



Corporate Common Power Steering Pump

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This specification defines a series of interchangeable pump families that cover the global range of GM vehicles. All pumps shall be of the balanced vane type with integral pressure relief and flow control valves (unbalanced variable displacement types will be considered).

A family in this context is defined as a group of pumps with identical packaging, interfaces and performance across a range of rotating group capacities. A given family may contain pumps from multiple suppliers, and a given pump design may cover multiple families. Pumps within a given family will have a range of displacements, pressure relief settings and flow control settings. (See Table 1.)

1.2 Applicability. All light duty cars and trucks equipped with hydraulic power steering systems.

Table 1: Family Definition

Pump Family	Type	Theoretical Displacement
A1	Fixed	≤11cc/rev
A2	Variable flow	≤11cc/rev
A3	Variable displacement	≤11cc/rev
B1	Fixed	≤11cc/rev
B2	Variable flow	≤11cc/rev
B3	Variable displacement	≤11cc/rev
C1	Fixed	11-15 cc/rev
C2	Variable flow	11-15 cc/rev
C3	Variable displacement	11-15 cc/rev
D1	Fixed	11-15 cc/rev
D2	Variable flow	11-15 cc/rev
D3	Variable displacement	11-15 cc/rev

Note: Variable displacement (Family A3, B3, C3, and D3) requirements are not defined.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ANSI S12.55-2006

ISO 4406

ISO 4407

SAE J2747

ASTM B117

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2.2 GM Standards/Specifications.

9986117	GMW3059	GMW14101 (ID)	GMW15443
9986153	GMW3116	GMW14872	GMW15841
GMW3044	GMW3191	GMW15357	GMW15862

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

2.3 Additional References.

- AKN83694 Unigraphics File
- CG1579 Design Review by Test Results
- GM Part Number 9274926 (Pentosin CHF202)
- GM Underhood Harmony Guidelines
- Statement of Requirements (SOR)

3 Requirements

3.1 Component Definition.

3.1.1 Appearance. Pump external components shall be black or silver/aluminum per GM Underhood Harmony Guidelines. Any combination of these colors is permissible (e.g., black front housing, bare aluminum rear housing, black fasteners).

3.1.2 Content. This specification covers the power steering pump assembly minus pulley and reservoir. Integral reservoirs may be required by specific programs, but will be defined by the program Statement of Requirements (SOR).

3.1.3 Ambient Environment.

3.1.3.1 Temperature. The pump shall function without incident throughout the expected vehicle ambient temperature range. Hydraulic output may be reduced at extremely low temperatures, but should return to normal after the power steering fluid heats up (see 3.1.3.1.3.3).

3.1.3.1.1 External Ambient Temperature. The maximum free air temperature range within which the vehicle may be operated is -40 °C (-40 °F) to 52 °C (125 °F). This range is extended to 93 °C (200 °F) for 20 minutes under non-operating conditions (component storage and final line paint repair ovens).

3.1.3.1.2 Underhood Ambient Temperature. The pump shall operate normally and without degradation of function at underhood ambient temperatures between -20 °C (-4 °F) and 135 °C (275 °F) continuous/150 °C (302 °F) excursion. The maximum excursion temperature may be assumed to occur 400 times totaling 60 h per 100 000 mi of vehicle life with no single event exceeding 30 minutes.

3.1.3.1.3 Oil Temperature.

3.1.3.1.3.1 DEXRON®-VI ATF. The pump shall operate normally and without degradation of function at operating oil temperatures between -40 °C and +135 °C ($T_{\max}$ continuous), +150 °C ($T_{\max}$ excursion – “excursion” defined as 600 events totaling 90 h over one vehicle life with no single event exceeding 30 minutes).

3.1.3.1.3.2 Pentosin CHF202. The pump shall operate normally and without degradation of function at operating oil temperatures between -40 °C and +120 °C ($T_{\max}$ continuous), +135 °C ($T_{\max}$ excursion – “excursion” defined as 600 events totaling 90 h over one vehicle life with no single event exceeding 30 minutes).

3.1.3.1.3.3 Performance Variation with Temperature. The pump shall provide full output as defined in 3.2.1.5 at oil temperatures between -20 °C and 120 °C.

Note: For oil temperatures between -29 °C and -20 °C, output may be reduced by 20% maximum; between -40 °C and -29 °C, output may be reduced by 40% maximum.

Note: For oil temperatures between 120 °C and $T_{\max}$ excursion, output may be reduced by 10% maximum.

3.1.3.2 Relative Humidity. The pump will be exposed to humidity levels between 2% and 100% relative humidity.

3.1.3.3 Altitude. The pump will be exposed to altitudes between 91 m (300 ft) below and 4572 m (15 000 ft) above sea level. Typical operation is between sea level and 2438 m (8000 ft).

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3.1.3.4 External Contaminants. The pump shall operate normally and without degradation of function after prolonged exposure to mud, sand, dust, automotive fluids, etc., that might be encountered in an underhood environment.

3.1.3.5 Jet Spray. The pump shall withstand water jet spray from any angle of 6.9 bar to 10.3 bar at a rate of 9.8 liters per minute (lpm), typical of those encountered in a self-operated vehicle wash and automated underbody car washes. No temporary or permanent degradation of function shall result, nor shall any moisture enter the pump.

3.1.3.6 Submersion. No damage, leakage (either water in or oil out) or degradation of function or durability shall occur when the pump at $T_{\text{max continuous}}$ is submerged in water at 0 °C (32 °F).

3.1.4 Interfaces.

3.1.4.1 Packaging Envelope. All pumps shall meet the dimensions defined in Figure 1, Figure 2 and Table 2.

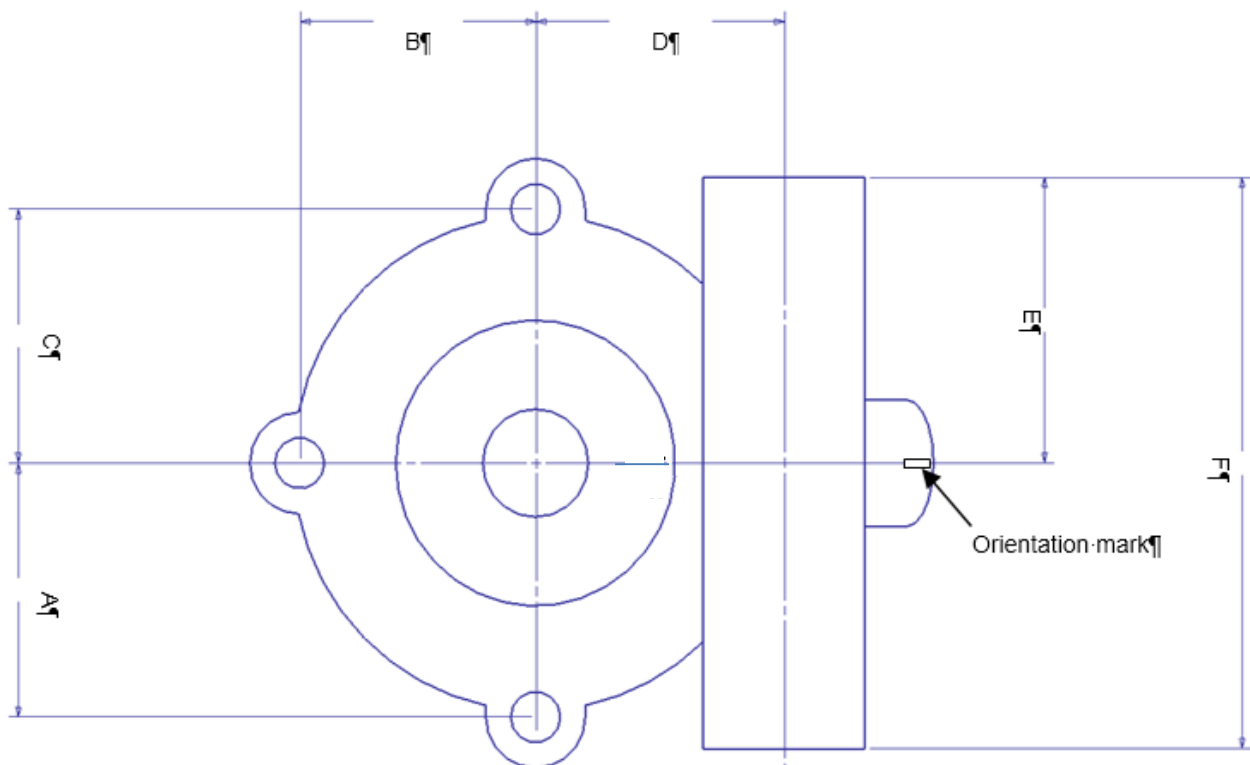


Figure 1: Key Dimensions (Front View)

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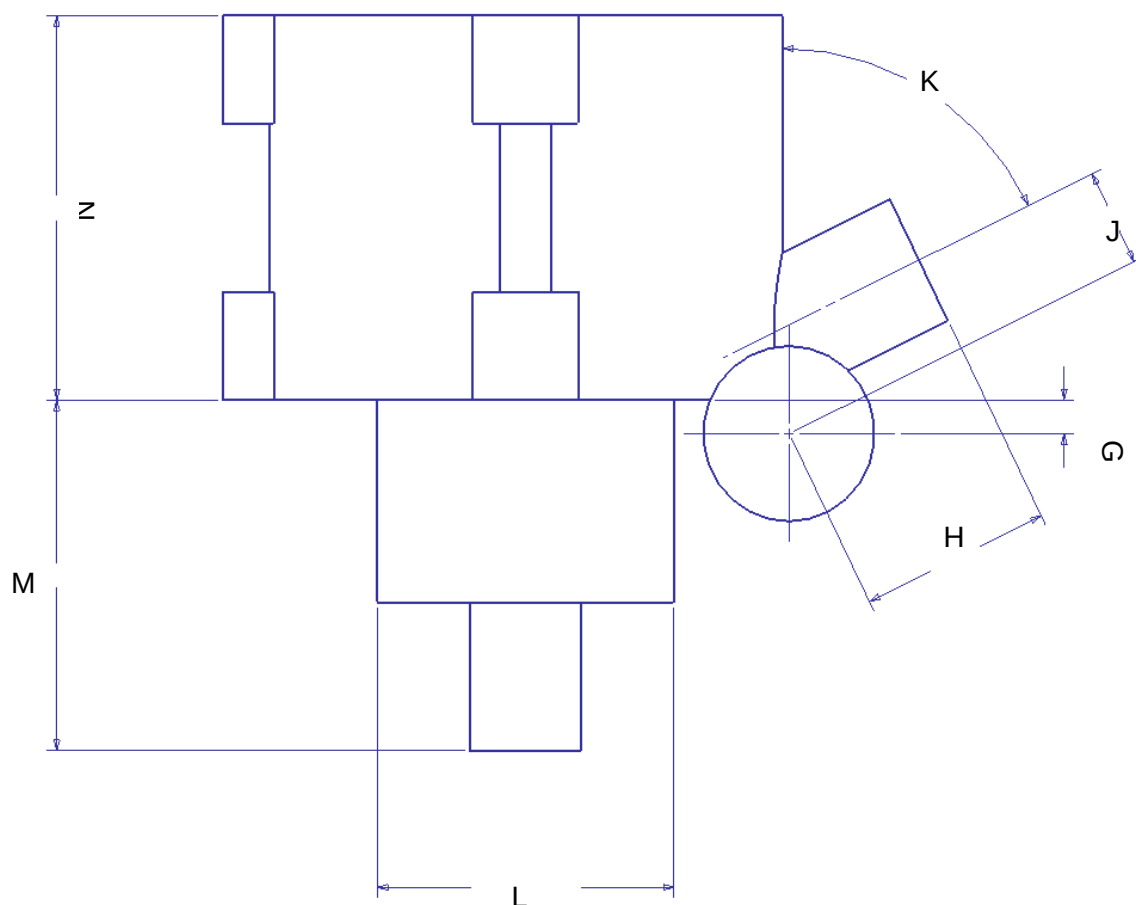


Figure 2: Key Dimensions (Plan View)

Table 2: Key Dimension Values

Dimension	Target Value (millimeters)	Allowable Range (millimeters)
A	40	40
B	38	38
C	40	40
D	35	33 to 45
E	43	43 to 47
F	86	97 maximum
G	0	-2 to +5.5
H*	29	29
J*	14.5	14.5
K*	64°	64°
L	52 maximum	56 maximum

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Dimension	Target Value (millimeters)	Allowable Range (millimeters)
M	52	52
N	57.1 ^{+0.5}	57.1 ± 0.5

Note: Dimensions marked with an asterisk (*) may be replaced by an intake port normal to, and with attachment plane not more than 55 mm from, the shaft axis.

Any new product being developed should meet the target dimensions. The allowable range is to minimize tear-up to suppliers' existing designs but may result in non-interchangeable parts.

In addition to meeting the above dimensions, all pumps shall fit within the envelope defined by Unigraphics file AKN83694.

3.1.4.2 Mounting.

3.1.4.2.1 Indirect Mounting. Indirect-mounted pumps shall be attached to the engine by means of an accessory mounting bracket. Attachment requirements are as follows:

3.1.4.2.1.1 Front bolt pattern shall be per Figure 1.

3.1.4.2.1.2 Fasteners shall be M8.

3.1.4.2.1.3 Minimum full thread depth shall be 16 mm.

3.1.4.2.1.4 Mounting pads for bracket attachment shall be 16 mm minimum diameter (dia).

3.1.4.2.1.4.1 Surfaces shall be machined in one operation, where possible.

3.1.4.2.1.4.2 Surface-to-surface axial variation shall not exceed 0.05 mm.

3.1.4.2.1.4.3 Surface perpendicularity shall not exceed 0.12 mm to the bearing bore centerline.

3.1.4.2.1.5 Rear bolt pattern shall be to same requirements as front bolt pattern with the following exceptions:

3.1.4.2.1.5.1 For a single mounting surface, surface flatness shall not exceed 0.1 mm across the entire face.

3.1.4.2.1.5.2 For multiple mounting surfaces, surface-to-surface axial variation shall not exceed 0.05 mm.

3.1.4.2.2 Direct Mounting. Direct-mounted pumps shall be attached directly to the engine with no intermediate bracket. Attachment requirements are as follows.

3.1.4.2.2.1 Bolt pattern shall be two 8.2 mm axial through holes in full-length lugs, 180 degrees opposed on 40 mm centers.

3.1.4.2.2.2 The mounting surface(s) of the housing shall mate to the engine block.

3.1.4.2.2.2.1 Surfaces must be machined, in one operation where possible.

3.1.4.2.2.2.2 For a single mounting surface, surface flatness shall not exceed 0.1 mm across the entire face.

3.1.4.2.2.2.3 For multiple mounting surfaces, surface-to-surface axial variation shall not exceed 0.05 mm.

3.1.4.2.2.2.4 Surface perpendicularity shall not exceed 0.12 mm to the bearing bore centerline.

3.1.4.3 Reservoir Interfaces. If an integral reservoir is required, the reservoir-to-pump interfaces and attachment method may be defined by the supplier as long as they do not impact the packaging envelope. The need for integral reservoirs will be defined in the program-specific SOR.

3.1.4.4 Hose Interfaces.

3.1.4.4.1 Intake Port. If an intake port is required for remote reservoir applications, the preferred orientation is shown in Figures 1 and 2. Alternative orientations as described in 3.1.4.1 may be negotiated. Requirements are as follows:

3.1.4.4.1.1 The pump shall provide a nipple for a 5/8 in (15.88 mm) nominal inside diameter intake/suction hose. The nipple may be pressed in or bolted on. The desired nipple dimensions are shown in Figure 3 (other, supplier-standard nipple forms may be negotiated).

3.1.4.4.1.2 The pump shall also be capable of providing a nipple for 18 mm or 3/4 in nominal inner diameter (ID) intake/suction hose for cold start noise suppression. The pump internal flow path shall be designed to accommodate the flow from a 3/4 in ID hose without additional restriction.

3.1.4.4.1.3 The nipple shall be capable of orientation in any direction.

3.1.4.4.1.4 Nipple wall thickness shall not exceed 2 mm in any material.

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3.1.4.4.1.5 The pump assembly shall include a hose orientation mark next to the stop bead on the intake nipple.

3.1.4.4.1.5.1 For cast aluminum or molded plastic intake nipples, the mark shall be a raised feature on the outboard face of the nipple, 2 mm wide x 2 mm high x 10 mm long.

3.1.4.4.1.5.2 For tubular steel intake nipples with a stop bead, the mark shall be a raised feature or white paint stripe on the outboard face of the nipple, 2 mm wide x 2 mm high x 10 mm long.

3.1.4.4.1.5.3 For tubular steel intake nipples without a stop bead (i.e., the hose stops against the pump housing), the mark shall be a raised feature or white paint stripe on the housing, 2 mm wide x 2 mm high x 10 mm long, and in the position shown in Figure 3.

3.1.4.4.1.5.4 Other mark styles or dimensions may be negotiable.

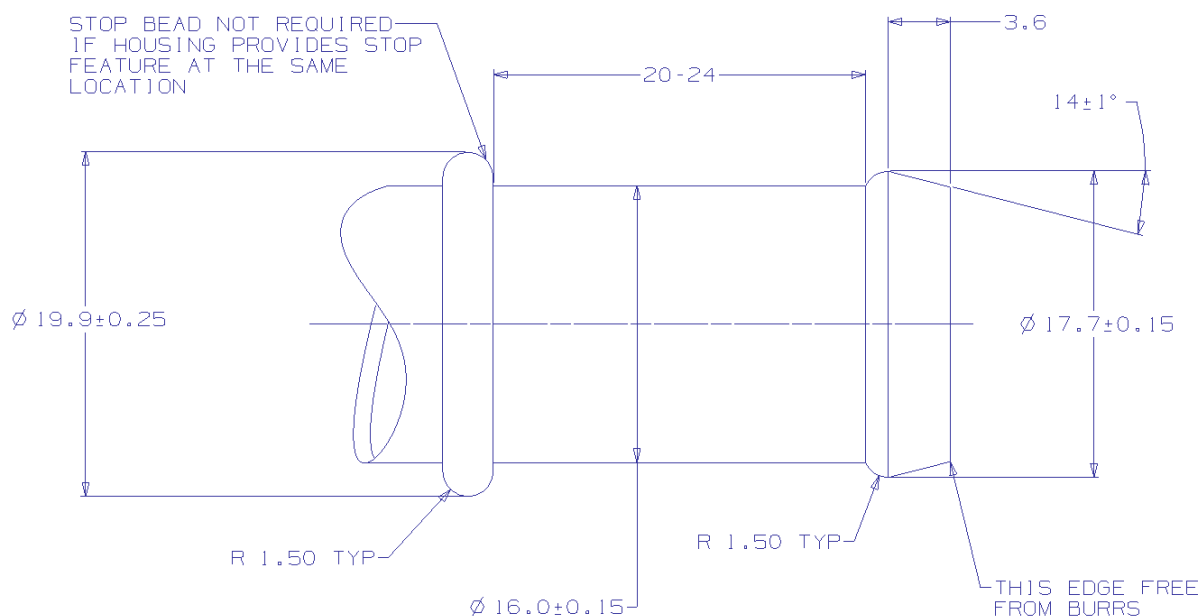


Figure 3: Intake Nipple Dimensions

3.1.4.4.2 Discharge Port. Both left-hand and right-hand discharge versions of each design must be available, including variable-flow derivatives. Requirements are as follows.

3.1.4.4.2.1 Mainstream Design. M16 female thread with stepped bore to accept flare and o-ring tube endform per Figures 4 and 5.

3.1.4.4.2.2 Optional Design. M16 female thread to accept banjo fitting bolt with torque up to 50 N•m, per Figure 6 (Dimension E in Figure 1 may increase to 54 mm with this option).

3.1.4.4.2.3 Discharge port fittings shall be zinc plated per GMW3044 8K240/120.

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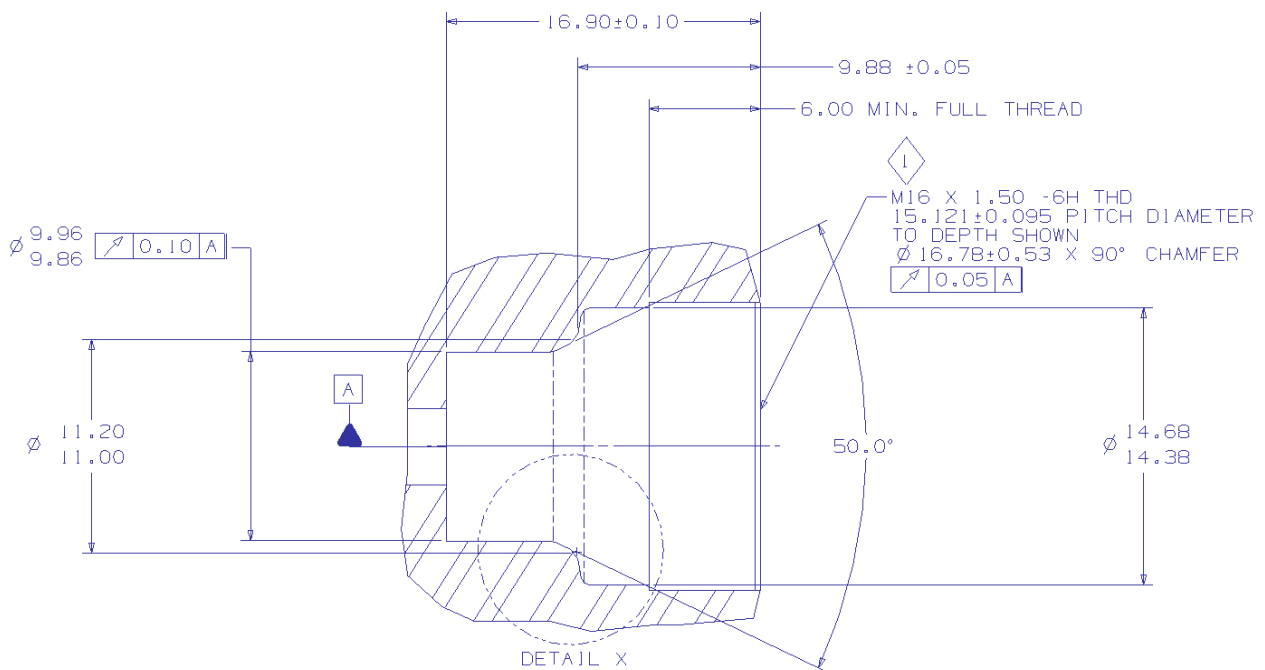


Figure 4: Discharge Port Dimensions (Tube Nut Style)

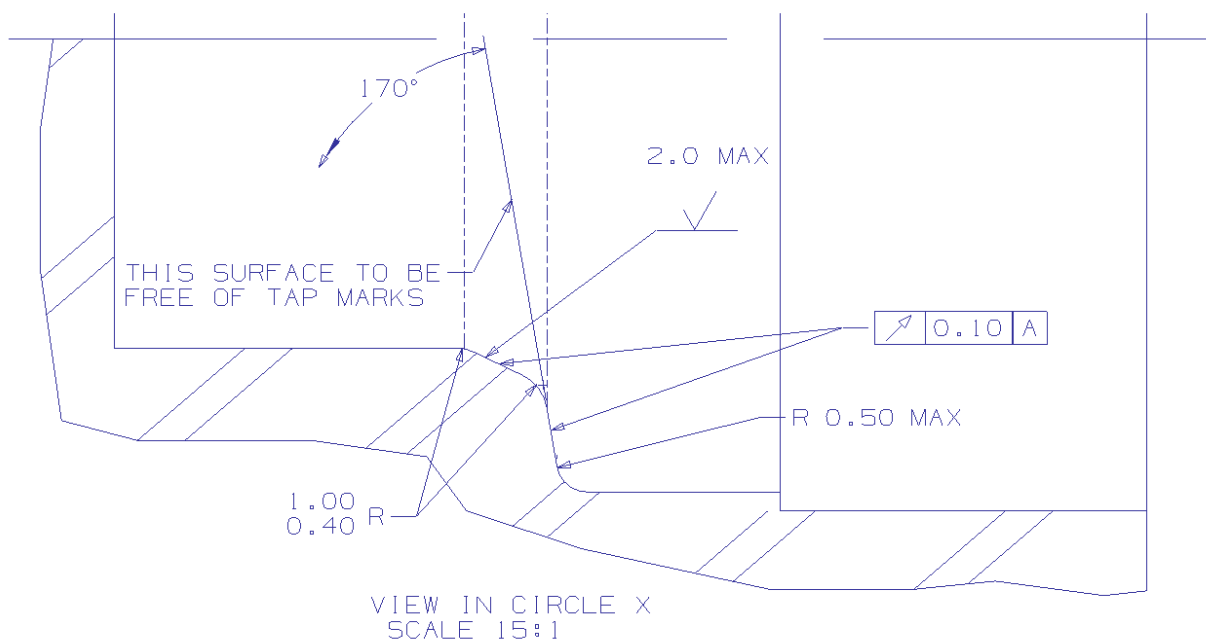


Figure 5: Discharge Port Dimensions (Tube Nut Style)-Detail

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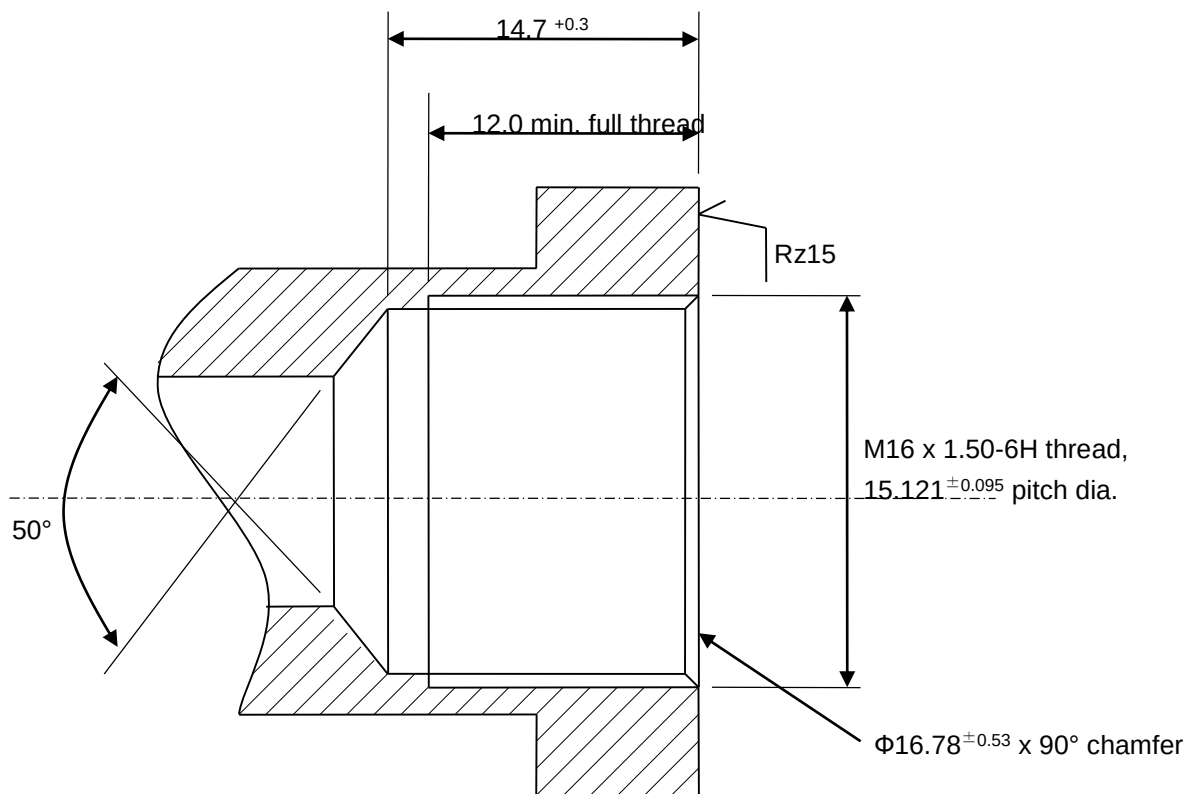


Figure 6: Discharge Port Dimensions (Banjo Fitting Style)

3.1.4.5 Drive Type.

3.1.4.5.1 Direct Drive. No direct drive applications for the Corporate Common Pump are anticipated.

3.1.4.5.2 Pulley Drive. All pulleys shall be of the press-fit type. The press tool force shall be reacted against the pump shaft internal thread rather than the pump bearings. Requirements are as follows.

3.1.4.5.2.1 Shaft diameter shall be 16.888 mm - 0.01 mm.

3.1.4.5.2.2 Engagement length shall be 21 mm minimum (refer to Figure 7).

3.1.4.5.2.3 Shaft surface finish shall be 0.3 μm R_a maximum (12 micro inches) in both X and Y directions.

Note: X-direction is along the shaft axis, Y-direction is circumferential.

Note: A minimum shaft surface finish specification will be developed to address excessive pulley press force issues.

Note: For reference, pulley torque-to-turn requirement = 68.0 N•m.

Note: This surface finish requirement applies to pulley interface area only – supplier may define different surface finish requirements in other areas to meet the performance requirements specified in this document.

3.1.4.5.2.4 Shaft shall include a tooling interface consisting of a $\frac{3}{8}$ in-16 UNC internal thread.

3.1.4.5.2.4.1 Thread length shall be 15 mm minimum.

3.1.4.5.2.4.2 Full thread shall begin no more than 12 mm from end of shaft.

3.1.4.5.2.4.3 Suppliers may use additional internal features as necessary for function test, etc.

3.1.4.5.2.5 Lead-in = $2.0^{+0/-0.5}\text{mm}$ x 45° chamfer or similar.

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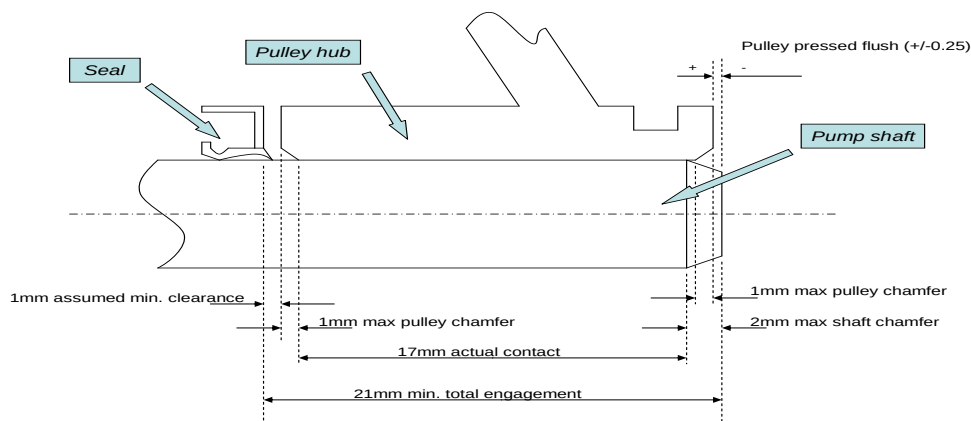


Figure 7: Driveshaft Dimensions

3.1.4.6 Electrical Connections. Variable-flow or variable-displacement pumps with electric actuation shall include either a molded in header to accept a sealed connector, or a pigtail. In either case, the connection must meet the requirements of GMW15841 and GMW3191.

3.1.4.7 Power Steering Fluids. The pump must be compatible with the following fluids.

3.1.4.7.1 DEXRON®-VI automatic transmission fluid, see 9986153.

3.1.4.7.2 Pentosin CHF202, see GM Part Number 9274926.

3.1.4.8 Assembly Plant Interfaces.

3.1.4.8.1 Fluid Fill. Pumps shall be compatible with GM production evacuation and fill equipment with the following performance parameters:

- Vacuum greater than 26.7 mbar (20 mmHg) within 20 s.
- Fluid dispense rate of 250 ml/s.
- Maximum permissible vacuum decay = 2.7 mbar (2 mmHg) per 10 s.

3.1.4.8.2 The pump shall withstand a vacuum of 10 mbar (7.5 mmHg) without temporary or permanent loss of function including entrainment of air. The supplier shall provide the vacuum value at which loss of function occurs, even if greater than the value previously specified, to indicate the upper control limit for plant equipment.

3.1.5 Product Usage.

3.1.5.1 Hub Load. The maximum hub load, $F_{hub\ max}$ shall be 2000 N peak steady-state (dynamic uncontrolled) at a maximum overhang of 37 mm (front mounting surface to center of belt) and may be applied in any direction. If a bushing design is used, the design must allow for orientation of the bushing split at any radial location. For a given application, the supplier must provide the bushing orientation window within which the accessory drive belt resultant load vector must fall.

3.2 Product Characteristics.

3.2.1 Performance Requirements.

3.2.1.1 Direction of Rotation. Pumps shall rotate clockwise as viewed from front of the pump.

3.2.1.2 Speed Range. The maximum speeds of the pump families shall be according to Table 3.

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