



TRANSMISSION DATA — 4000 PRODUCT FAMILY —

ALLISON ON-HIGHWAY TRANSMISSIONS

Contents:

- 1.0 Transmission Models and Ratings
- 2.0 Power Take-Off Drive Gear Ratings
- 3.0 Transmission Temperatures
- 4.0 Installed Angles of Transmission in Chassis
- 5.0 Transmission Operating Angles (Including Installed Angles)
- 6.0 Torque Converter Data
- 7.0 Transmission Main Pressure
- 8.0 Dry Weights
- 9.0 Center of Gravity
 - 9.1 Close Ratio and Wide Ratio Models
 - 9.2 Seven-Speed Models
- 10.0 Transmission Static Bending Moment Limit
- 11.0 Mass Moments of Inertia
 - 11.1 Close Ratio and Wide Ratio Models
 - 11.2 Seven-Speed Models
- 12.0 Gear Ratios
- 13.0 Oil Types and Oil Fill Information
- 14.0 Retarder Performance
 - 14.1 Retarder Capacity
 - 14.2 Retarder Response - Initial Apply
- 15.0 Typical Cranking Torque Characteristics
- 16.0 External Hydraulic Circuits
 - 16.1 General
 - 16.2 Remote-Mounted Filters
 - 16.3 Cooler Circuit Flow and Restriction
- 17.0 Allison Oil-to-Water Cooler Characteristics
 - 17.1 Coolant Fill Volume for Allison Coolers
 - 17.2 Vibration Profiles for Allison Coolers
 - 17.3 Remote Retarder / Sump Cooler
 - 17.4 Direct-Mount Retarder / Sump Cooler
 - 17.5 Direct-Mount Standard-Capacity Cooler, Non-Retarder
 - 17.6 Direct-Mount High-Capacity Cooler, Non-Retarder
 - 17.7 Remote-Mount Tube & Shell Cooler (29553529) Non-Retarder & Retarder
 - 17.8 Remote-Mount Tube & Shell Cooler (29559270) Non-Retarder & Retarder

List of Referenced Documents

Revision History

Unless otherwise noted, all documents referenced in this document may be found in the Allison HUB located on the Allison Transmission website, www.allisontransmission.com. To locate the referenced documents, which are identified by *italic* font, look for Tech Data under the Engineering heading on the Allison HUB home page. Contact your Allison Transmission representative if you do not have access to the Allison HUB.

1.0 MODELS AND RATINGS: 4000 PRODUCT FAMILY

The transmission gear ratios (close ratio or wide ratio) are based on the transmission model. A comprehensive list of transmission models is available in a separate document entitled [Transmission Families and Models](#). For gear ratios of the individual gear schemes, refer to Table 12.0, Gear Ratios of this document.

A comprehensive list of Input and Output Ratings for all models in the 4000 Product Family is available in a separate document entitled [4000 Product Family Transmission Ratings](#).

2.0 POWER TAKE-OFF DRIVE GEAR RATINGS

| TRANSMISSION CONFIGURATION | MAXIMUM VALUE | UNIT |
|---|------------------|------------------|
| Drive Gear Torque (Continuous Operation) | | |
| With PTO on One Pad | 930 (685) Max. | N•m (pound-foot) |
| With PTO on Both Pads – Combined Total * | 1595 (1175) Max. | N•m (pound-foot) |
| Number of teeth on drive gear | 97 | — |

* Refer to [4000 Product Family Transmission Ratings](#) for minimum engine idle speed required if dual PTOs are used simultaneously.

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

3.0 TRANSMISSION TEMPERATURES

| PARAMETER | UNIT VALUE °C (°F) | TRANSMISSION OPERATIONAL LIMITATIONS |
|---|---------------------------|--|
| Sump, Minimum Start-Up, TES295 fluid | -35 (-31) | Limited to N, R, 2nd ranges below -1°C (30°F), lockup is available at all temperatures |
| Sump, Minimum Start-Up, Schedule One TES389 fluid | -25 (-13) | Limited to N, R, 2nd ranges below -1°C (30°F), lockup is available at all temperatures. Also applies to TES295 fluid |
| Sump, Full Functionality | -1 (30) and higher | None |
| Sump, Recommended Minimum Continuous | 40 (100) | None |
| Sump, Typical Continuous | 80 to 100 (176 to 212) | None |
| Sump, Maximum | 121 (250) | None |
| To Cooler, Maximum | 149 (300) | None |
| Retarder-Out, Maximum (General, Truck) | 165 (330) | None |
| Retarder-Out, Maximum (Bus & Coach) | 149 (300) | None |
| | | |
| MAXIMUM TEMPERATURE PERMITTED | | |
| At Transmission External Surfaces | 121 (250) | None |

4.0 INSTALLED ANGLES OF TRANSMISSION IN CHASSIS

| PARAMETER | MAXIMUM VALUE | UNIT |
|----------------------------|---------------|---------|
| Pitch — Minimum, Tail-Down | 0 | degrees |
| Pitch — Maximum, Tail-Down | 7 | degrees |
| Roll | 0 | degrees |

5.0 TRANSMISSION OPERATING ANGLES (INCLUDING INSTALLED ANGLES)

| PARAMETER | MAXIMUM VALUE | | UNIT |
|-----------|---------------|------------------|---------|
| | DEEP OIL SUMP | SHALLOW OIL SUMP | |
| Pitch | 38 | 24 | degrees |
| Roll | 45 | 28 | degrees |

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

6.0 TORQUE CONVERTER DATA

| TORQUE CONVERTER | NOMINAL STALL TORQUE | NOMINAL K-FACTOR AT STALL | MAXIMUM ENGINE TORQUE |
|------------------|----------------------|--|-----------------------|
| TC-521 | 2.42 | 50.7 rpm/ $\sqrt{N \cdot m}$ (59.0 rpm/ $\sqrt{lb \cdot ft}$) | 2644 N·m (1950 lb-ft) |
| TC-531 | 2.34 | 44.8 rpm/ $\sqrt{N \cdot m}$ (52.2 rpm/ $\sqrt{lb \cdot ft}$) | 2644 N·m (1950 lb-ft) |
| TC-541 | 1.90 | 39.7 rpm/ $\sqrt{N \cdot m}$ (46.2 rpm/ $\sqrt{lb \cdot ft}$) | 2644 N·m (1950 lb-ft) |
| TC-551 | 1.79 | 38.2 rpm/ $\sqrt{N \cdot m}$ (44.5 rpm/ $\sqrt{lb \cdot ft}$) | 2644 N·m (1950 lb-ft) |
| TC-561 | 1.58 | 35.4 rpm/ $\sqrt{N \cdot m}$ (41.2 rpm/ $\sqrt{lb \cdot ft}$) | 2644 N·m (1950 lb-ft) |
| TC-571 | 1.62 | 32.5 rpm/ $\sqrt{N \cdot m}$ (37.8 rpm/ $\sqrt{lb \cdot ft}$) | 2644 N·m (1950 lb-ft) |
| TC-571H* | 1.62 | 32.5 rpm/ $\sqrt{N \cdot m}$ (37.8 rpm/ $\sqrt{lb \cdot ft}$) | 3200 N·m (2360 lb-ft) |

NOTE: Availability of some converter models is limited in some geographical regions. Contact your Allison representative.
 * H indicates high rate damper developed to accommodate engines rated over 2644 N·m (1950 lb-ft).

7.0 TRANSMISSION MAIN PRESSURE

| Range | Main Pressure During Normal Operation | | | Units |
|--|---------------------------------------|------------------------|---|--------------|
| | at 600 rpm | | at 1800 rpm | |
| | PTO Request * On | PTO Request * Off | PTO Request * On or Off | |
| Reverse (R1 & R2) | 1448–2055 (210–298) | 1172–1586 (170–230) | 1806–2055 (262–298) | kPa (psi) |
| Neutral | 1517–2055 (220–298) | 1172–1586 (170–230) | PTO Request On 1806–2055 (262–298) PTO Request Off 1310–1720 (190–250) | kPa (psi) |
| Forward Converter (All Gear Ranges) | 1241–1793 (180–260) | 869–1338 (126–194) | 1551–1793 (225–260) | kPa (psi) |
| Forward Lockup | | | | |
| All models except seven-speeds | | | | |
| Ranges 1— 5 | — | — | 1082–1365 (157–198) | kPa (psi) |
| Range 6 | — | — | 1034–1234 (150–179) | kPa (psi) |
| Seven-speed models | | | | |
| Ranges 1— 6 | — | — | 1082–1365 (157–198) | kPa (psi) |
| Range 7 | — | — | 1034–1234 (150–179) | kPa (psi) |
| * Allison 5th Gen Controls PTO Drive Interface Input; 4th Gen Controls PTO Request Input | | | | |

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

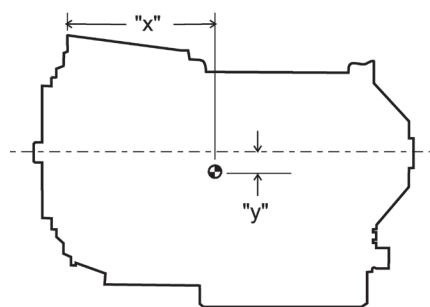
8.0 DRY WEIGHTS

| HARDWARE | NOMINAL VALUE | UNIT |
|--|-----------------------|----------------|
| Transmission Assembly | | |
| Close Ratio and Wide Ratio Models (No PTO / No Retarder) | 377 (831) | kg (pounds) |
| Seven-Speed Models (No PTO / No Retarder configuration) | 493 (1087) | kg (pounds) |
| Optional features / hardware have additional weight as follows: | | |
| Power Take-Off Provision | 28 (62) | kg (pounds) |
| Retarder Option | 34 (75) | kg (pounds) |
| Direct-Mount Retarder / Sump Cooler | 33 (72) | kg (pounds) |
| Remote Retarder / Sump Cooler | 32 (70) | kg (pounds) |
| Direct-Mount Non-Retarder Standard-Capacity Cooler | 16 (35) | kg (pounds) |
| Direct-Mount Non-Retarder High-Capacity Cooler | 23 (50) | kg (pounds) |
| Retarder Accumulator | 4.5 (10) | kg (pounds) |
| Retarder Accumulator Solenoid | 0.6 (1.25) | kg (pounds) |
| Remote-Mount Provision | 52 (114) | kg (pounds) |
| Rear Mount Bracket for Remote-Mount 6-Speed Transmissions | 17 (37) | kg (pounds) |
| Output Flange or Yoke * Typical, varies by type. Refer to the following 4000 Product Family Installation Drawings : • Available Flanges • Available Yokes | 5 – 12* (11 – 26)* | kg (pounds) |

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

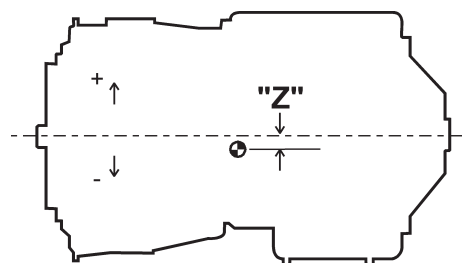
9.0 CENTER OF GRAVITY

SIDE VIEW



A658A

TOP VIEW



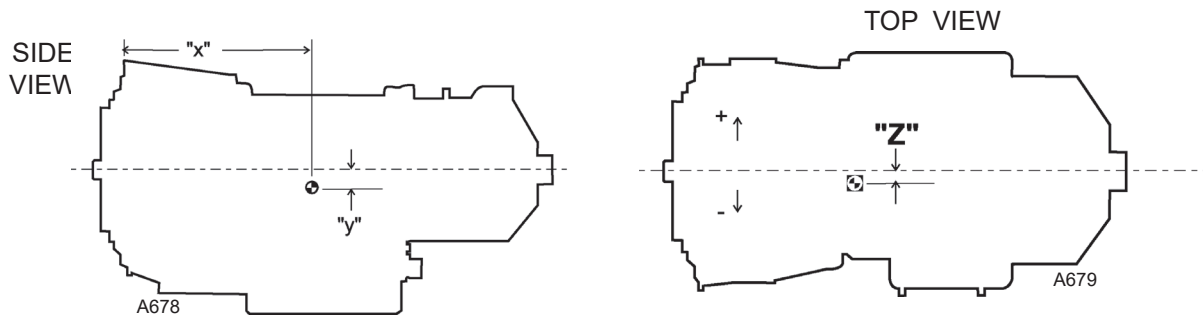
A659A

9.1 CENTER OF GRAVITY: Close Ratio and Wide Ratio Models

| TRANSMISSION CONFIGURATION | NOMINAL VALUE | | | UNIT |
|---|---------------|--------------|------------|----------|
| | X | Y | Z | |
| DIRECT-MOUNT TRANSMISSIONS | | | | |
| No Retarder, No PTO Provision | | | | |
| With remote cooler provision | 342.7 (13.49) | 40.2 (1.58) | 3.6 (0.14) | mm (in.) |
| With standard-capacity, direct-mount cooler | 357.9 (14.09) | 40.8 (1.89) | 3.6 (0.14) | mm (in.) |
| With high-capacity, direct-mount cooler | 367.5 (14.47) | 51.3 ((2.02) | 3.6 (0.14) | mm (in.) |
| No Retarder, With PTO Provision | | | | |
| With remote cooler provision | 387.7 (15.26) | 36.3 (1.43) | 0.6 (0.02) | mm (in.) |
| With standard-capacity, direct-mount cooler | 402.8 (15.86) | 43.7 (1.72) | 0.6 (0.02) | mm (in.) |
| With high-capacity, direct-mount cooler | 412.5 (16.24) | 47.0 (1.85) | 0.6 (0.02) | mm (in.) |
| With Retarder, No PTO Provision | | | | |
| With remote cooler provision | 367.5 (14.47) | 45.7 (1.80) | 7.1 (0.28) | mm (in.) |
| With direct-mount retarder/sump cooler | 407.9 (16.06) | 56.4 (2.22) | 6.1 (0.24) | mm (in.) |
| With Retarder, With PTO Provision | | | | |
| With remote cooler provision | 404.6 (15.93) | 37.6 (1.48) | 5.3 (0.21) | mm (in.) |
| With direct-mount retarder/sump cooler | 445.2 (17.53) | 46.5 (1.83) | 4.8 (0.19) | mm (in.) |
| REMOTE-MOUNT TRANSMISSIONS | | | | |
| No Retarder, No PTO Provision | | | | |
| With remote cooler provision | 288.7 (11.37) | 35.2 (1.38) | 3.6 (0.14) | mm (in.) |
| With standard-capacity, direct-mount cooler | 304.0 (11.97) | 42.1 (1.66) | 3.6 (0.14) | mm (in.) |
| With high-capacity, direct-mount cooler | 313.7 (12.35) | 45.2 (1.78) | 3.6 (0.14) | mm (in.) |
| No Retarder, With PTO Provision | | | | |
| With remote cooler provision | 331.9 (13.11) | 32.0 (1.26) | 0.6 (0.02) | mm (in.) |
| With standard-capacity, direct-mount cooler | 348.2 (13.71) | 38.9 (1.53) | 0.6 (0.02) | mm (in.) |
| With high-capacity, direct-mount cooler | 357.6 (14.08) | 41.7 (1.64) | 0.6 (0.02) | mm (in.) |
| With Retarder, No PTO Provision | | | | |
| With remote cooler provision | 314.7 (12.39) | 40.4 (1.59) | 7.1 (0.28) | mm (in.) |
| With direct-mount retarder/sump cooler | 354.0 (13.94) | 50.4 (1.98) | 6.1 (0.24) | mm (in.) |
| With Retarder, With PTO Provision | | | | |
| With remote cooler provision | 350.9 (13.84) | 33.5 (1.32) | 5.3 (0.21) | mm (in.) |
| With direct-mount retarder/sump cooler | 391.8 (15.40) | 41.8 (1.64) | 4.8 (0.19) | mm (in.) |

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

9.0 CENTER OF GRAVITY



9.2 CENTER OF GRAVITY: Seven-Speed Models

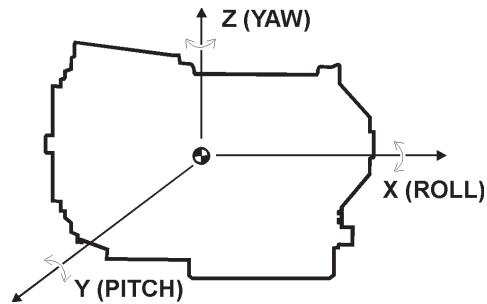
| TRANSMISSION CONFIGURATION | NOMINAL VALUE | | | UNIT |
|--|---------------|-------------|--------------|----------|
| | X | Y | Z | |
| <i>DIRECT-MOUNT TRANSMISSIONS</i> | | | | |
| No Retarder, No PTO Provision | 414.0 (16.30) | 38.4 (1.51) | -1.5 (-0.06) | mm (in.) |
| No Retarder, With PTO Provision | 489.5 (19.27) | 33.8 (1.33) | 2.8 (0.11) | mm (in.) |
| With Retarder, No PTO Provision | 465.8 (18.34) | 42.7 (1.68) | 0.8 (0.03) | mm (in.) |
| With Retarder, With PTO Provision | 525.5 (20.69) | 39.9 (1.57) | 5.6 (0.22) | mm (in.) |
| <i>REMOTE-MOUNT TRANSMISSIONS</i> | | | | |
| No Retarder, No PTO Provision | 364.7 (14.36) | 34.6 (1.36) | -1.5 (-0.06) | mm (in.) |
| No Retarder, With PTO Provision | 435.8 (17.16) | 30.6 (1.21) | 2.8 (0.11) | mm (in.) |
| With Retarder, No PTO Provision | 414.8 (16.33) | 38.7 (1.53) | 0.8 (0.03) | mm (in.) |
| With Retarder, With PTO Provision | 471.7 (18.57) | 36.4 (1.43) | 5.6 (0.22) | mm (in.) |

10.0 TRANSMISSION STATIC BENDING MOMENT LIMIT

| TRANSMISSION CONFIGURATION | MAXIMUM VALUE | UNIT |
|----------------------------|---------------|---------------------------|
| All Models | 3500 (2580) | N•m (lb _F -ft) |

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

11.0 MASS MOMENTS OF INERTIA



A658B

11.1 MOMENTS OF INERTIA - Close Ratio and Wide Ratio Models

| TRANSMISSION CONFIGURATION | NOMINAL VALUE* | | | UNIT |
|--|----------------|---------------|---------------|---|
| | X (ROLL) | Y (PITCH) | Z (YAW) | |
| No Retarder, No PTO Provision | 11.93 (8.80) | 28.35 (20.91) | 26.44 (19.50) | kg-m ² (lb _f -ft-sec ²) |
| No Retarder, With PTO Provision | 12.08 (8.91) | 33.65 (24.82) | 31.50 (23.23) | kg-m ² (lb _f -ft-sec ²) |
| With Retarder, No PTO Provision With Remote Cooler Provision With Direct-Mount Retarder/Sump Cooler | 13.02 (9.60) | 32.59 (24.04) | 30.44 (22.45) | kg-m ² (lb _f -ft-sec ²) |
| | 15.28 (11.27) | 44.66 (32.94) | 41.70 (30.76) | kg-m ² (lb _f -ft-sec ²) |
| With Retarder and PTO Provision With Remote Cooler Provision With Direct-Mount Retarder/Sump Cooler | 14.18 (10.46) | 41.01 (30.25) | 37.87 (27.93) | kg-m ² (lb _f -ft-sec ²) |
| | 15.55 (11.47) | 54.06 (39.87) | 49.84 (36.76) | kg-m ² (lb _f -ft-sec ²) |

11.2 MOMENTS OF INERTIA - Seven-Speed Models

| TRANSMISSION CONFIGURATION | NOMINAL VALUE* | | | UNIT |
|--|----------------|---------------|---------------|---|
| | X (ROLL) | Y (PITCH) | Z (YAW) | |
| No Retarder, No PTO Provision | 15.34 (11.31) | 53.10 (39.16) | 48.82 (36.00) | kg-m ² (lb _f -ft-sec ²) |
| No Retarder, With PTO Provision | 15.27 (11.26) | 62.02 (45.74) | 57.79 (42.62) | kg-m ² (lb _f -ft-sec ²) |
| With Retarder, No PTO Provision | 15.34 (11.31) | 59.16 (43.63) | 54.13 (39.92) | kg-m ² (lb _f -ft-sec ²) |
| With Retarder and PTO Provision | 16.43 (12.12) | 68.15 (50.26) | 64.91 (47.87) | kg-m ² (lb _f -ft-sec ²) |

* Includes Output Flange

NOTE: Moment of inertia of those parts which always rotate with the engine can be found on [Installation Drawing: Engine/Transmission Adaptation – General](#).

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

12.0 GEAR RATIOS

| GEAR RANGE | TRANSMISSION MODEL GEAR SCHEME* | | | |
|--------------------|---------------------------------|------------------------|--------------------|------------|
| | CLOSE-RATIO (CR) MODELS | WIDE-RATIO (WR) MODELS | SEVEN-SPEED MODELS | |
| | | | Deep Ratio | Wide Ratio |
| FORWARD | | | | |
| First | 3.51 | 4.70 | 7.63 | 4.70 |
| Second | 1.91 | 2.21 | 3.51 | 3.30 |
| Third | 1.43 | 1.53 | 1.91 | 2.21 |
| Fourth | 1.00 | 1.00 | 1.43 | 1.53 |
| Fifth | 0.74 | 0.76 | 1.00 | 1.00 |
| Sixth | 0.64 | 0.67 | 0.74 | 0.76 |
| Seventh | - | - | 0.64 | 0.67 |
| REVERSE | -4.80 | -5.55 | -4.80 | -5.55 |
| 2nd REVERSE | - | - | -17.12** | -2.42** |

* To determine the gear scheme of a specific transmission model, refer to [Transmission Families and Models](#).

** For model availability refer to [Technical Document \(TD\) 188, Application and Installation Requirements for 2nd Reverse with 4th Gen Controls](#) or [Technical Document 191, Application and Installation Requirements for 2nd Reverse with 5th Gen Controls](#).

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

13.0 OIL TYPES AND OIL FILL INFORMATION

| PARAMETER | VALUE | UNIT |
|---|-----------|-----------------|
| INITIAL FILL VOLUME¹ | | |
| Base Models – Transmission Only² | | |
| Deep Oil Sump, with PTO Provision | 48 (51) | liters (quarts) |
| Deep Oil Sump, without PTO Provision | 45 (48) | liters (quarts) |
| Shallow Oil Sump, with PTO Provision | 41 (43) | liters (quarts) |
| Shallow Oil Sump, without PTO Provision | 38 (40) | liters (quarts) |
| Seven-Speed Models - Transmission Only² | | |
| Deep Oil Sump, with PTO Provision | 51 (54) | liters (quarts) |
| Deep Oil Sump, without PTO Provision | 48 (51) | liters (quarts) |
| Additional Fill for Allison Coolers | | |
| Direct-Mount, Non-Retarder, Standard-Capacity Cooler | 1.0 (1.1) | liters (quarts) |
| Direct-Mount, Non-Retarder, High-Capacity Cooler | 2.1 (2.2) | liters (quarts) |
| Direct-Mount, Retarder/Sump Cooler | 2.5 (2.6) | liters (quarts) |
| Remote, Retarder with Sump Cooler | 2.5 (2.6) | liters (quarts) |
| Additional Fill for Retarder Accumulator | 0.6 (0.6) | liters (quarts) |

ACCEPTABLE FLUIDS:

For off-highway, articulated rear dump truck applications

TES-668 licensed fluid, TES-295 licensed fluid, or fully-synthetic Schedule One TES-389 licensed fluid

For 4750 OFS, 4800 OFS, and 4870 OFS applications

Refer to [TD183, Application Requirements for Oil Field Service \(OFS\) Transmissions](#)

For all other applications:

TES-668 licensed fluid, TES-295 licensed fluid, or Schedule One TES-389 licensed fluid

[Lists of the fluids](#) approved for use with Allison transmissions can be found on the Allison Transmission web site at: www.allisontransmission.com.

¹ Transmission or listed components only (transmission at 0° installed angle). Does not include external circuits or additional volume which may be required if installed angle of the transmission greater than 0°.

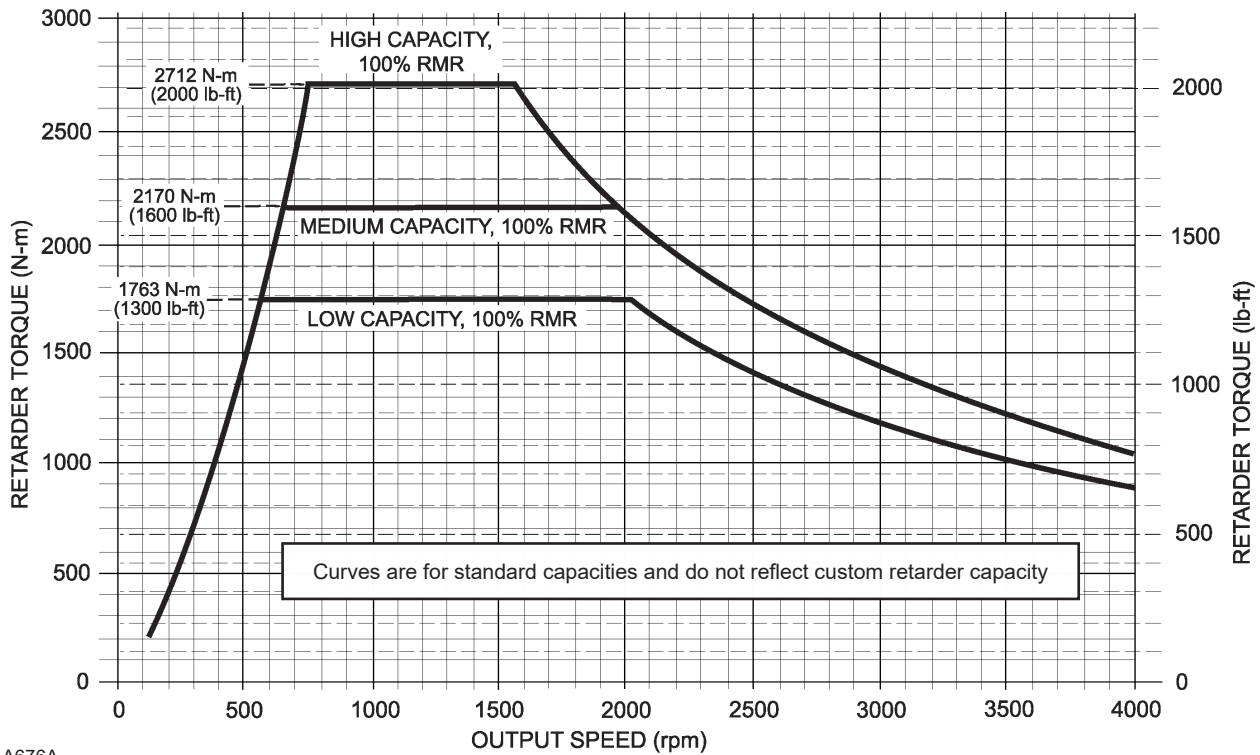
² Amount to fill dry transmission after disassembly and rebuild. The initial fill for a transmission as received from the Allison factory will be less. Residual fluid remains in the transmission after acceptance testing.

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

14.0 RETARDER PERFORMANCE

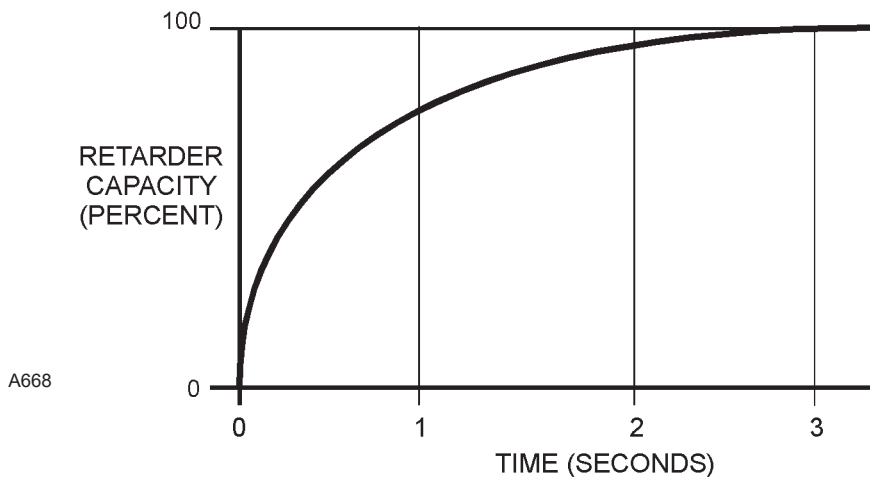
14.1 RETARDER CAPACITY*

* AT COMMAND FOR 100% APPLY



A676A

14.2 RETARDER RESPONSE: INITIAL APPLY



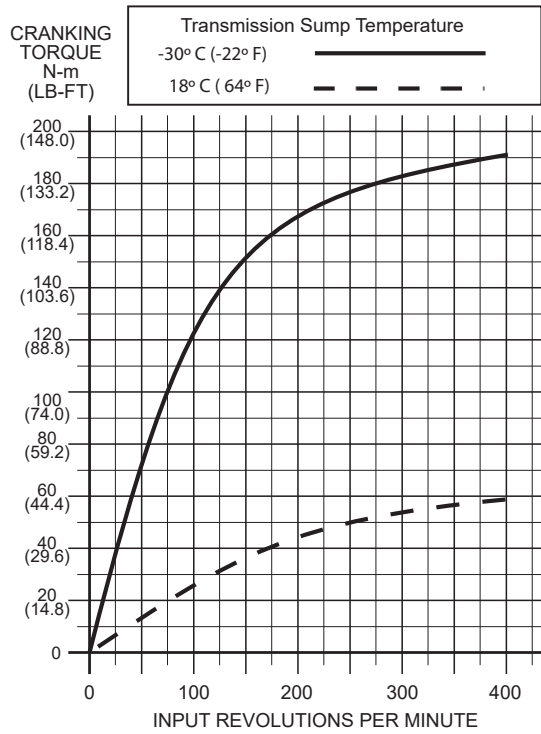
A668

NOTE: Initial apply timing in a forward range, if equipped with a retarder accumulator, and the transmission is not in the process of a shift.

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

15.0 TYPICAL CRANKING TORQUE CHARACTERISTICS

Typical Torque Required to Rotate Transmission Parts During Engine Cranking



A660B

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.0 EXTERNAL HYDRAULIC CIRCUITS

16.1 GENERAL

Fluid Compatibility for Coolers and Hydraulic Lines

Must be compatible with acceptable fluids listed in Table 13.0, Oil Types and Oil Fill Information

Pressures for Coolers and Hydraulic Lines

| | | |
|-----------------|------------------------------|--------------------------|
| Operating, Max: | 896.4 kPa | (130 psi) |
| Spike, Max: | 2068.5 kPa | (300 psi) |
| Gradient: | 413.6 kPa within 1 sec. | (60 psi within 1 sec.) |
| Pulsation: | 16 Hz at 413.6 +/- 103.4 kPa | (16 Hz at 60 +/- 15 psi) |

Temperatures for Coolers and Hydraulic Lines

All components except retarder out (to cooler) line

| | | |
|---------------------------------------|----------------|------------------|
| Fluid temperature range: | 38 to 121 °C | (100 to 250 °F) |
| With maximum intermittent excursions: | - 40 to 149 °C | (- 40 to 300 °F) |

Retarder out (to cooler) line

| | | |
|---------------------------------------|----------------|------------------|
| Fluid temperature range: | 38 to 121 °C | (100 to 250 °F) |
| With maximum intermittent excursions: | - 40 to 165 °C | (- 40 to 330 °F) |

| | | |
|--------------------|----------------|------------------|
| Gradient, initial: | 28 °C per sec. | (50 °F per sec.) |
|--------------------|----------------|------------------|

Hydraulic Line Size, Cooler Circuit

Circuit must meet pressure drop requirements (Refer to Tables 16.2 and 16.3)

Circuit must allow sufficient flow to meet cooling requirements

Recommended minimum inside diameter:

| | | |
|--|---------|--------------|
| Non-retarder cooling circuit: | 22.2 mm | (0.875 inch) |
| Retarder cooling circuit: | 28.6 mm | (1.125 inch) |
| Retarder accumulator oil circuit: | 28.6 mm | (1.125 inch) |
| Sump cooling circuit (retarder units): | 15.9 mm | (0.625 inch) |

Hydraulic Line Requirements, Cooler Circuit

Hydraulic lines must meet the above pressure and temperature requirements.

Hydraulic lines must be compatible with oils listed in Table 13.0.

In addition, Allison strongly recommends that hoses meet or exceed the tests described in Society of Automotive Engineers (SAE) J2545 and SAE J1405, Option IV – High Temperature Circulation Test.

Metal tubing is acceptable; requires flexible section (e.g. hose) between powerpack and chassis.

O-Ring Seal Requirements

Fluorocarbon elastomer, American Society of Testing and Materials (ASTM) D2000, material designation HK, recommended durometer hardness of 75. The material grade of the seal must be compatible with all acceptable fluids listed in Table 13.0.

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.2 REMOTE-MOUNTED FILTERS

Fluid Compatibility for Filters and Hydraulic Lines

Refer to Acceptable Fluids in Table 13.0, Oil Types and Oil Fill Information

Pressures for Filters and Hydraulic Lines

| | | |
|-----------------|----------|------------|
| Operating, Max: | 2069 kPa | (300 psi) |
| Spike, Max: | 6895 kPa | (1000 psi) |

Temperatures for Filters and Hydraulic Lines

| | | |
|---------------------------------|----------------|------------------|
| Fluid temperature range: | | |
| Normal operating range | 38 to 121 °C | (100 to 250 °F) |
| Maximum intermittent excursions | - 40 to 149 °C | (- 40 to 300 °F) |

Hydraulic Line Size

Circuits must meet pressure drop requirements:

| | |
|--------------------------------------|---|
| Main circuit filter | 207 kPa max. at 114 liters/minute (30 psi at 30 gpm) |
| Lube circuit filter | 104 kPa max. at 83 liters/minute (15 psi at 22 gpm) |
| Recommended minimum inside diameter: | 22.2 mm (0.875 inch) |

Hydraulic Line Requirements

Hydraulic lines must meet the above pressure and temperature requirements

Hydraulic lines must be compatible with oils listed under Fluid Compatibility

In addition, Allison strongly recommends that hoses meet or exceed the tests described in Society of Automotive Engineers (SAE) J2545 and SAE J1405, Option IV – High Temperature Circulation Test.

O-Ring Seal Requirements

Fluorocarbon elastomer, American Society of Testing and Materials (ASTM) D2000, material designation HK, recommended durometer hardness of 75. The material grade of the seal must be compatible with all acceptable fluids listed in Table 13.0.

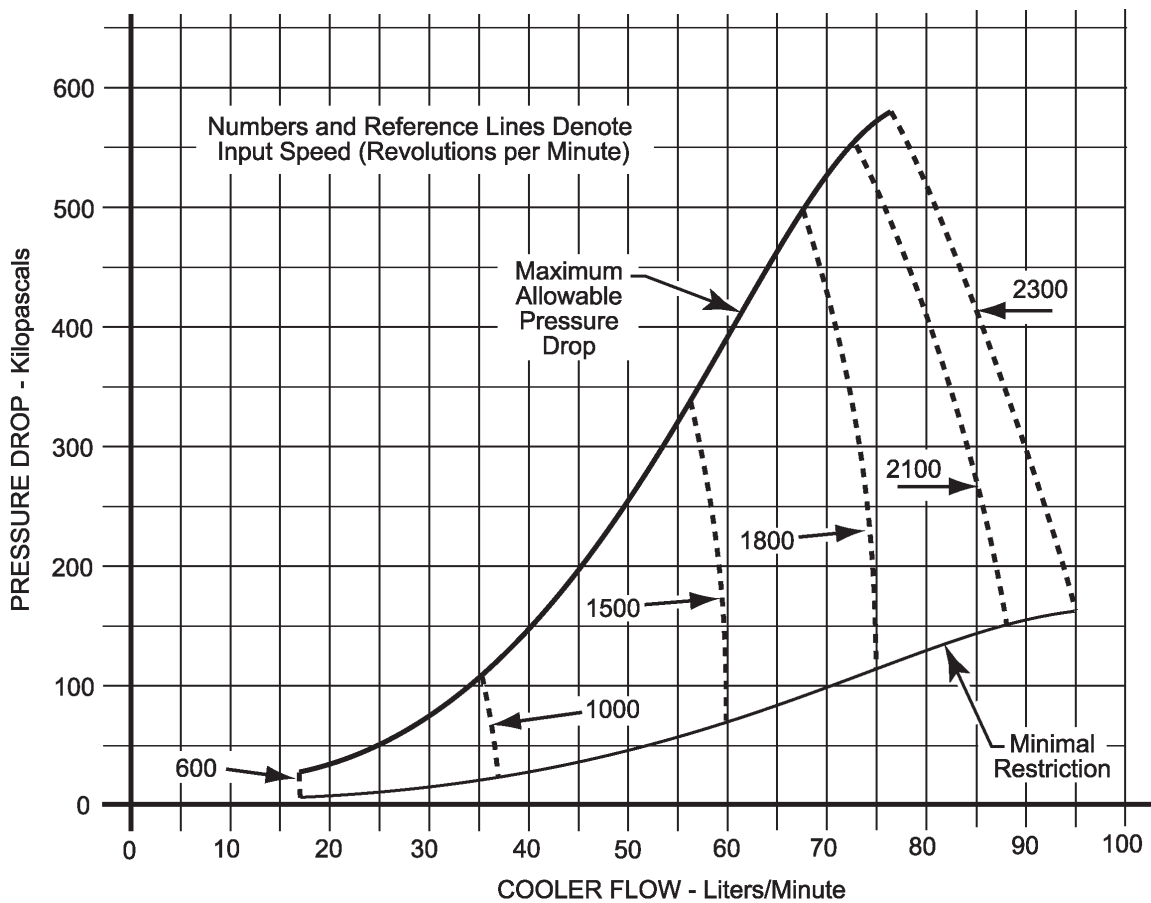
NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.3 COOLER CIRCUIT FLOW AND RESTRICTION NON-RETARDER – CONVERTER OPERATION* (METRIC UNITS)

COOLER FLOW VERSUS PRESSURE DROP

| INPUT SPEED Revolutions Per Minute (rpm) | AT MINIMAL PRESSURE DROP | | AT MAXIMUM ALLOWABLE PRESSURE DROP | |
|--|------------------------------------|---------------------------------------|------------------------------------|---------------------------------------|
| | FLOW Liters Per Minute (lpm) | PRESSURE DROP Kilopascals (kPa) | FLOW Liters Per Minute (lpm) | PRESSURE DROP Kilopascals (kPa) |
| 600 | 17 | 4 | 17 | 32 |
| 1000 | 37 | 25 | 36 | 112 |
| 1500 | 60 | 73 | 57 | 346 |
| 1800 | 75 | 111 | 68 | 491 |
| 2100 | 88 | 151 | 73 | 552 |
| 2300 | 95 | 162 | 77 | 586 |

* 93°C SUMP TEMPERATURE



C315

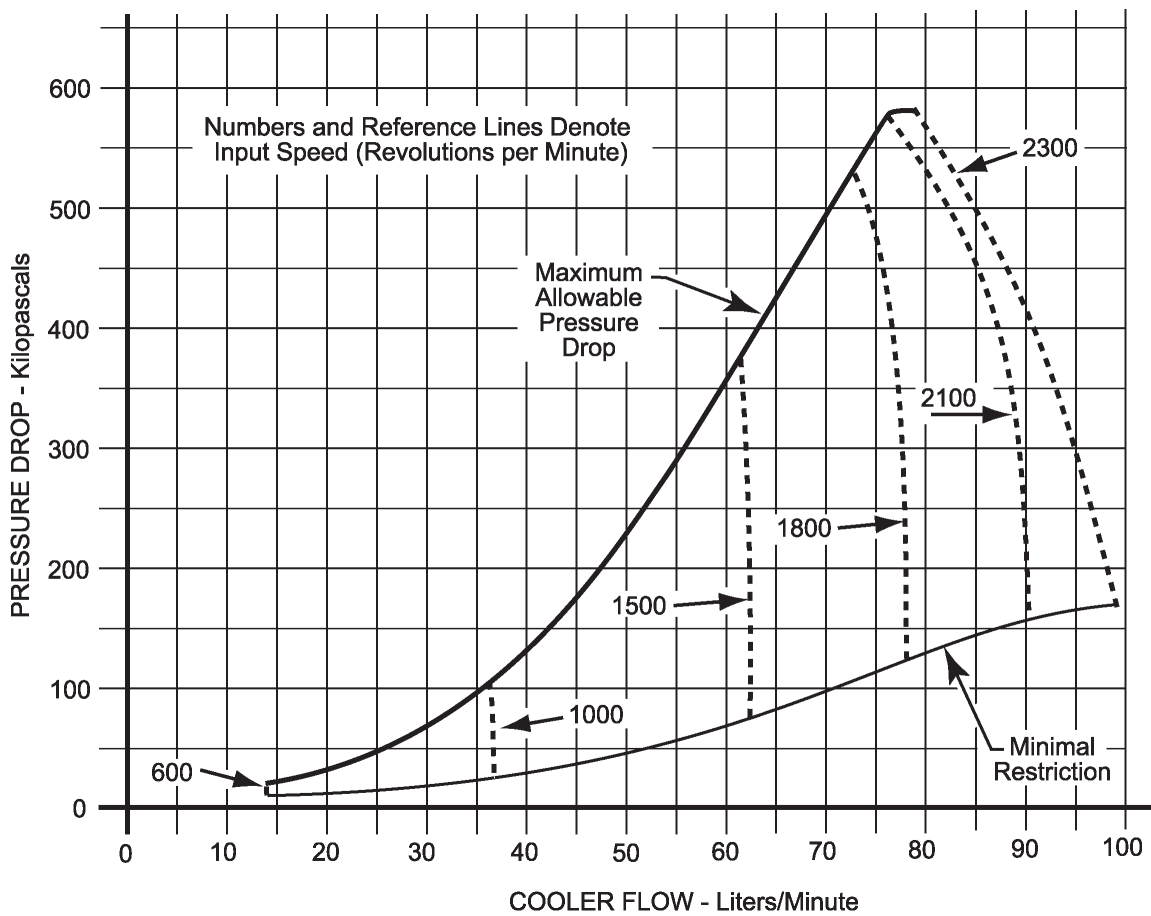
NOTE: Values in U.S. units are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.3 COOLER CIRCUIT FLOW AND RESTRICTION NON-RETARDER – LOCKUP OPERATION* (METRIC UNITS)

COOLER FLOW VERSUS PRESSURE DROP

| | AT MINIMAL PRESSURE DROP | | AT MAXIMUM ALLOWABLE PRESSURE DROP | |
|--|------------------------------------|---------------------------------------|------------------------------------|---------------------------------------|
| INPUT SPEED Revolutions Per Minute (rpm) | FLOW Liters Per Minute (lpm) | PRESSURE DROP Kilopascals (kPa) | FLOW Liters Per Minute (lpm) | PRESSURE DROP Kilopascals (kPa) |
| 600 | 14 | 5 | 14 | 20.5 |
| 1000 | 37 | 27 | 37 | 108 |
| 1500 | 62 | 77 | 62 | 368 |
| 1800 | 77 | 114 | 73 | 528 |
| 2100 | 91 | 154 | 76 | 574 |
| 2300 | 99 | 167 | 79 | 576 |

* 93°C SUMP TEMPERATURE



C316

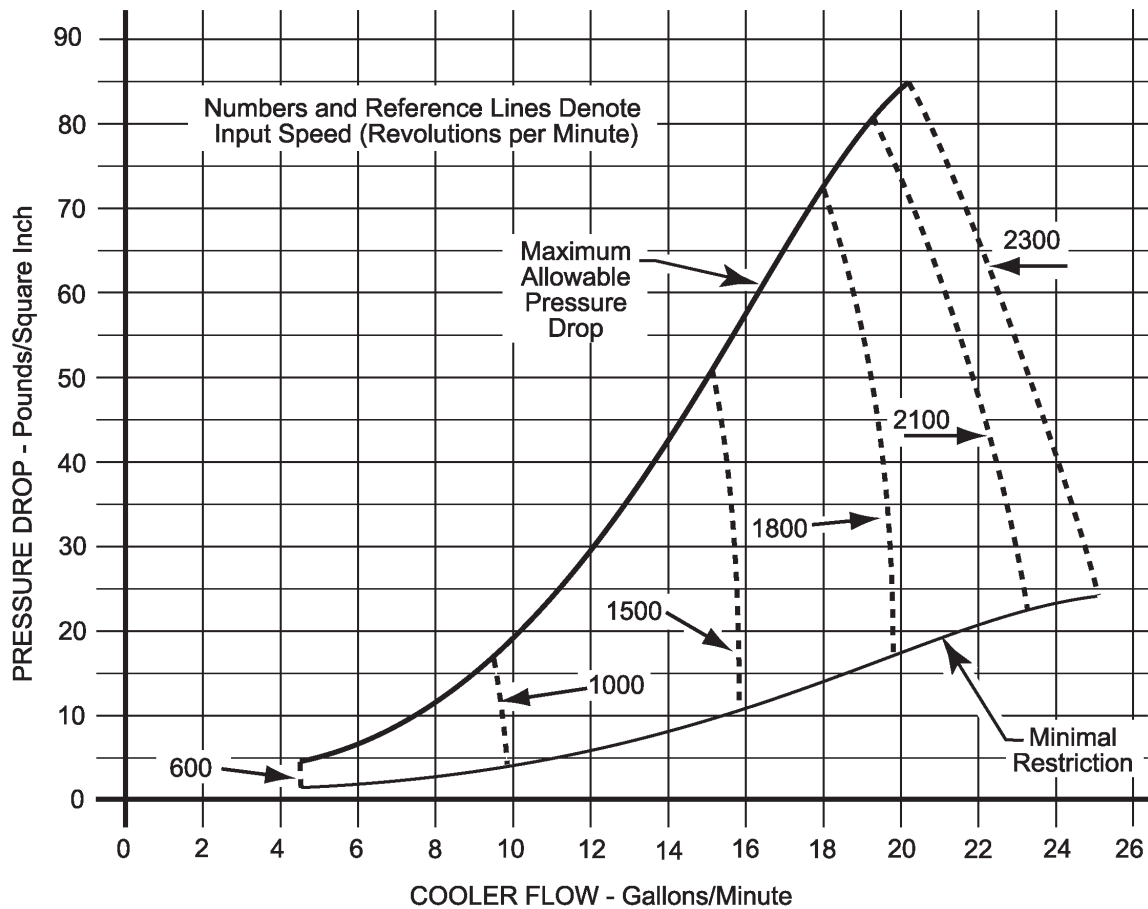
NOTE: Values in U.S. units are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.3 COOLER CIRCUIT FLOW AND RESTRICTION NON-RETARDER – CONVERTER OPERATION* (U.S. UNITS)

COOLER FLOW VERSUS PRESSURE DROP

| | AT MINIMAL PRESSURE DROP | | AT MAXIMUM ALLOWABLE PRESSURE DROP | |
|--|-------------------------------------|--|-------------------------------------|--|
| INPUT SPEED Revolutions Per Minute (rpm) | FLOW Gallons Per Minute (gpm) | PRESSURE DROP Pounds Per Square Inch (psi) | FLOW Gallons Per Minute (gpm) | PRESSURE DROP Pounds Per Square Inch (psi) |
| 600 | 4.5 | 0.6 | 4.5 | 4.6 |
| 1000 | 9.8 | 3.6 | 9.5 | 16.2 |
| 1500 | 15.8 | 10.5 | 15.0 | 50.2 |
| 1800 | 19.8 | 16.1 | 18.0 | 71.2 |
| 2100 | 23.2 | 21.9 | 19.2 | 80.0 |
| 2300 | 25.0 | 23.5 | 20.3 | 85.0 |

* 200°F SUMP TEMPERATURE



C313

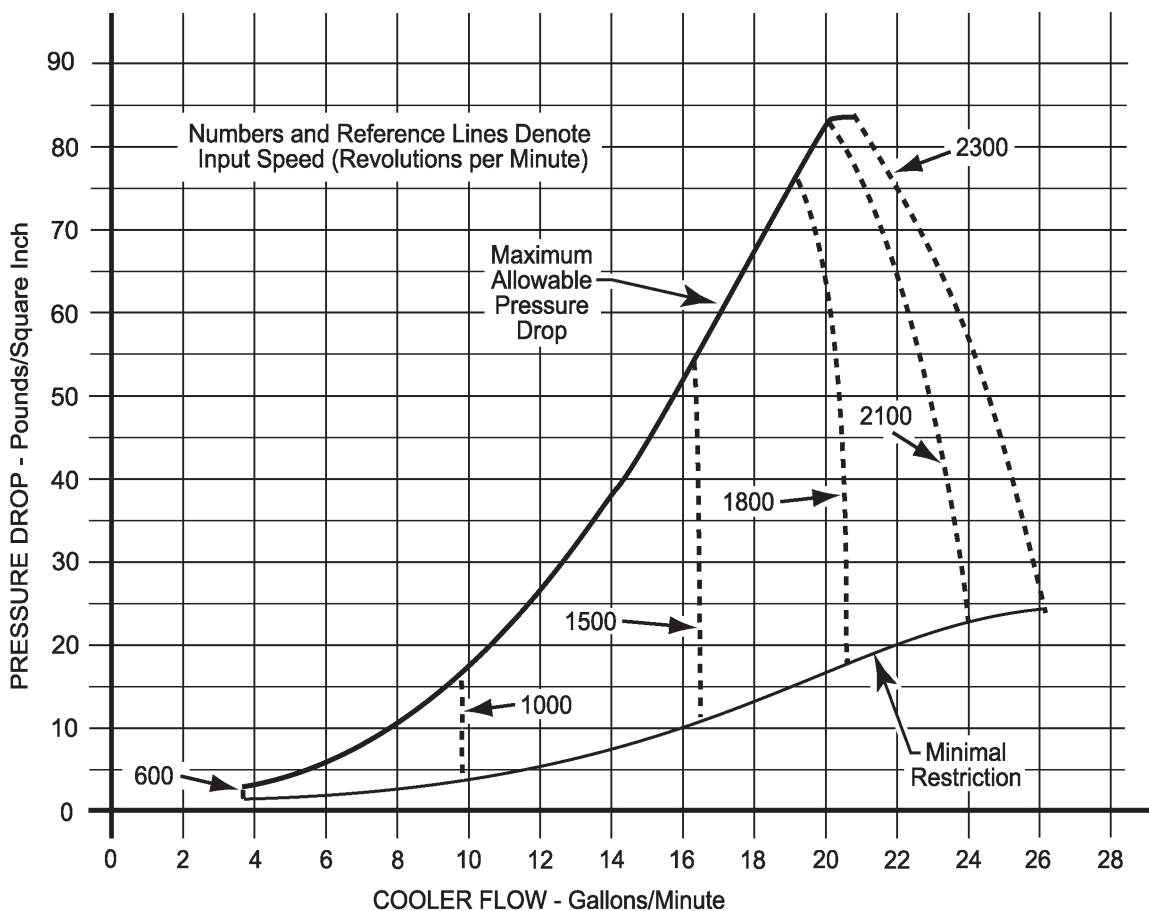
NOTE: Values in U.S. units are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.3 COOLER CIRCUIT FLOW AND RESTRICTION NON-RETARDER – LOCKUP OPERATION* (U.S. UNITS)

COOLER FLOW VERSUS PRESSURE DROP

| INPUT SPEED Revolutions Per Minute (rpm) | AT MINIMAL PRESSURE DROP | | AT MAXIMUM ALLOWABLE PRESSURE DROP | |
|--|-------------------------------------|--|-------------------------------------|--|
| | FLOW Gallons Per Minute (gpm) | PRESSURE DROP Pounds Per Square Inch (psi) | FLOW Gallons Per Minute (gpm) | PRESSURE DROP Pounds Per Square Inch (psi) |
| 600 | 3.7 | 0.7 | 3.7 | 3.0 |
| 1000 | 9.8 | 3.9 | 9.8 | 15.6 |
| 1500 | 16.4 | 11.2 | 16.4 | 53.4 |
| 1800 | 20.3 | 16.5 | 19.2 | 76.6 |
| 2100 | 24.0 | 22.3 | 20.1 | 83.2 |
| 2300 | 26.1 | 24.2 | 20.8 | 83.5 |

* 200°F SUMP TEMPERATURE



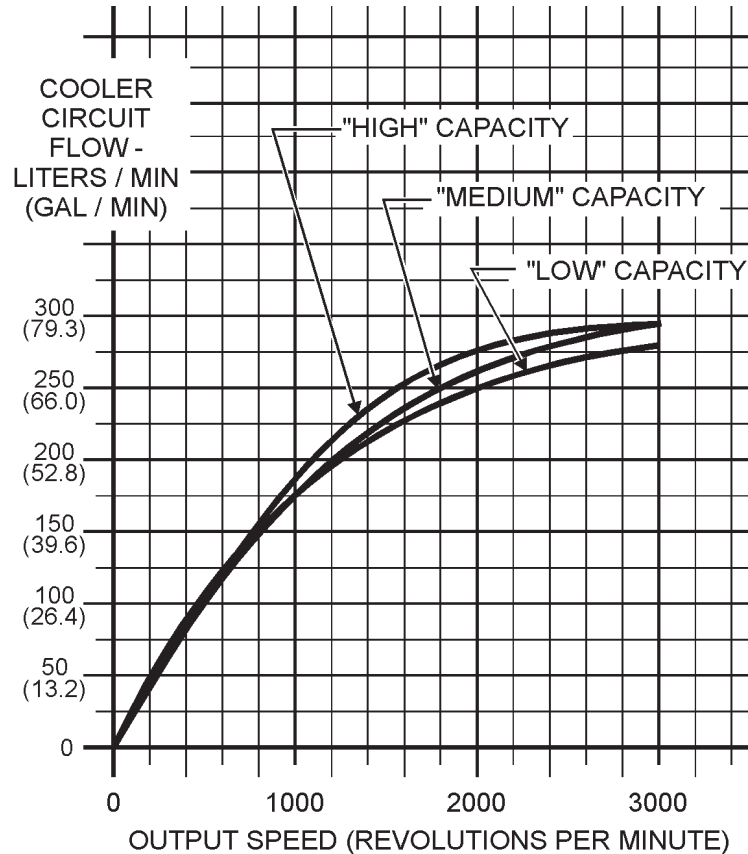
C314

NOTE: Values in U.S. units are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

16.3 COOLER CIRCUIT FLOW AND RESTRICTION RETARDER OPERATION

Retarder circuit flow measured under the following test conditions:

- 88°C (190°F) fluid temperature
- circuit pressure drop (ΔP) set at 277 kPa (40 psi) for a flow of 215 liters/minute (57 gallons/minute)



A662

NOTE: Allison Transmission has specific pressure drop requirements for retarder installations that are integrated with Electronic Braking Systems (EBS). Refer to [Technical Document 182 \(TD-182\), Use of EBS with Allison Transmissions](#), for details.

NOTE: Values in U.S. units shown in parenthesis () are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

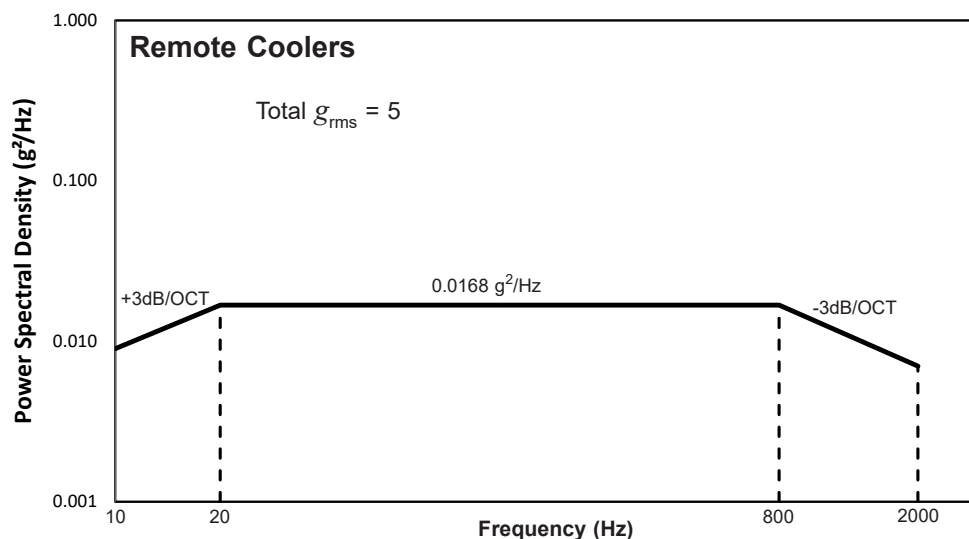
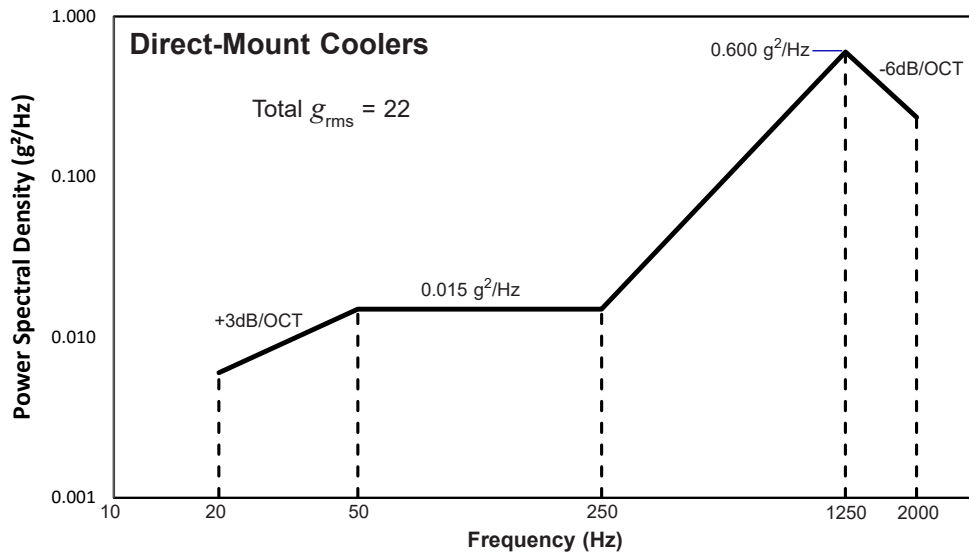
17.0 ALLISON OIL-TO-WATER COOLER CHARACTERISTICS

17.1 COOLANT FILL VOLUME FOR ALLISON COOLERS

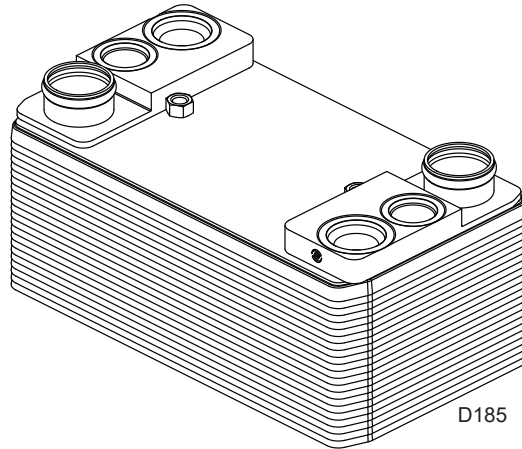
| PARAMETER | VALUE | UNIT |
|--|-----------|-----------------|
| Coolant Fill Volume for Allison Coolers | | |
| Retarder / Sump Cooler | 3.0 (3.2) | liters (quarts) |
| Direct-Mount, Standard-Capacity Cooler | 2.0 (2.1) | liters (quarts) |
| Direct-Mount, High-Capacity Cooler | 3.5 (3.7) | liters (quarts) |

17.2 VIBRATION PROFILES FOR ALLISON COOLERS

Allison Direct-Mount and Remote Coolers are designed to meet the random vibration profiles shown here. The vibration profiles are provided for vehicle builders to use in their installation design.

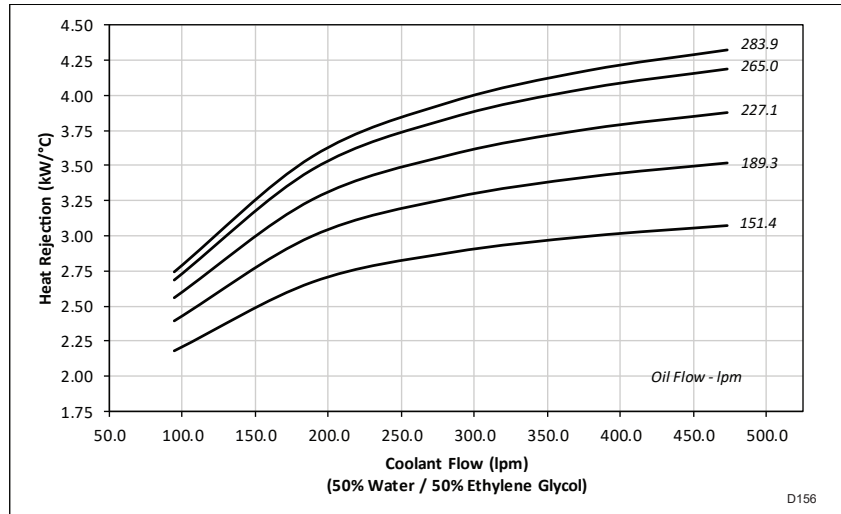


17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (METRIC UNITS)



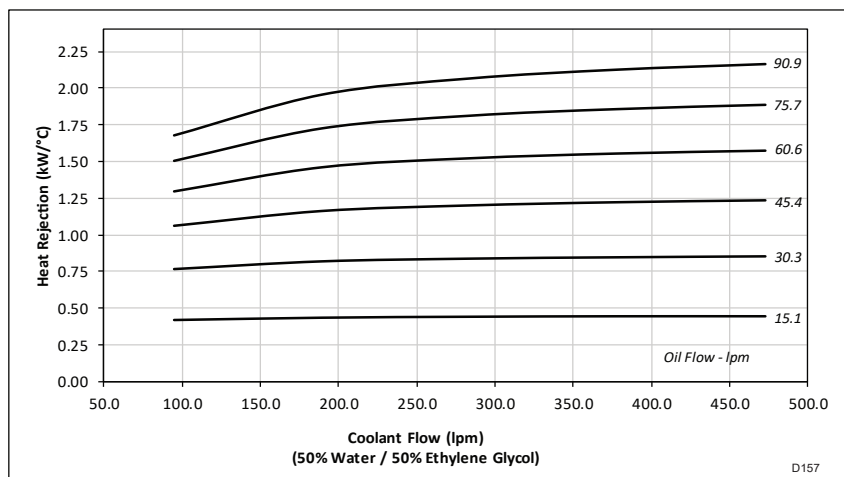
**RETARDER-SIDE
HEAT
REJECTION**

**RETARDER
MODE**



**RETARDER-SIDE
HEAT
REJECTION**

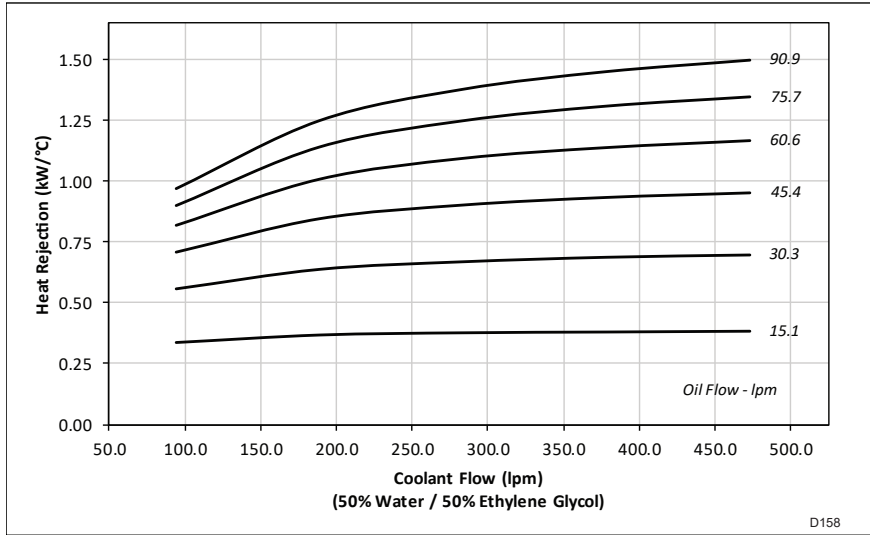
**CONVERTER
MODE**



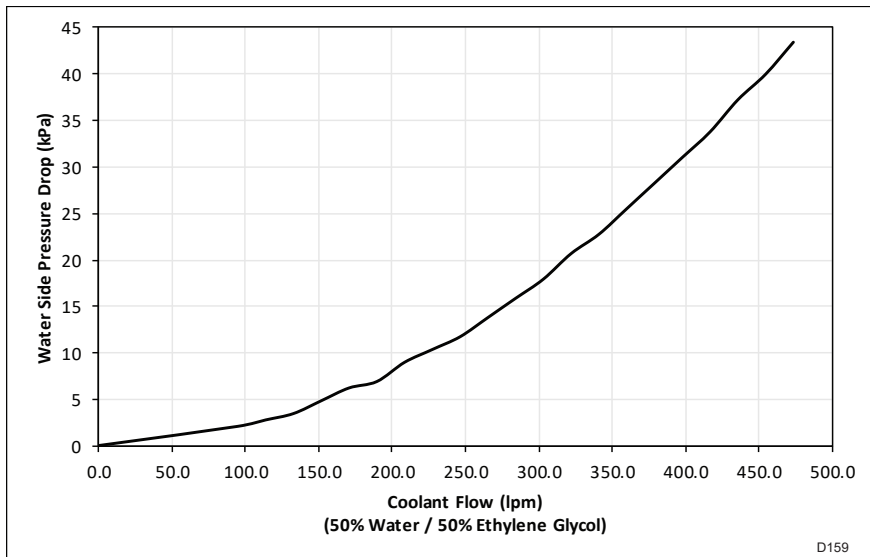
— continued on next page —

17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (METRIC UNITS - CONT'D)

SUMP-SIDE HEAT REJECTION



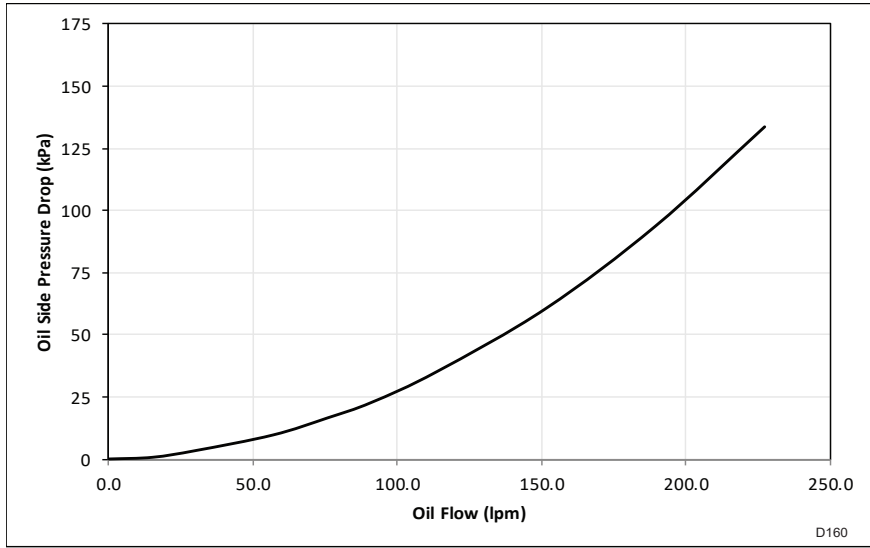
COOLANT-SIDE PRESSURE DROP



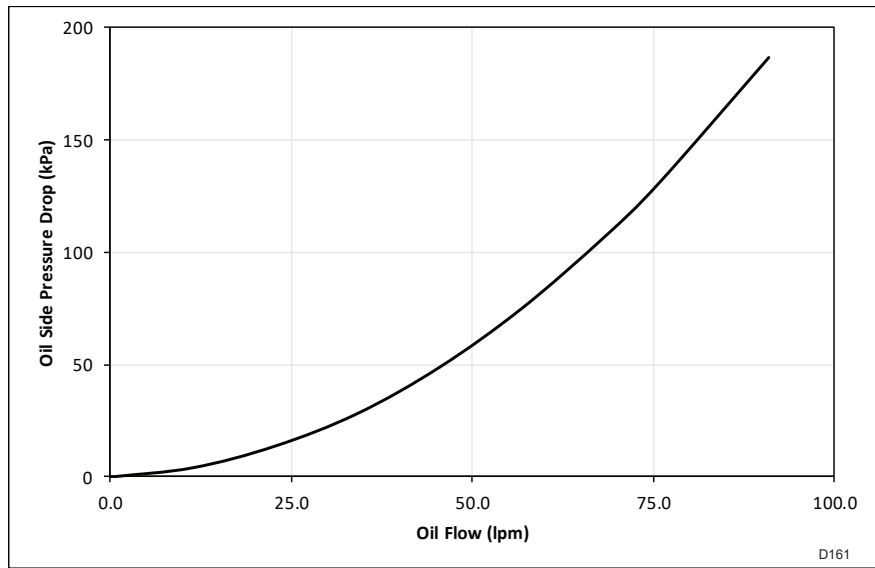
— continued on next page —

17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (METRIC UNITS - CONT'D)

RETARDER-SIDE OIL PRESSURE DROP

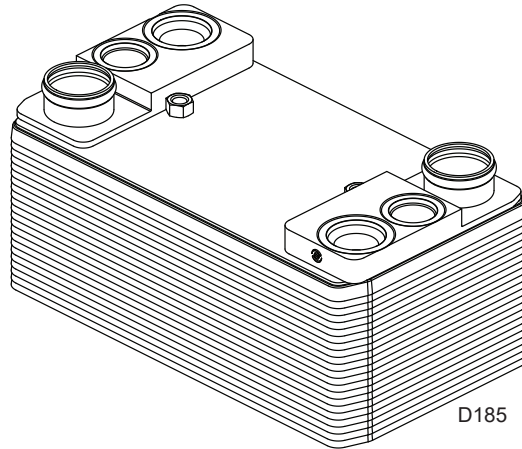


SUMP-SIDE OIL PRESSURE DROP



— continued on next page —

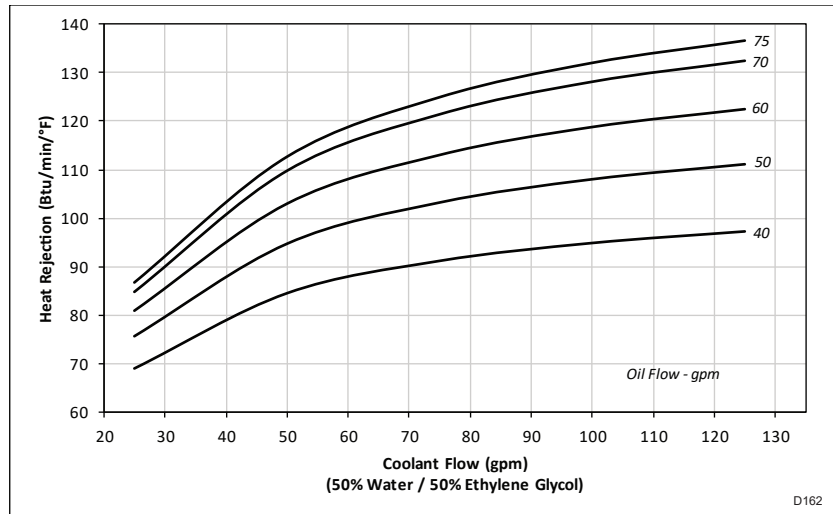
17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (U.S. UNITS)



D185

**RETARDER-SIDE
HEAT
REJECTION

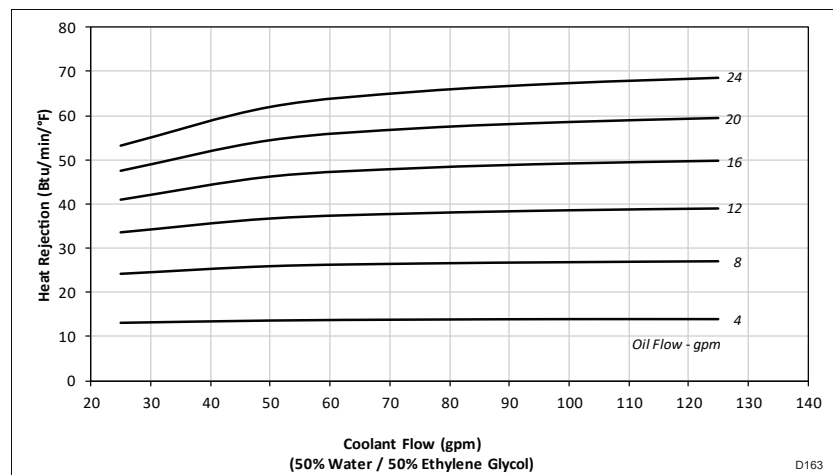
RETARDER
MODE**



D162

**RETARDER-SIDE
HEAT
REJECTION

CONVERTER
MODE**

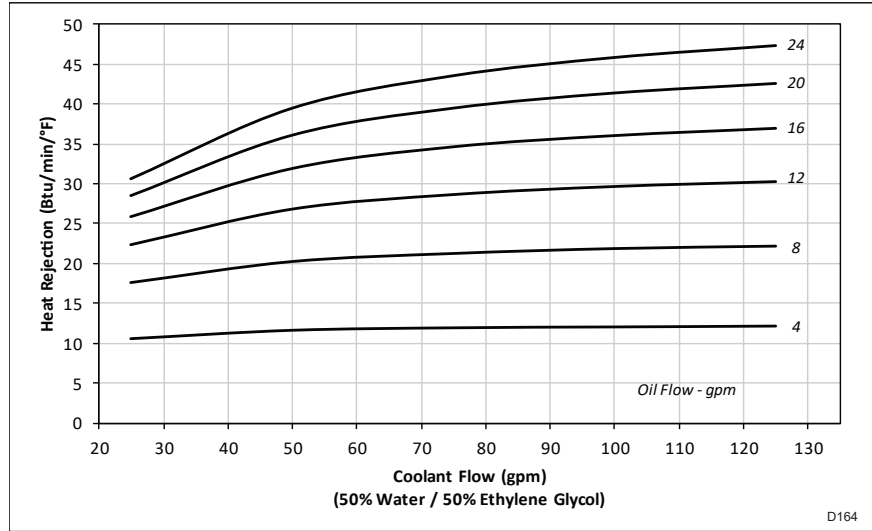


D163

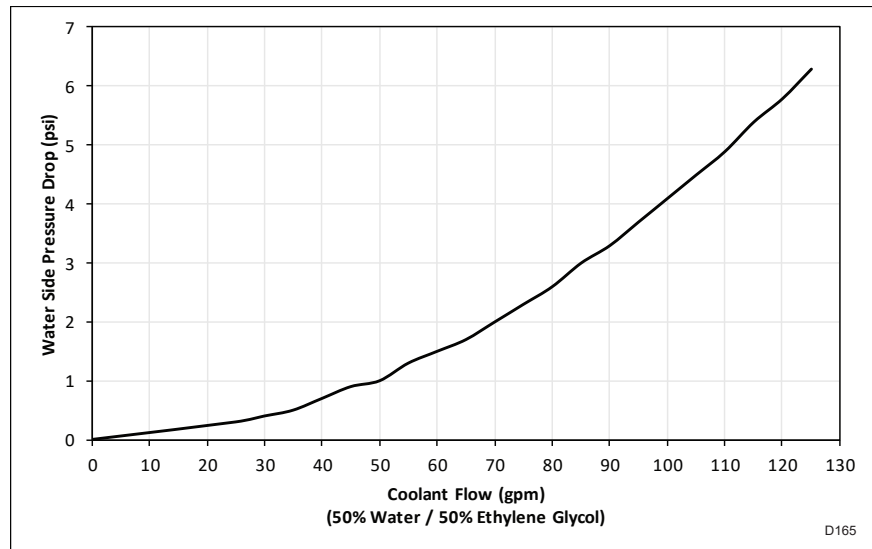
— continued on next page —

17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (U.S. UNITS - CONT'D)

SUMP-SIDE HEAT REJECTION



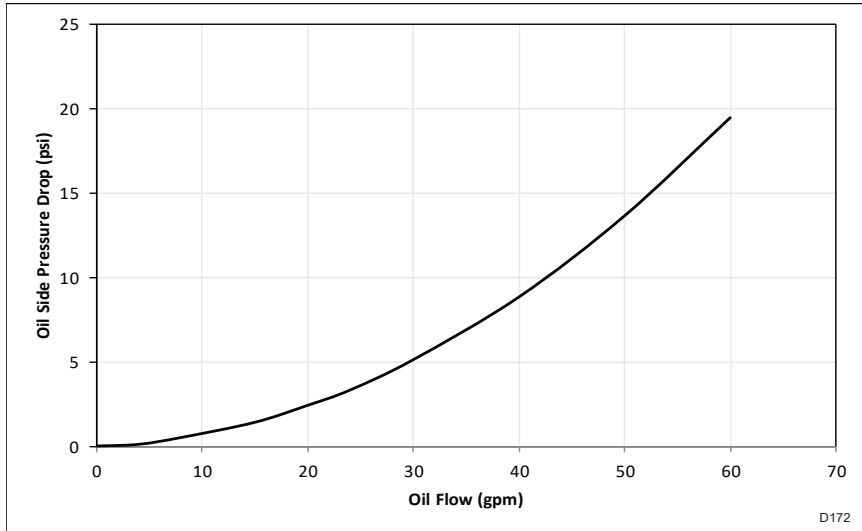
COOLANT-SIDE PRESSURE DROP



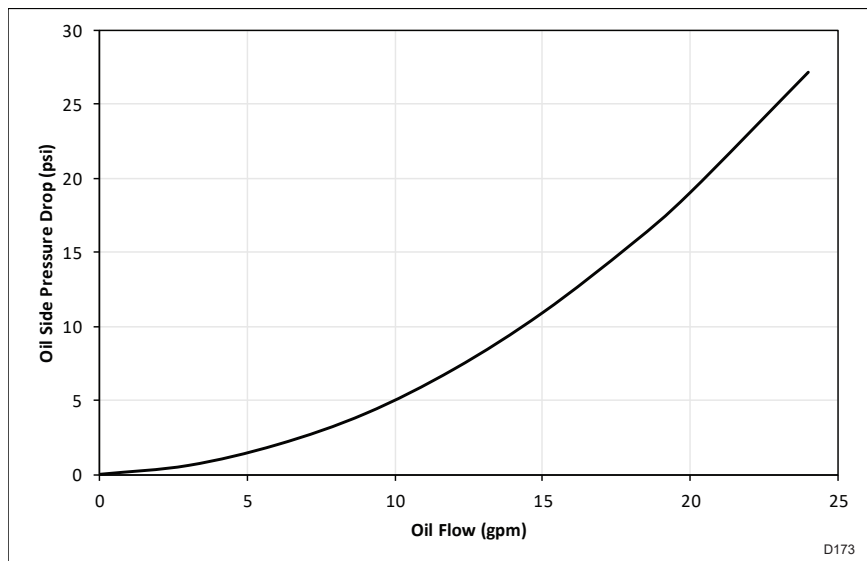
— continued on next page —

17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (U.S. UNITS - CONT'D)

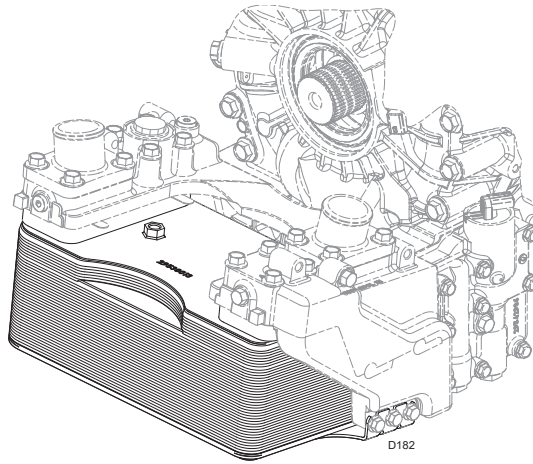
RETARDER-SIDE OIL PRESSURE DROP



SUMP-SIDE OIL PRESSURE DROP

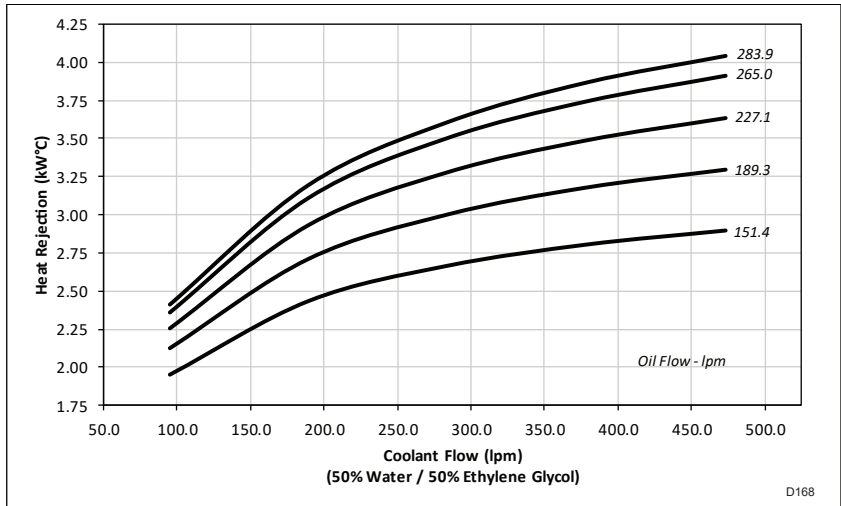


17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (METRIC UNITS)



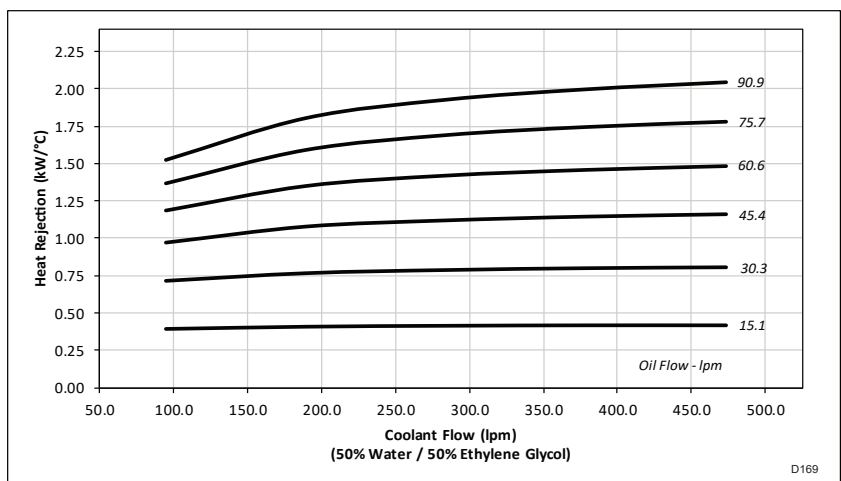
**RETARDER-SIDE
HEAT
REJECTION**

**RETARDER
MODE**



**RETARDER-SIDE
HEAT
REJECTION**

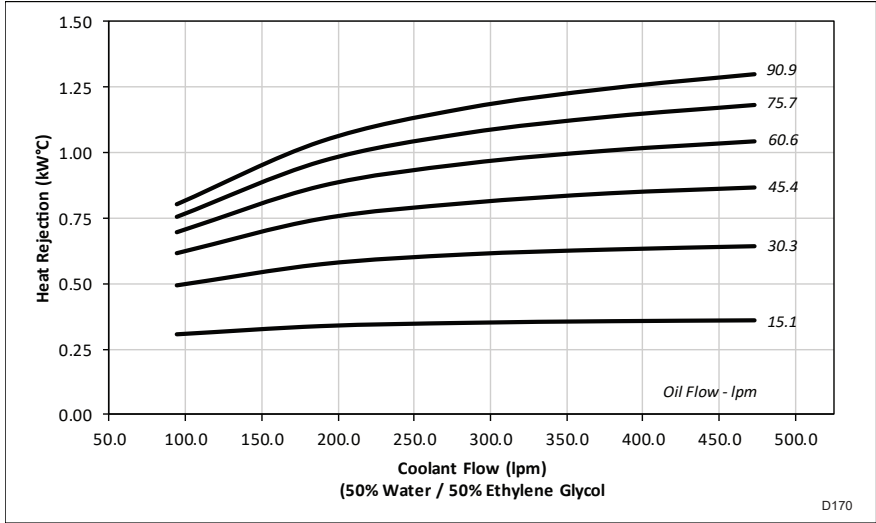
**CONVERTER
MODE**



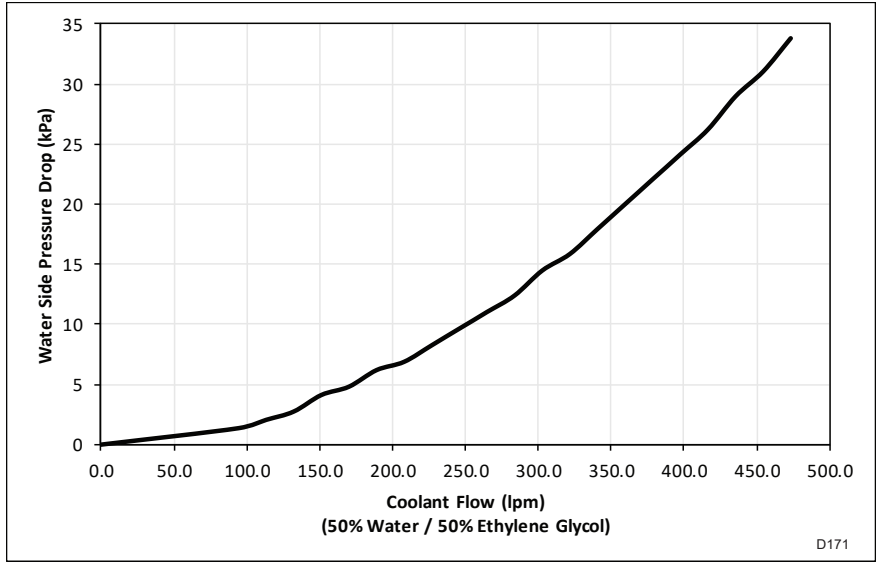
— continued on next page —

17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (METRIC UNITS - CONT'D)

**SUMP-SIDE
HEAT
REJECTION**



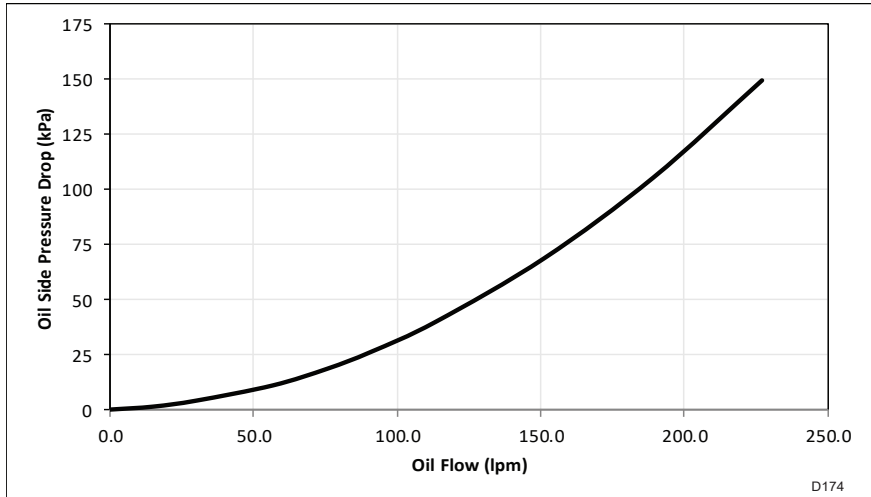
**COOLANT-SIDE
PRESSURE
DROP**



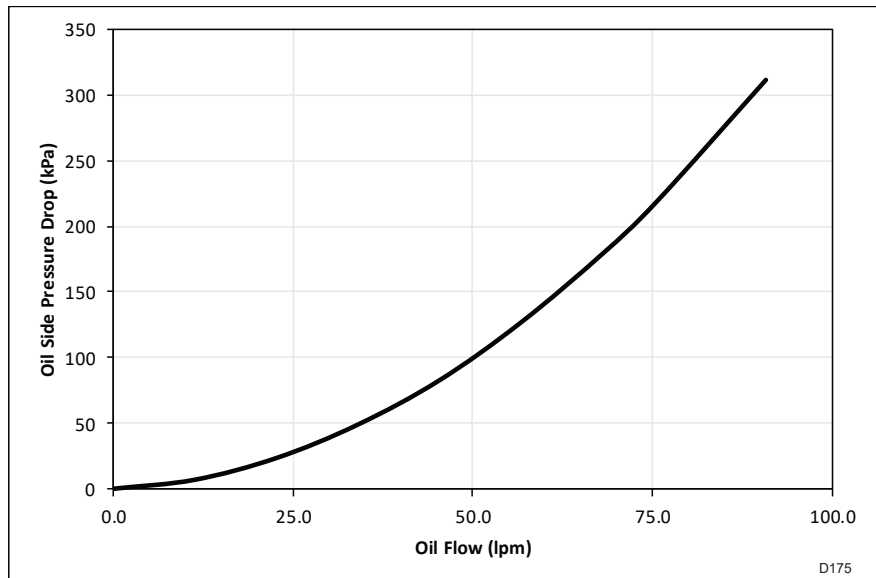
— continued on next page —

17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (METRIC UNITS - CONT'D)

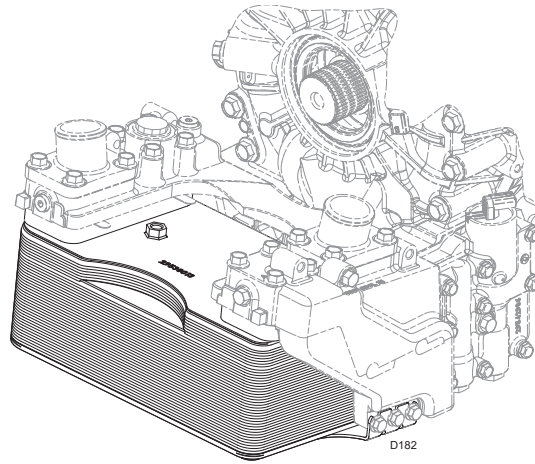
RETARDER-SIDE OIL PRESSURE DROP



SUMP-SIDE OIL PRESSURE DROP

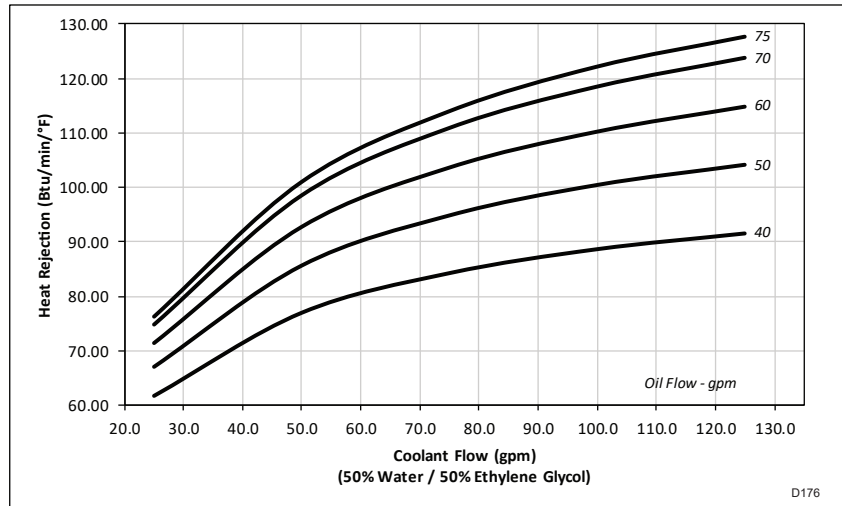


17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (U.S. UNITS)



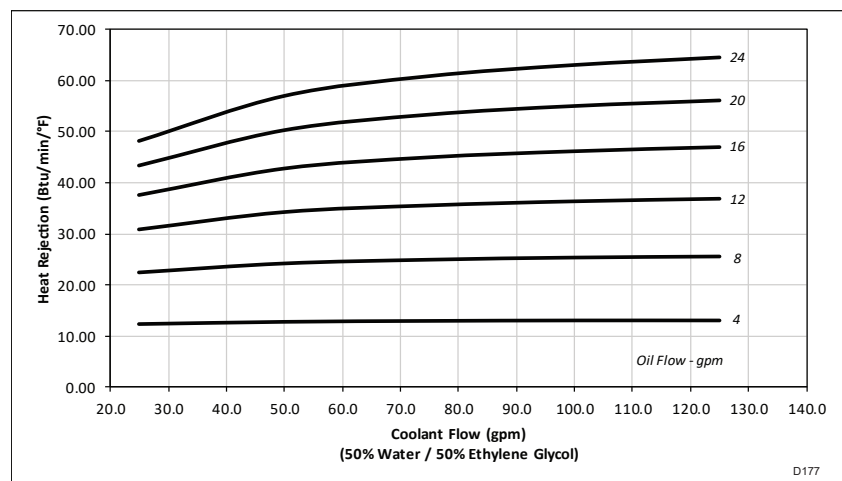
**RETARDER-SIDE
HEAT
REJECTION

RETARDER
MODE**



**RETARDER-SIDE
HEAT
REJECTION

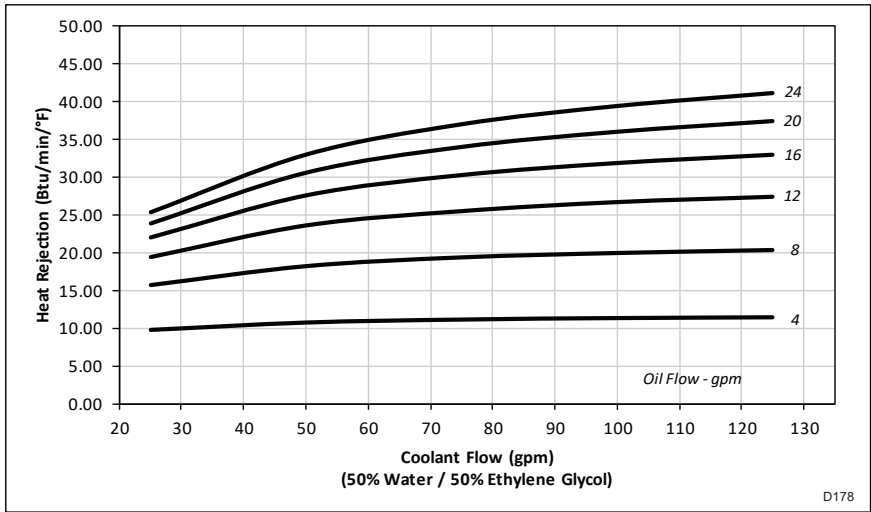
CONVERTER
MODE**



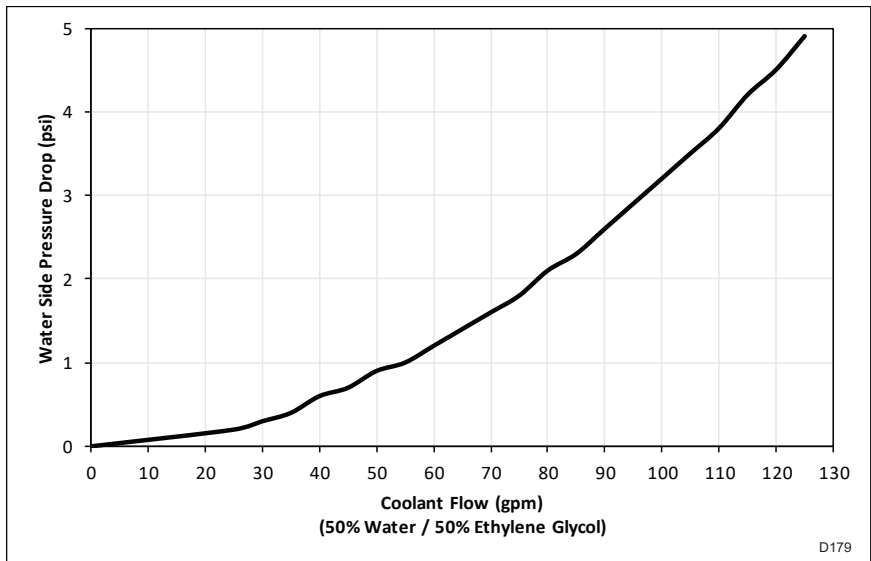
— continued on next page —

17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (U.S. UNITS - CONT'D)

SUMP-SIDE HEAT REJECTION



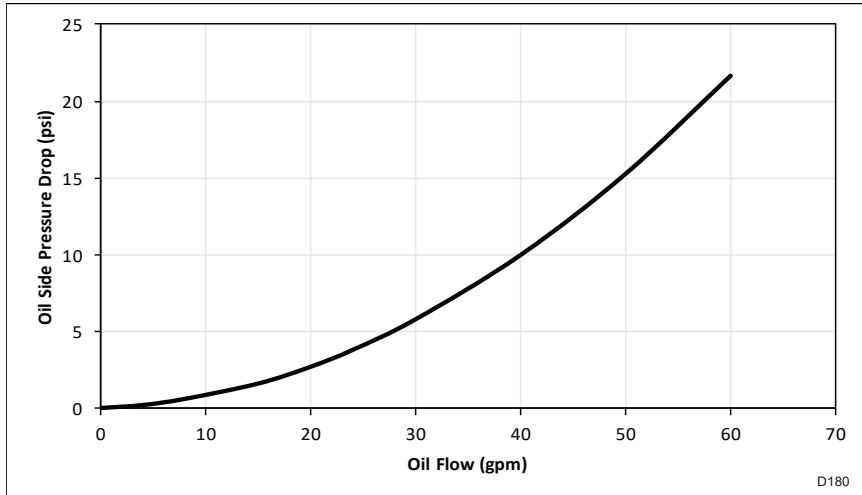
COOLANT-SIDE PRESSURE DROP



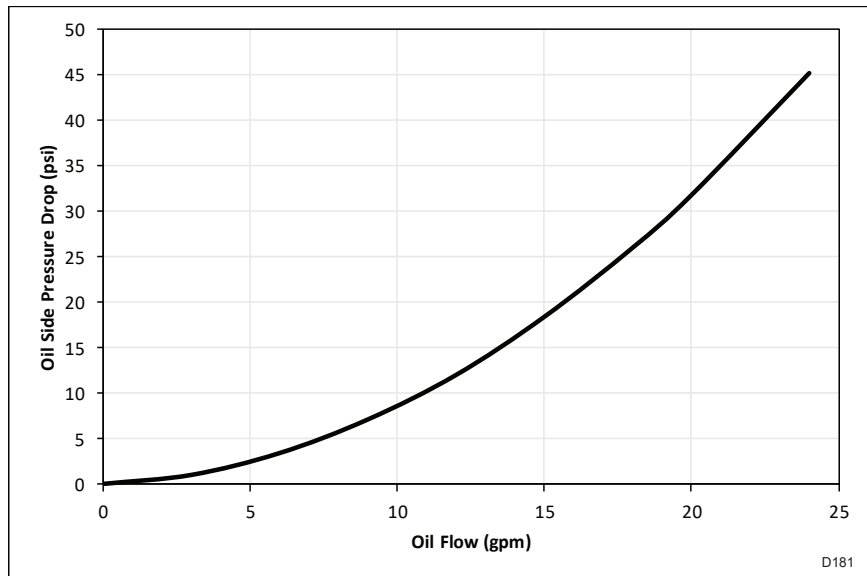
— continued on next page —

17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (U.S. UNITS - CONT'D)

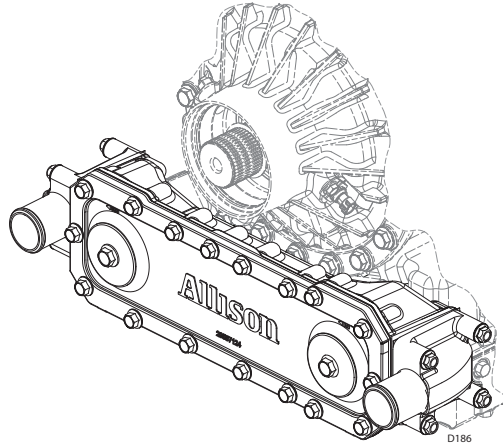
RETARDER-SIDE OIL PRESSURE DROP



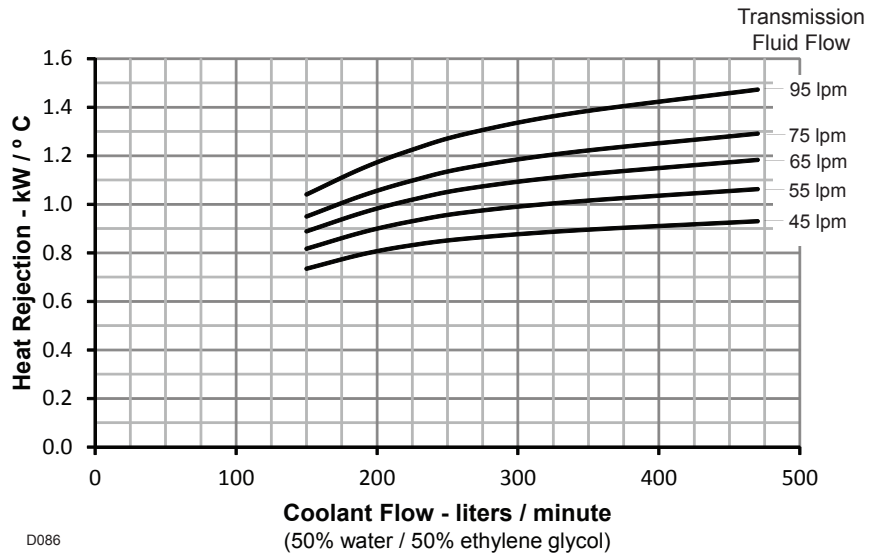
SUMP-SIDE OIL PRESSURE DROP



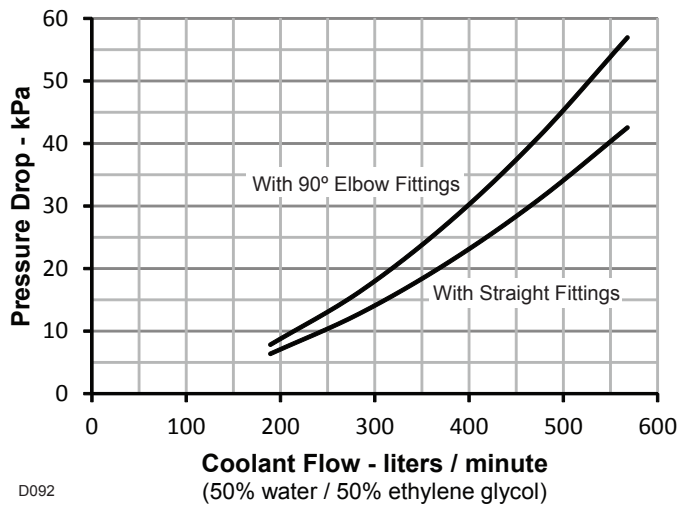
17.5 DIRECT-MOUNT, STANDARD-CAPACITY COOLER (29555184) CHARACTERISTICS, NON-RETARDER (METRIC UNITS)



HEAT REJECTION



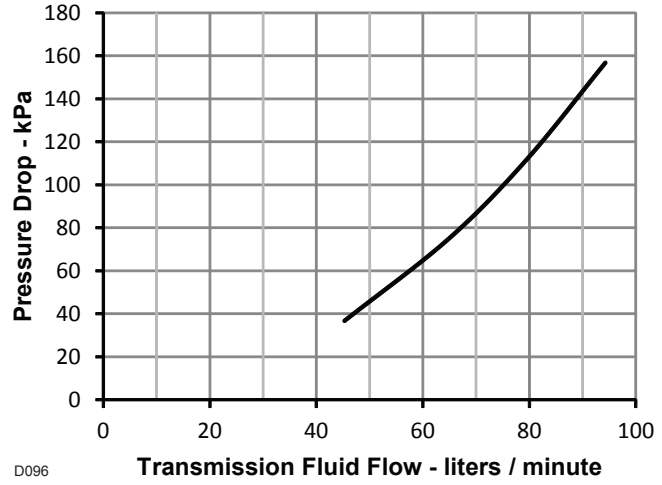
COOLANT-SIDE PRESSURE DROP



— continued on next page —

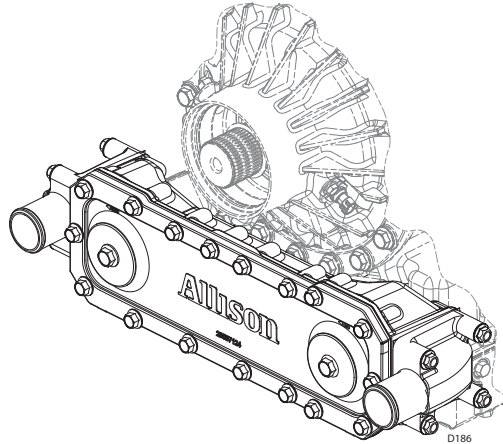
**17.5 DIRECT-MOUNT, STANDARD-CAPACITY COOLER (29555184)
CHARACTERISTICS, NON-RETARDER (METRIC UNITS - CONT'D)**

**OIL-SIDE
PRESSURE
DROP**

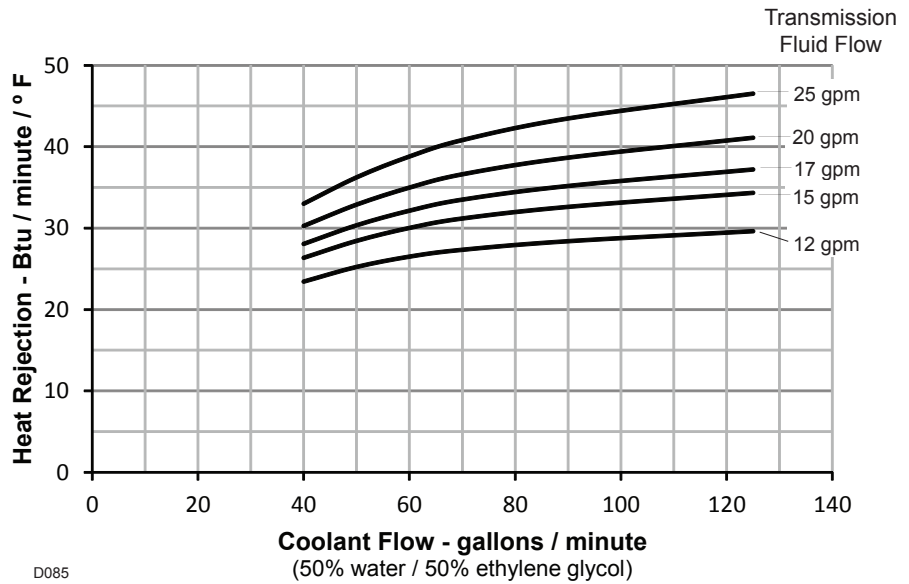


D096

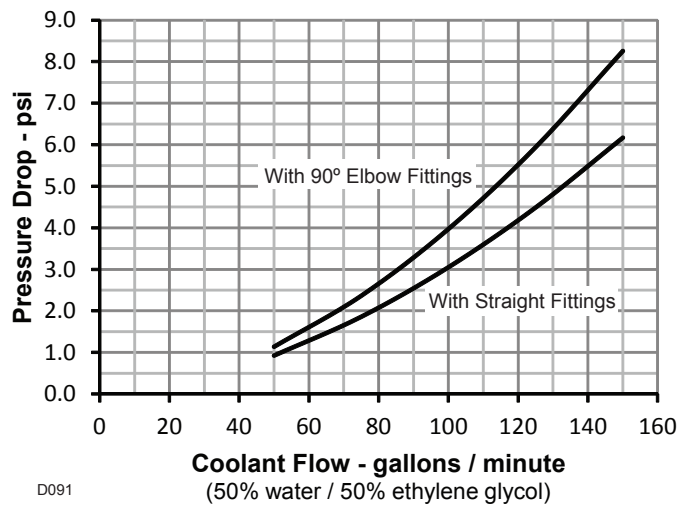
17.5 DIRECT-MOUNT, STANDARD-CAPACITY COOLER (29555184) CHARACTERISTICS, NON-RETARDER (U.S. UNITS)



HEAT REJECTION



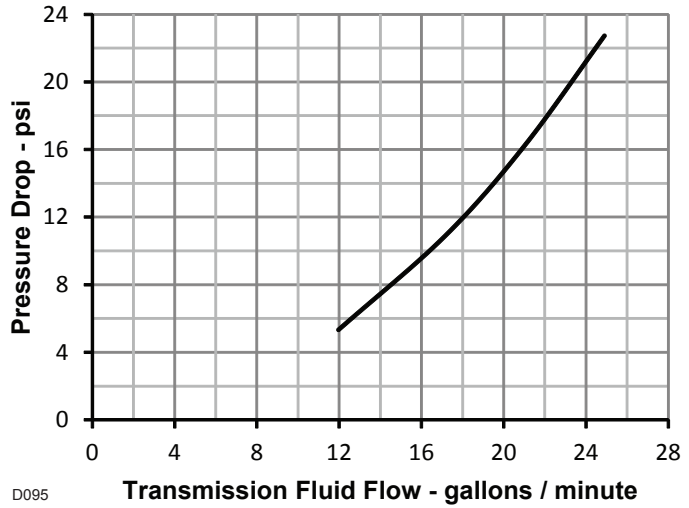
COOLANT-SIDE PRESSURE DROP



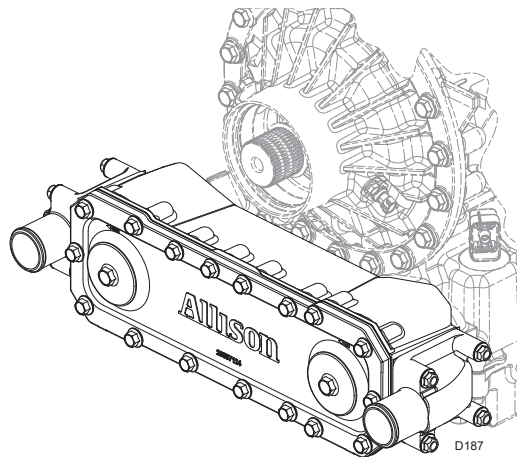
— continued on next page —

**17.5 DIRECT-MOUNT, STANDARD-CAPACITY COOLER (29555184)
CHARACTERISTICS, NON-RETARDER (U.S. UNITS - CONT'D)**

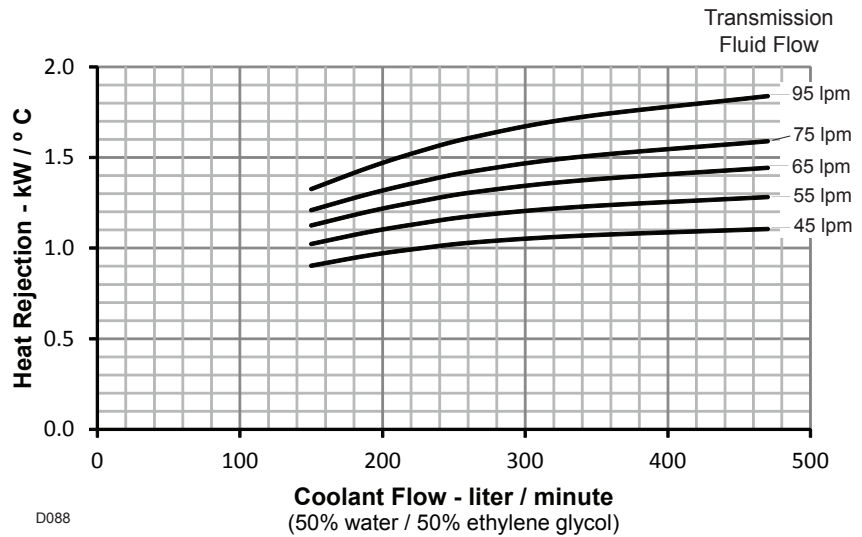
**OIL-SIDE
PRESSURE
DROP**



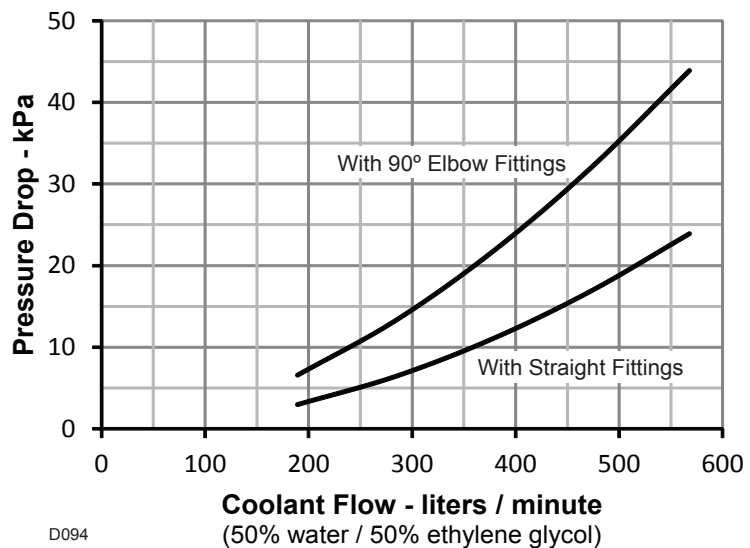
17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183) CHARACTERISTICS, NON-RETARDER (METRIC UNITS)



HEAT REJECTION



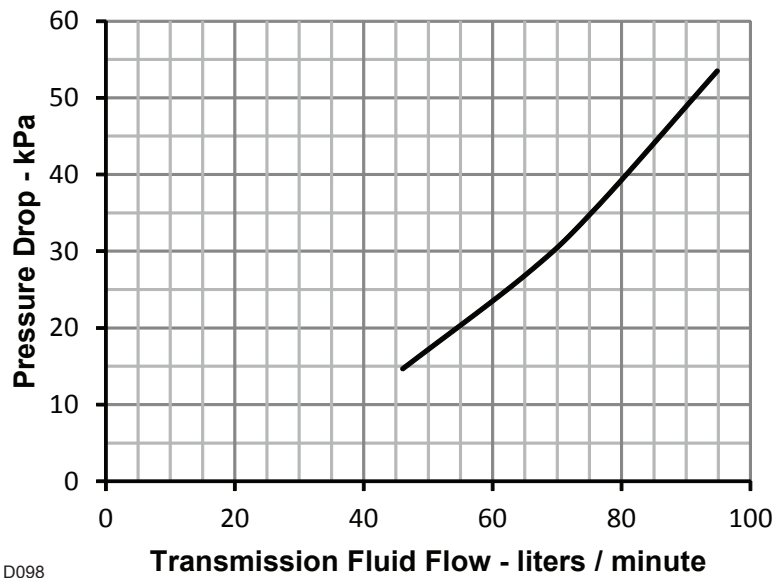
COOLANT-SIDE PRESSURE DROP



— continued on next page —

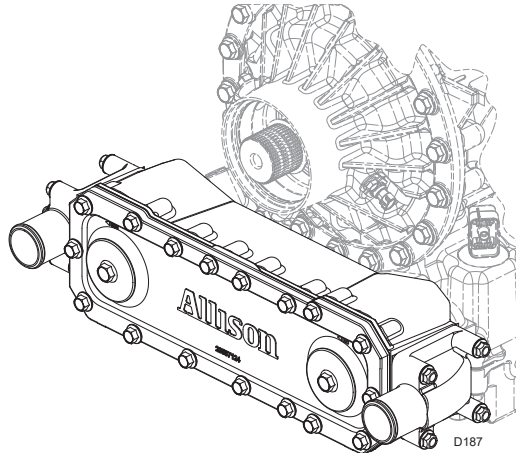
**17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183)
CHARACTERISTICS, NON-RETARDER (METRIC UNITS - CONT'D)**

**OIL-SIDE
PRESSURE
DROP**

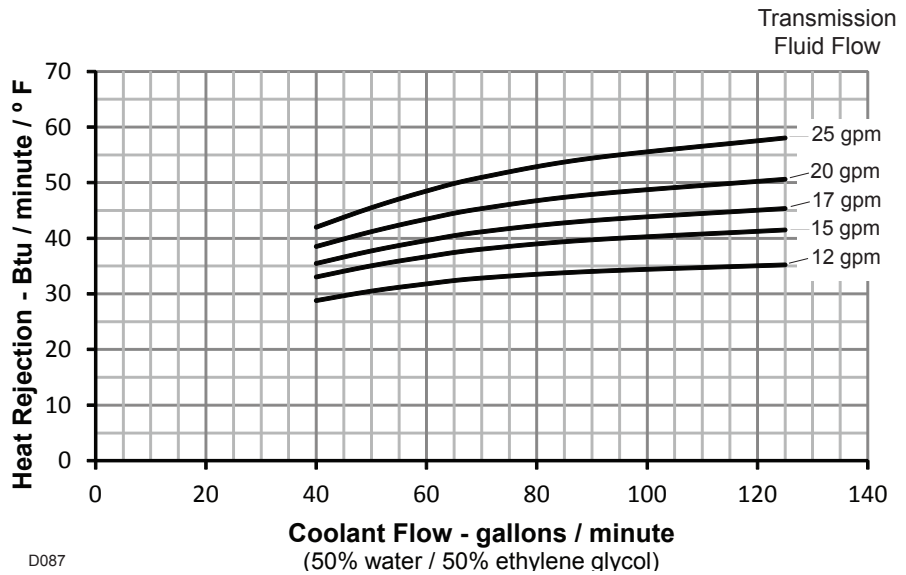


D098

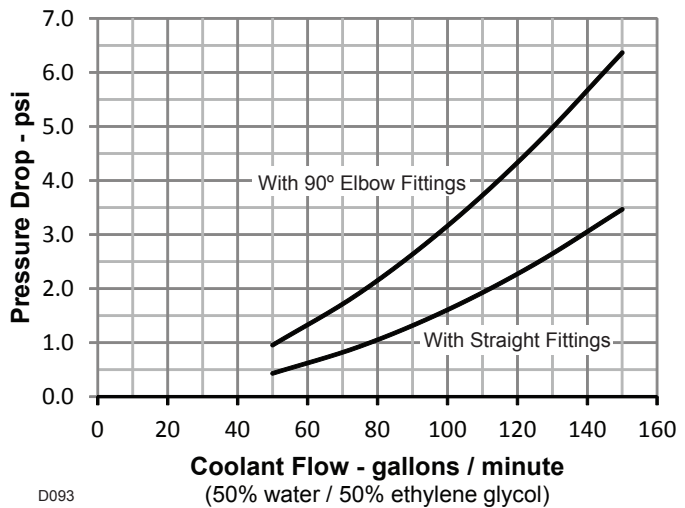
17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183) CHARACTERISTICS, NON-RETARDER (U.S. UNITS)



HEAT REJECTION



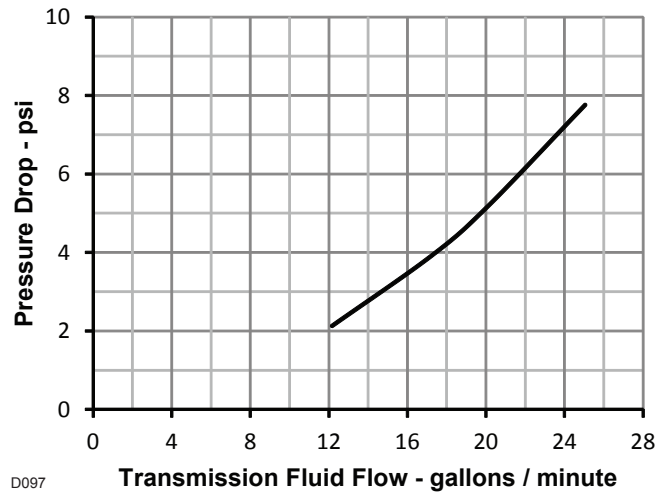
COOLANT-SIDE PRESSURE DROP



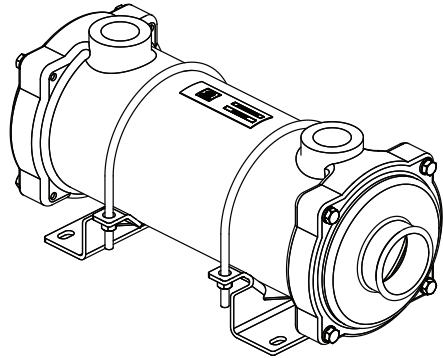
— continued on next page —

17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183) CHARACTERISTICS, NON-RETARDER (U.S. UNITS CONT'D)

**OIL-SIDE
PRESSURE
DROP**



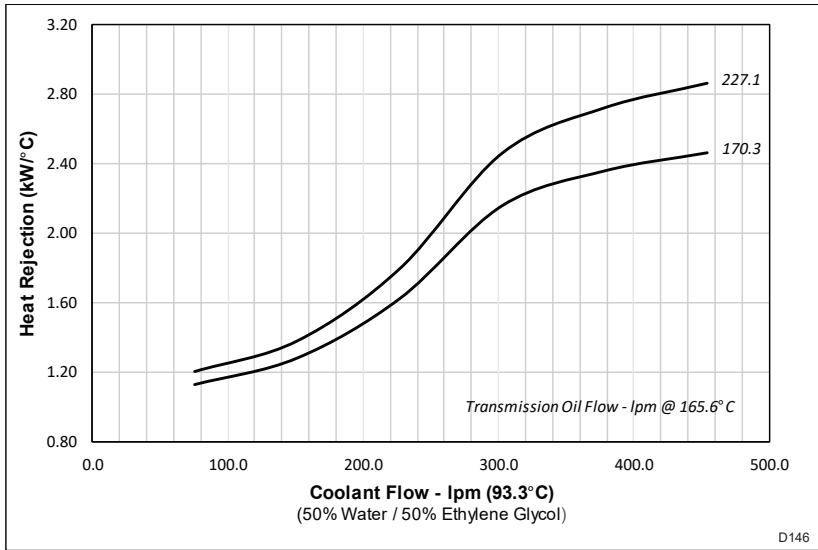
17.7 REMOTE-MOUNT TUBE & SHELL COOLER (29553529) CHARACTERISTICS NON-RETARDER & RETARDER (METRIC UNITS)



D184

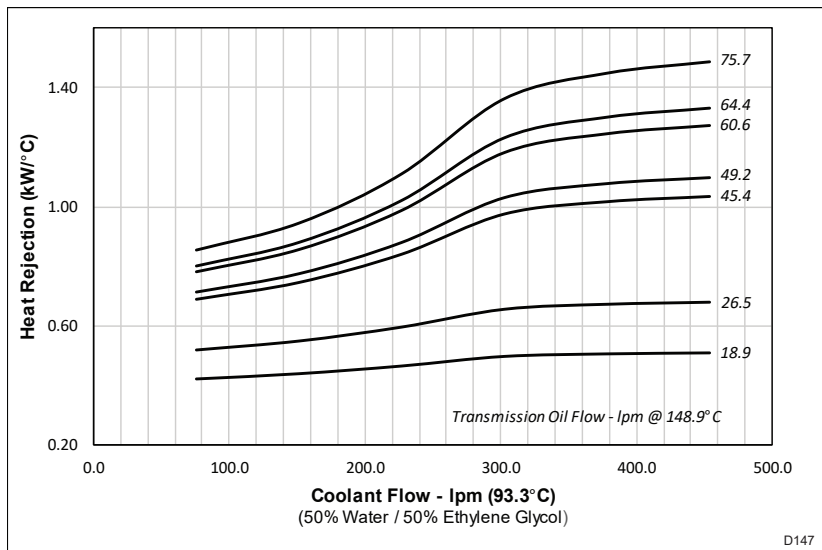
The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

HEAT REJECTION



D146

HEAT REJECTION

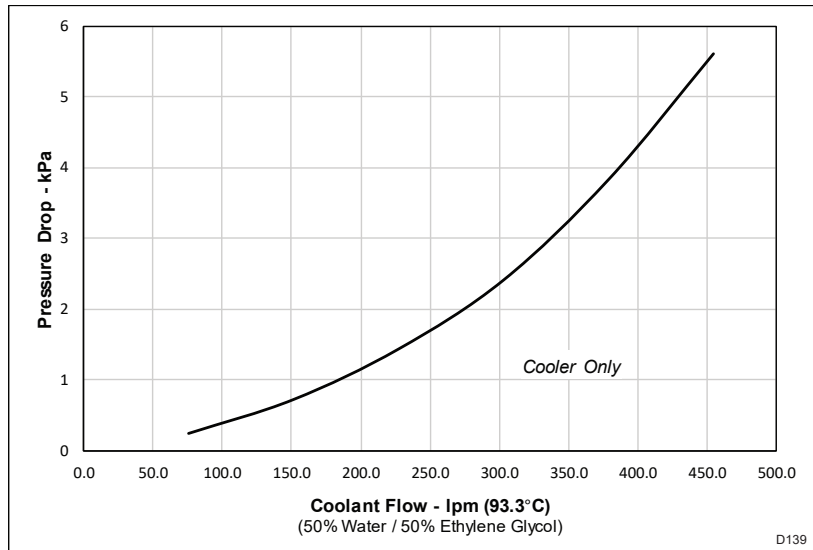


D147

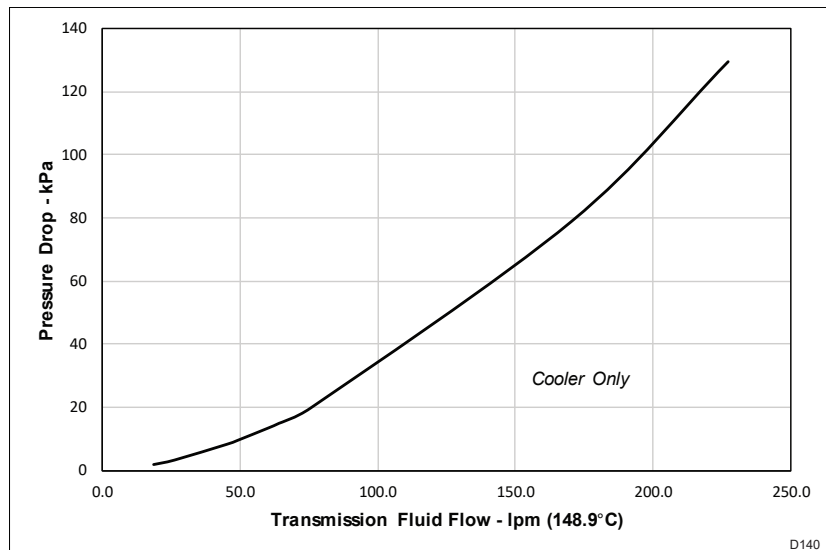
— continued on next page —

17.7 REMOTE-MOUNT TUBE & SHELL COOLER (29553529) CHARACTERISTICS NON-RETARDER & RETARDER (METRIC UNITS)

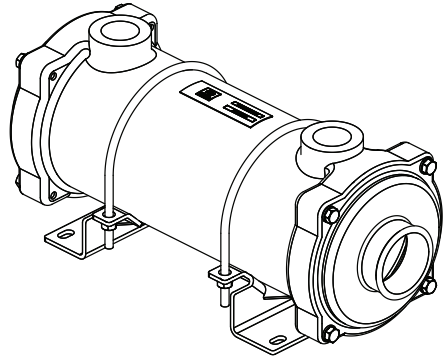
COOLANT-SIDE PRESSURE DROP



OIL-SIDE PRESSURE DROP



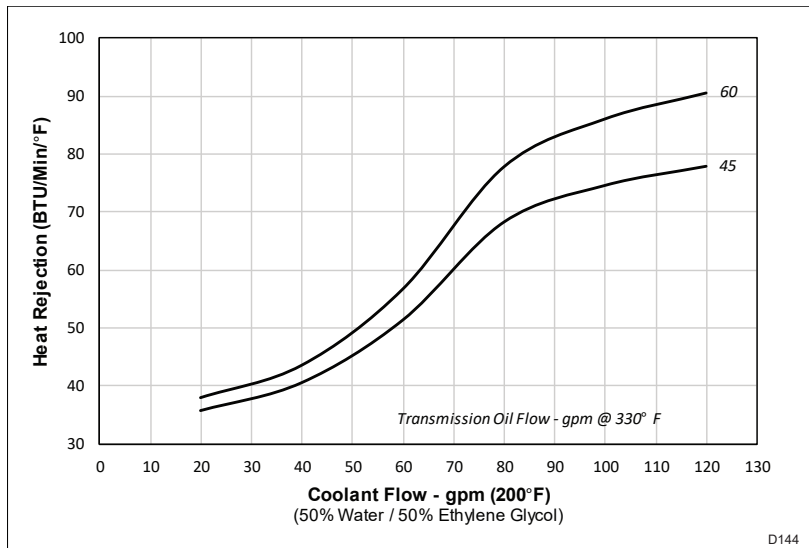
17.7 REMOTE-MOUNT TUBE & SHELL COOLER (29553529) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)



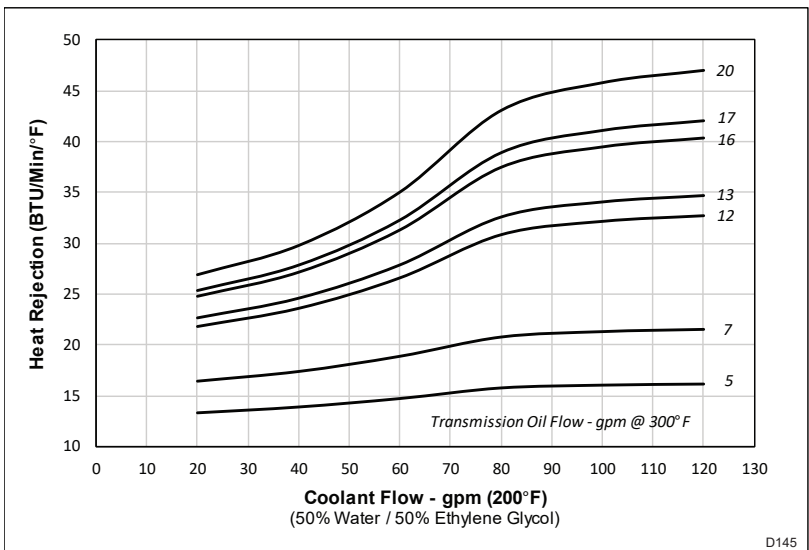
D184

The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

HEAT REJECTION



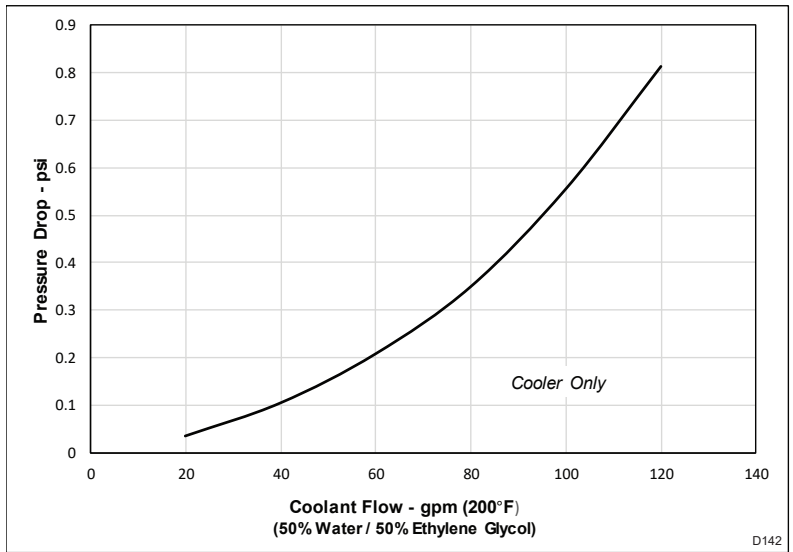
HEAT REJECTION



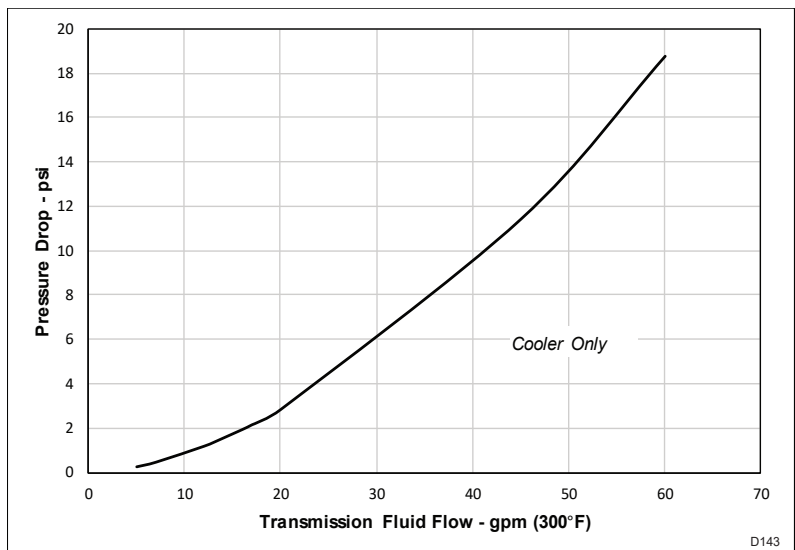
— continued on next page —

17.7 REMOTE-MOUNT TUBE & SHELL COOLER (29553529) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)

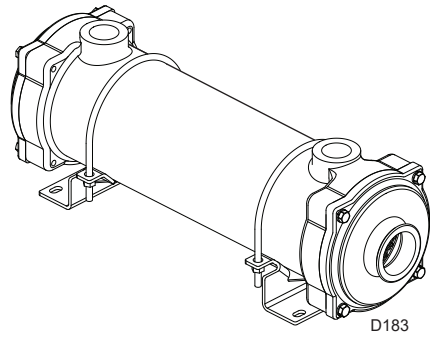
COOLANT-SIDE PRESSURE DROP



OIL-SIDE PRESSURE DROP

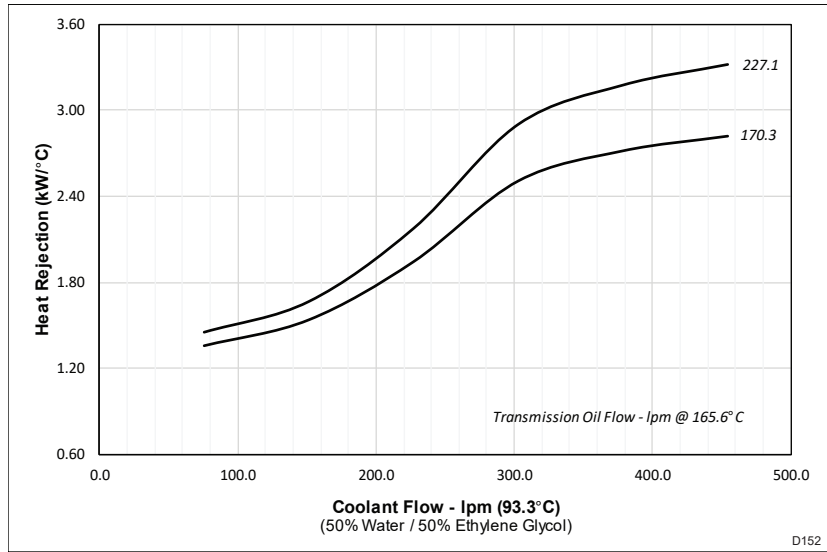


17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (METRIC UNITS)

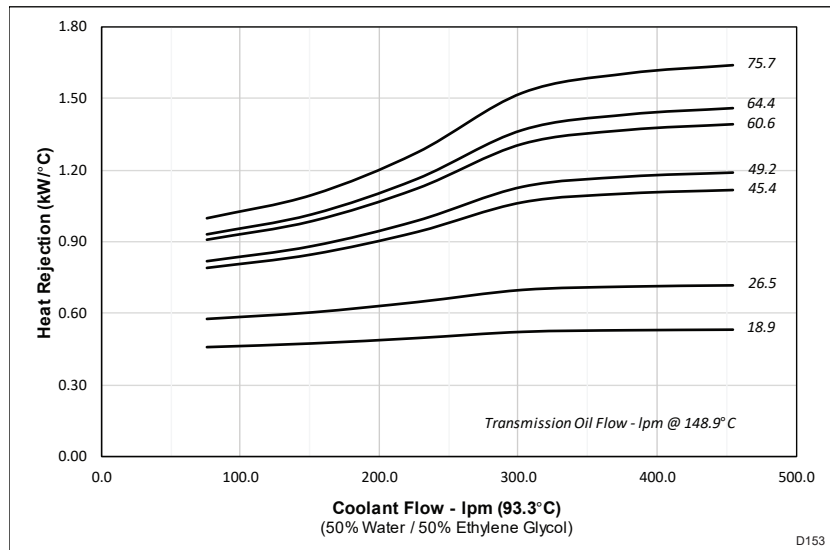


The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

HEAT REJECTION



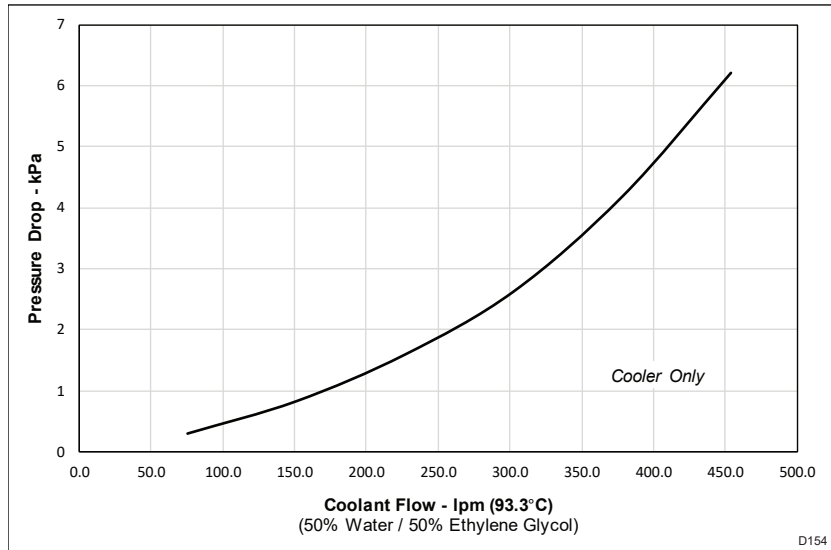
HEAT REJECTION



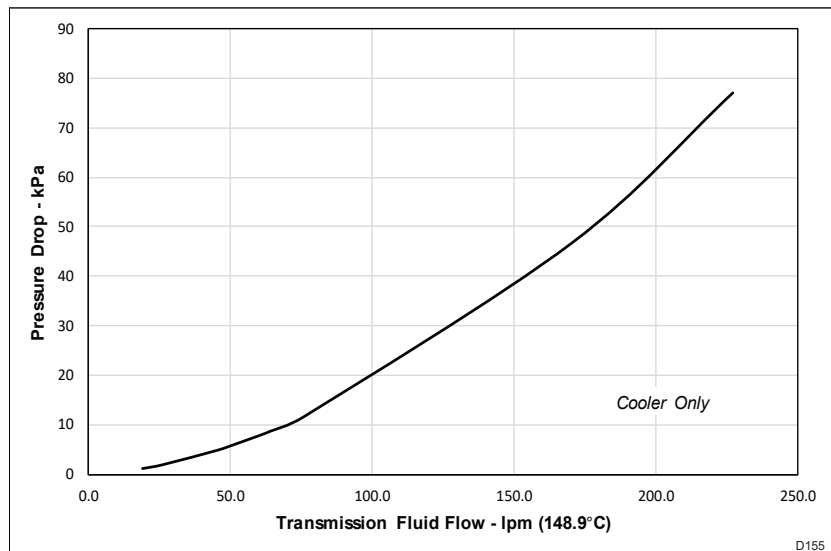
— continued on next page —

17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (METRIC UNITS)

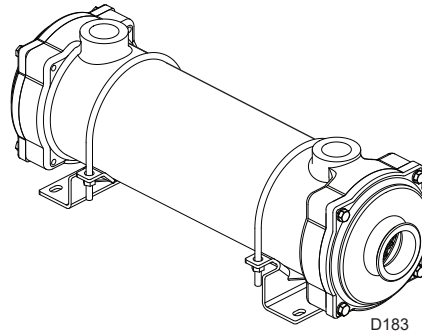
COOLANT-SIDE PRESSURE DROP



OIL-SIDE PRESSURE DROP

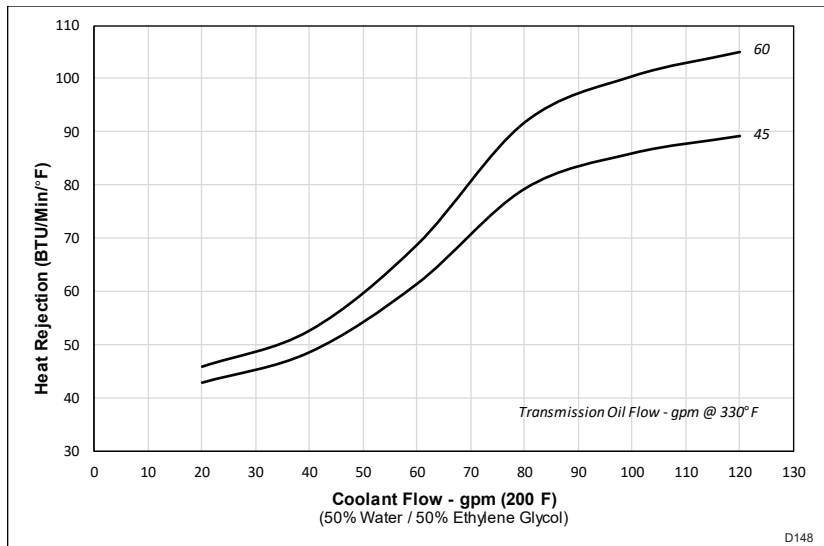


17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)



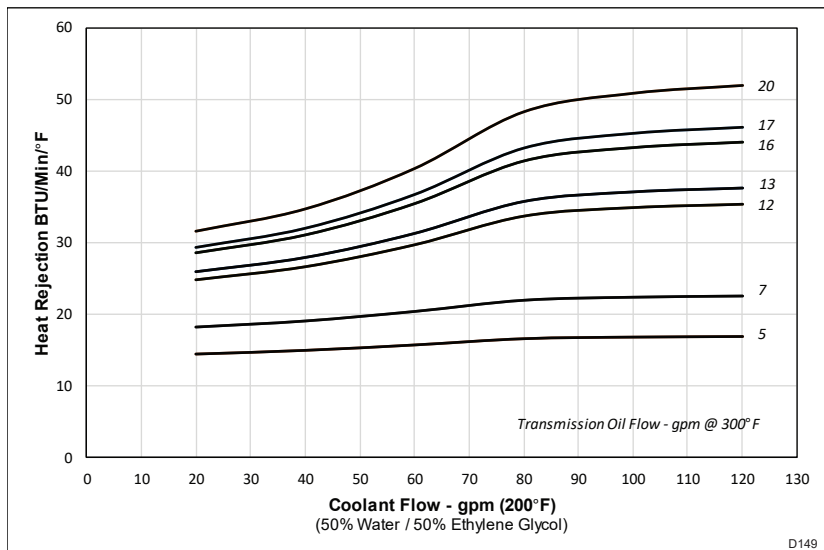
The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

HEAT REJECTION



D148

HEAT REJECTION

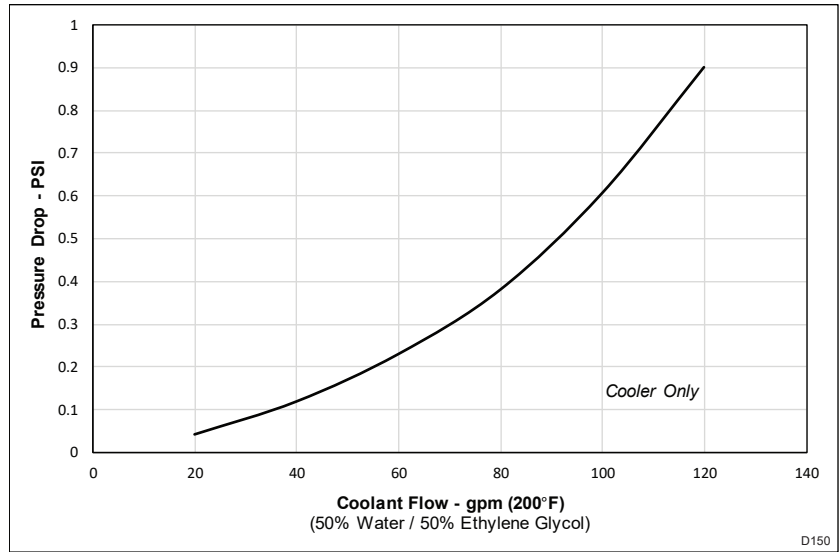


D149

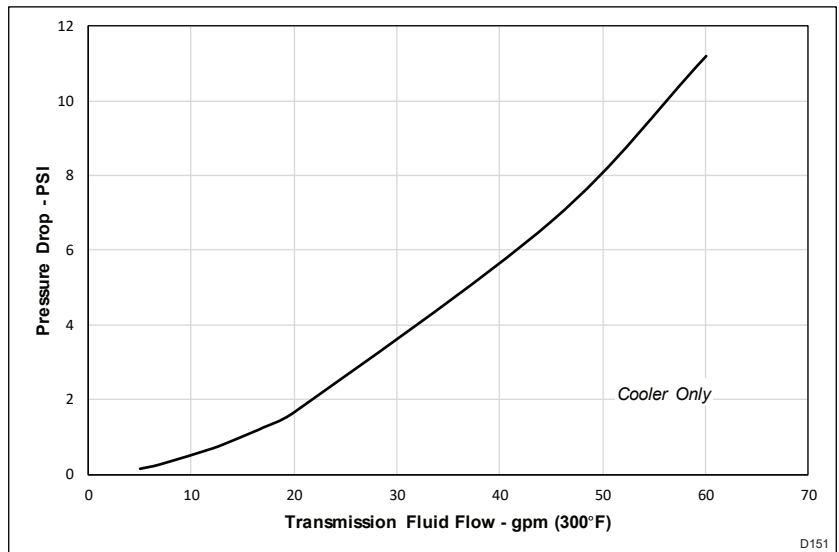
— continued on next page —

17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)

COOLANT-SIDE PRESSURE DROP



OIL-SIDE PRESSURE DROP



LIST OF REFERENCED DOCUMENTS

- [4000 Product Family Transmission Ratings](#)
- [Fluids at \[www.allisontransmission.com\]\(http://www.allisontransmission.com\)](#)

[4000 Product Family Installation Drawings](#)

- [Engine/Transmission Adaptation – General](#)
- [Output Flange Information](#)
- [Output Yoke Information](#)

Technical Documents (TD's)

- [TD-182. Use of Electronic Braking Systems \(EBS\) with Allison Transmissions](#)
- [TD-183. Application Requirements for the Oil Field Service \(OFS\) Transmissions](#)
- [TD-188. Application and Installation Requirements for the 2nd Reverse with 4th Gen Controls](#)
- [TD-191. Application and Installation Requirements for the 2nd Reverse with 5th Gen Controls](#)

REVISION HISTORY

August 18, 2023

- In 14.2, Revised note to include the use of a retarder accumulator for the initial apply timing

November 30, 2022

- In 6.0, Revised Maximum Engine Torque to 3200 N·m (2360 lb-ft) for the TC571H Torque Converter

November 28, 2022

- In 12.0, Added wide ratio gear ratios for the 4000 7-speed
- In 6.0, Added TC571H Torque Converter

May 18, 2021

- In 14.2, Added note, "Initial apply timing if a forward range is commanded and applied, and the transmission is not in the process of a shift."

October 15, 2020

- In 14.1, Added note, "Curves are for standard capacities and do not reflect custom retarder capacity"
- In 13.0, Added, "TES-668 Licensed Fluid" to the acceptable fluids list

February 15, 2019

- Created hyperlinks on the Contents page
- In 17.3, Revised Remote Retarder/Sump Cooler Characteristics, added graphic and part number
- In 17.4, Revised Direct Mount Retarder/Sump Cooler Characteristics, added graphic and part number
- In 17.5, added graphic and part number
- In 17.6, added graphic and part number
- In 17.7, Created Remote-Mount Tube & Shell Cooler (29553529) Non-Retarder & Retarder Characteristics
- In 17.8, Created Remote-Mount Tube & Shell Cooler (29559270) Non-Retarder & Retarder Characteristics

February 15, 2019

- In 15.0, added, "Transmission Sump Temperature" to chart.
- In Contents, replaced, "Allison Transmission Extranet" with "Allison HUB".

April 28, 2017

- Revised Table 3.0 with latest values and added Transmission Operational Limitations to table

February 10, 2016

- On Contents page, and on the actual tables, renamed tables 17.5 and 17.6 to align with naming convention used in 3000 Series Trans Data
- In table 17.1, reduced coolant fill volume to three items. The fill volume is the same for the Retarder/Sump cooler whether it is direct or remote mounted. Eliminated "Non-Retarder" from the names of the standard capacity cooler and the high capacity cooler