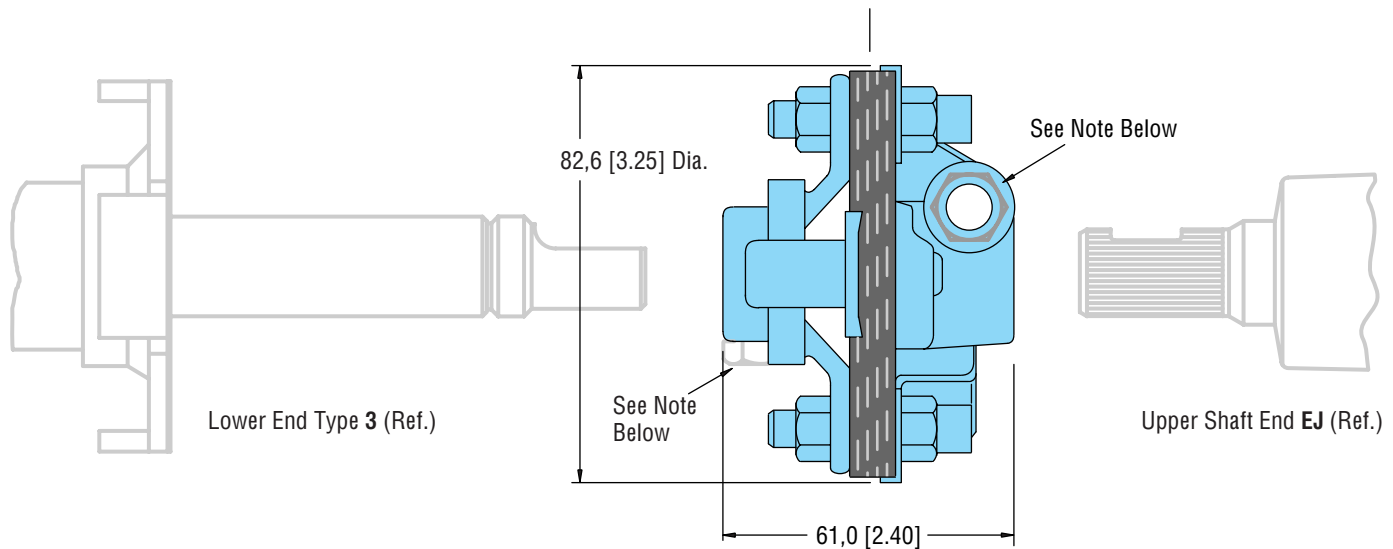
Char-Lynn steering wheel hub cavity cap, for no horn installations.

Nut, Hex Part Number	Upper Shaft End Configuration (See Page 94, 95)	Thread Size
14517	PT, SV	M18 x 1,5
14593	MJ	M20 x 1,5
14603	CK, CL	M16 x 1,5
21084	AJ	13/16-20 UNF

B – Product Information

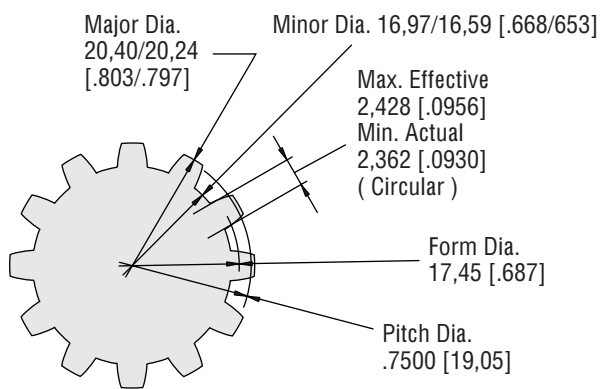
Auxiliary Column Equipment

This Noise Isolator is Available from
Eaton — Part Number 208-1017-002



Note: Two screws (3/8-24 UNF x 31,8 [1.25] long — **not included**) are required to join isolator to mating steering columns. Torque screws to 41 Nm [360 lb-in].

Want to Make your Own Column? You Must use these Spline Specs. — Lower Shaft End

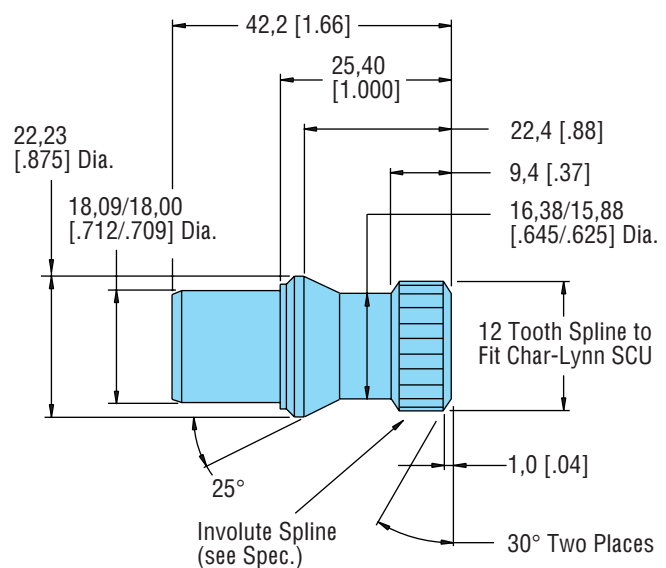


Fit	Flat Root Side Fit
Number of Teeth	12
Pitch	16/32
Pressure Angle	30°
Class of Fit	Special

Circular Tooth Thickness	
Max. Effective	2,428 [.0956]
Min, Actual	2,362 [.0930]

Splined End — AISI 8620 Mt'l Case
hardened to RC 40-50

This Splined Lower Shaft End Part (as shown below) is Available from Eaton — Part Number 8063



12 Tooth Spline Specification (left)

Can be press fit and welded into a 22,22 [.875] OD x 2,16 [.085] wall steel tube.



Quality System Certified
Products in this catalog are manufactured
in an ISO-9001-certified site.