



# 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](http://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
<b>Drive Gear Torque (Continuous Operation)</b>		
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 <a href="#">4000 Product Family Transmission Ratings</a> 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
<b>MAXIMUM TEMPERATURE PERMITTED</b>		
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/ $\sqrt{\text{N}\cdot\text{m}}$ (59.0 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	2644 N·m (1950 lb-ft)
TC-531	2.34	44.8 rpm/ $\sqrt{\text{N}\cdot\text{m}}$ (52.2 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	2644 N·m (1950 lb-ft)
TC-541	1.90	39.7 rpm/ $\sqrt{\text{N}\cdot\text{m}}$ (46.2 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	2644 N·m (1950 lb-ft)
TC-551	1.79	38.2 rpm/ $\sqrt{\text{N}\cdot\text{m}}$ (44.5 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	2644 N·m (1950 lb-ft)
TC-561	1.58	35.4 rpm/ $\sqrt{\text{N}\cdot\text{m}}$ (41.2 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	2644 N·m (1950 lb-ft)
TC-571	1.62	32.5 rpm/ $\sqrt{\text{N}\cdot\text{m}}$ (37.8 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	2644 N·m (1950 lb-ft)
TC-571H*	1.62	32.5 rpm/ $\sqrt{\text{N}\cdot\text{m}}$ (37.8 rpm/ $\sqrt{\text{lb}\cdot\text{ft}}$ )	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	
<b>Reverse (R1 &amp; R2)</b>	1448–2055 (210–298)	1172–1586 (170–230)	1806–2055 (262–298)	kPa (psi)
<b>Neutral</b>	1517–2055 (220–298)	1172–1586 (170–230)	PTO Request On 1806–2055 (262–298)  PTO Request Off 1310–1720 (190–250)	kPa (psi)
<b>Forward Converter</b> (All Gear Ranges)	1241–1793 (180–260)	869–1338 (126–194)	1551–1793 (225–260)	kPa (psi)
<b>Forward Lockup</b>				
<b>All models except seven-speeds</b>				
Ranges 1— 5	—	—	1082–1365 (157–198)	kPa (psi)
Range 6	—	—	1034–1234 (150–179)	kPa (psi)
<b>Seven-speed models</b>				
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.

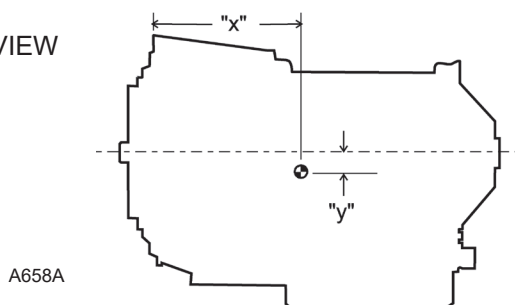
## 8.0 DRY WEIGHTS

HARDWARE	NOMINAL VALUE	UNIT
<b>Transmission Assembly</b>		
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)
<b>Optional features / hardware have additional weight as follows:</b>		
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 <a href="#">4000 Product Family Installation Drawings</a> : • <a href="#">Available Flanges</a> • <a href="#">Available Yokes</a>	5 – 12* (11 – 26)*	kg (pounds)

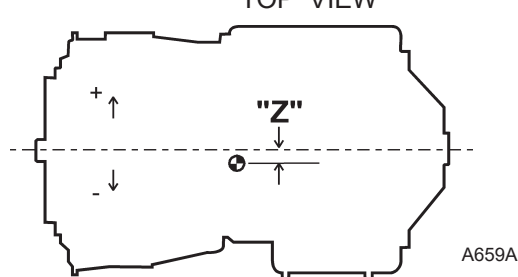
**NOTE:** Values in U.S. units shown in parenthesis ( ) are for reference only. Conversions between metric and U.S. units are not necessarily exactly equivalent.

## 9.0 CENTER OF GRAVITY

SIDE VIEW



TOP VIEW

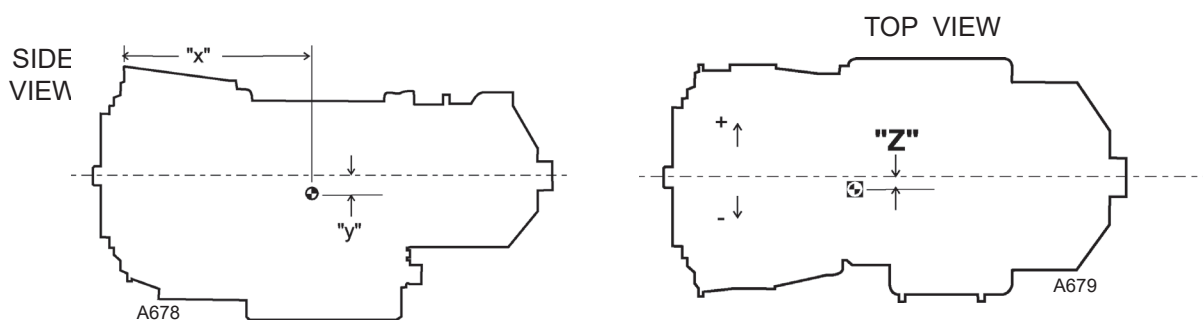


### 9.1 CENTER OF GRAVITY: Close Ratio and Wide Ratio Models

TRANSMISSION CONFIGURATION	NOMINAL VALUE			UNIT
<i>DIRECT-MOUNT TRANSMISSIONS</i>	X	Y	Z	
<b>No Retarder, No PTO Provision</b>				
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.)
<b>No Retarder, With PTO Provision</b>				
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.)
<b>With Retarder, No PTO Provision</b>				
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.)
<b>With Retarder, With PTO Provision</b>				
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.)
<i>REMOTE-MOUNT TRANSMISSIONS</i>	X	Y	Z	UNIT
<b>No Retarder, No PTO Provision</b>				
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.)
<b>No Retarder, With PTO Provision</b>				
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.)
<b>With Retarder, No PTO Provision</b>				
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.)
<b>With Retarder, With PTO Provision</b>				
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
<i>DIRECT-MOUNT TRANSMISSIONS</i>	X	Y	Z	
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>	X	Y	Z	UNIT
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.)

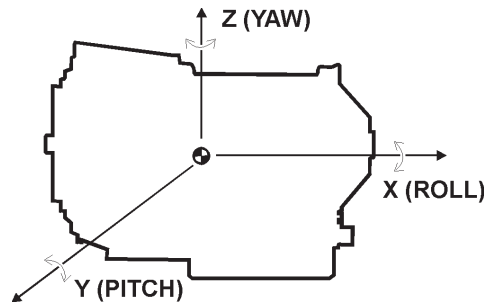
## 10.0 TRANSMISSION STATIC BENDING MOMENT LIMIT

TRANSMISSION CONFIGURATION	MAXIMUM VALUE	UNIT
All Models	3500 (2580)	N•m (lb <sub>F</sub> -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 <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
No Retarder, With PTO Provision	12.08 (8.91)	33.65 (24.82)	31.50 (23.23)	kg-m <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
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 <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
	15.28 (11.27)	44.66 (32.94)	41.70 (30.76)	kg-m <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
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 <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
	15.55 (11.47)	54.06 (39.87)	49.84 (36.76)	kg-m <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )

### 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 <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
No Retarder, With PTO Provision	15.27 (11.26)	62.02 (45.74)	57.79 (42.62)	kg-m <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
With Retarder, No PTO Provision	15.34 (11.31)	59.16 (43.63)	54.13 (39.92)	kg-m <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )
With Retarder and PTO Provision	16.43 (12.12)	68.15 (50.26)	64.91 (47.87)	kg-m <sup>2</sup> (lb <sub>f</sub> -ft-sec <sup>2</sup> )

\* 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
<b>FORWARD</b>				
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
<b>REVERSE</b>	-4.80	-5.55	-4.80	-5.55
<b>2nd REVERSE</b>	-	-	-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

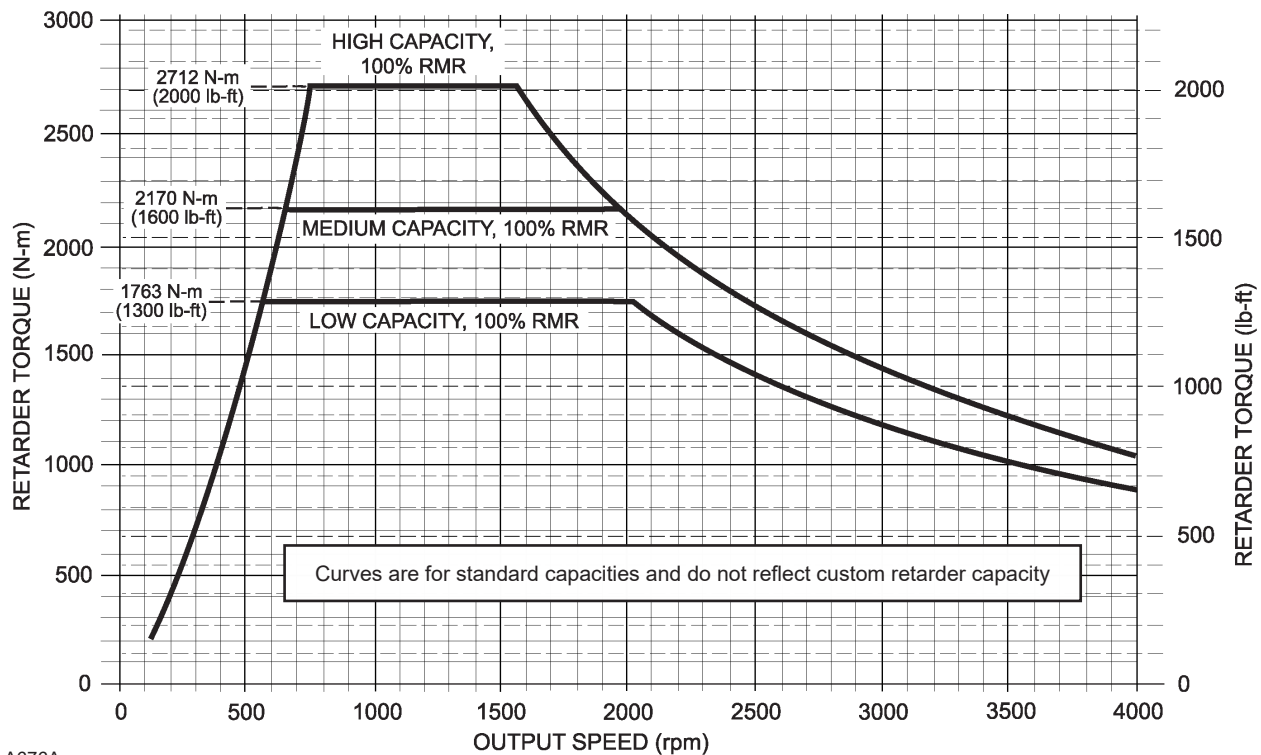
PARAMETER	VALUE	UNIT
<b>INITIAL FILL VOLUME<sup>1</sup></b>		
<b>Base Models – Transmission Only<sup>2</sup></b>		
Deep Oil Sump, with PTO Provision	48 (51)	liters (quarts)
Deep Oil Sump, without PTO Provision	45 (48)	liters (quarts)
Shallow Oil Sump, with PTO Provision	41 (43)	liters (quarts)
Shallow Oil Sump, without PTO Provision	38 (40)	liters (quarts)
<b>Seven-Speed Models - Transmission Only<sup>2</sup></b>		
Deep Oil Sump, with PTO Provision	51 (54)	liters (quarts)
Deep Oil Sump, without PTO Provision	48 (51)	liters (quarts)
<b>Additional Fill for Allison Coolers</b>		
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)
<b>Additional Fill for Retarder Accumulator</b>	0.6 (0.6)	liters (quarts)
<b>ACCEPTABLE FLUIDS:</b>		
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 <a href="#">TD183, Application Requirements for Oil Field Service (OFS) Transmissions</a>	
For all other applications:	TES-668 licensed fluid, TES-295 licensed fluid, or Schedule One TES-389 licensed fluid	
<a href="#">Lists of the fluids</a> approved for use with Allison transmissions can be found on the Allison Transmission web site at: <a href="http://www.allisontransmission.com">www.allisontransmission.com</a> .		
<sup>1</sup> 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°.		
<sup>2</sup> 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

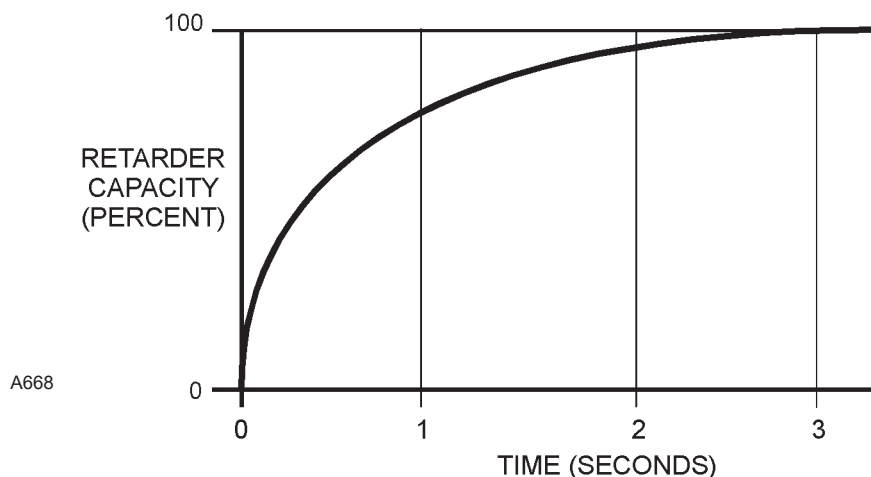
### 14.1 RETARDER CAPACITY\*

\* AT COMMAND FOR 100% APPLY



A676A

### 14.2 RETARDER RESPONSE: INITIAL APPLY



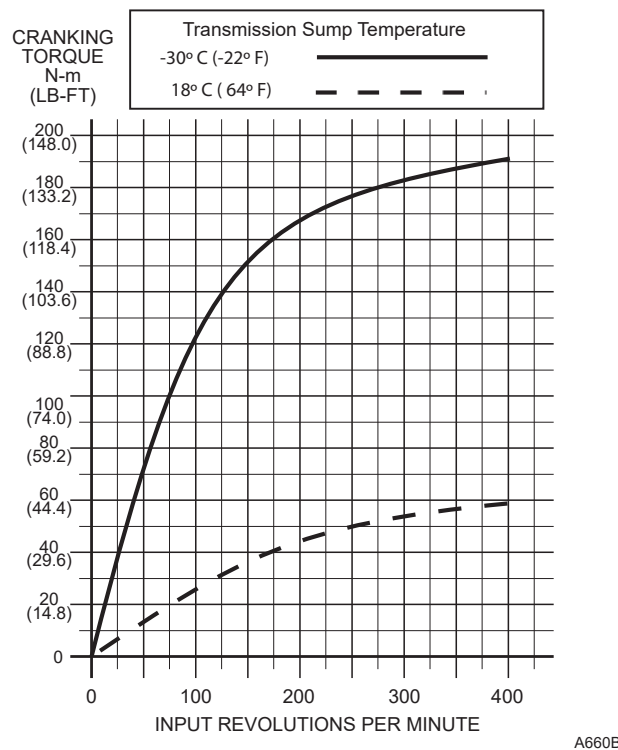
A668

**NOTE:** Initial apply timing if a forward range is commanded and applied, 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



**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.

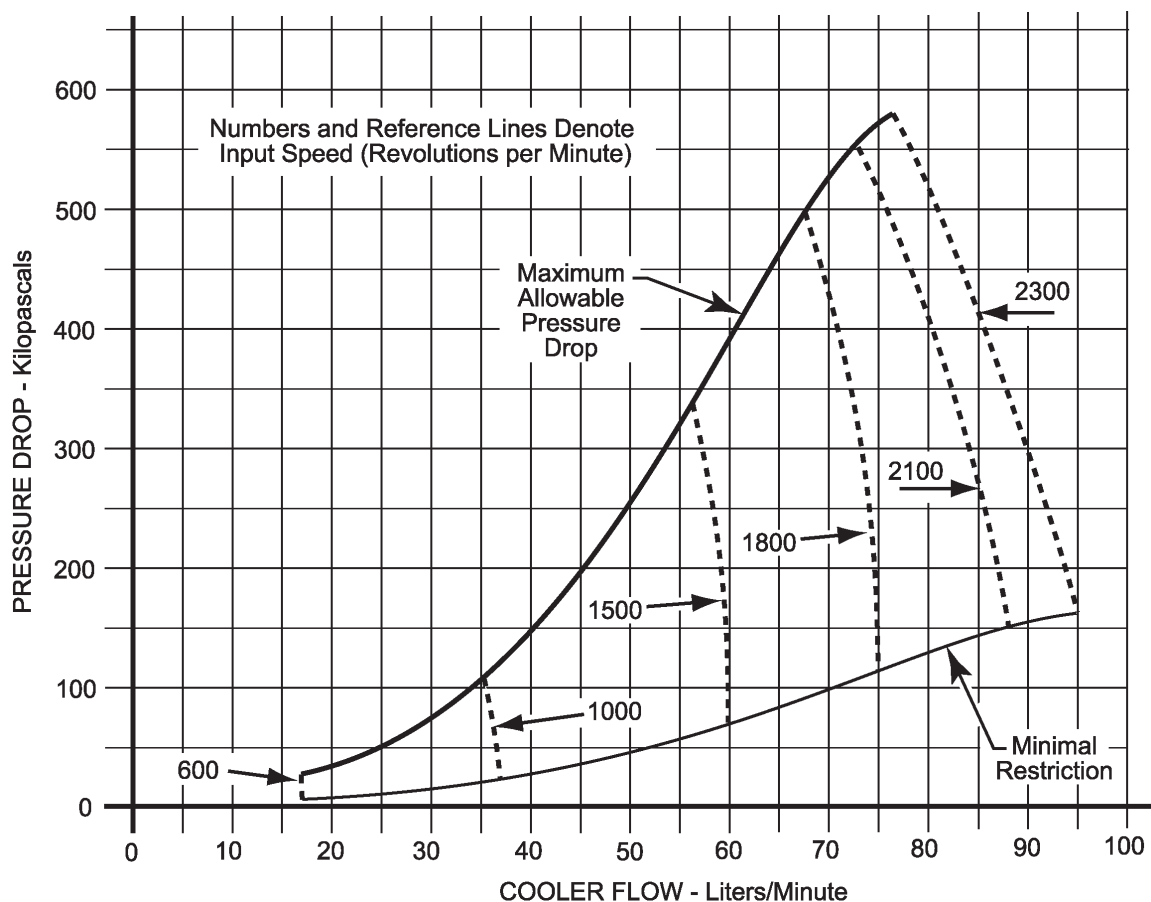
## 16.3 COOLER CIRCUIT FLOW AND RESTRICTION

### NON-RETARDER – CONVERTER OPERATION\* (METRIC UNITS)

**COOLER FLOW VERSUS PRESSURE DROP**

	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	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.



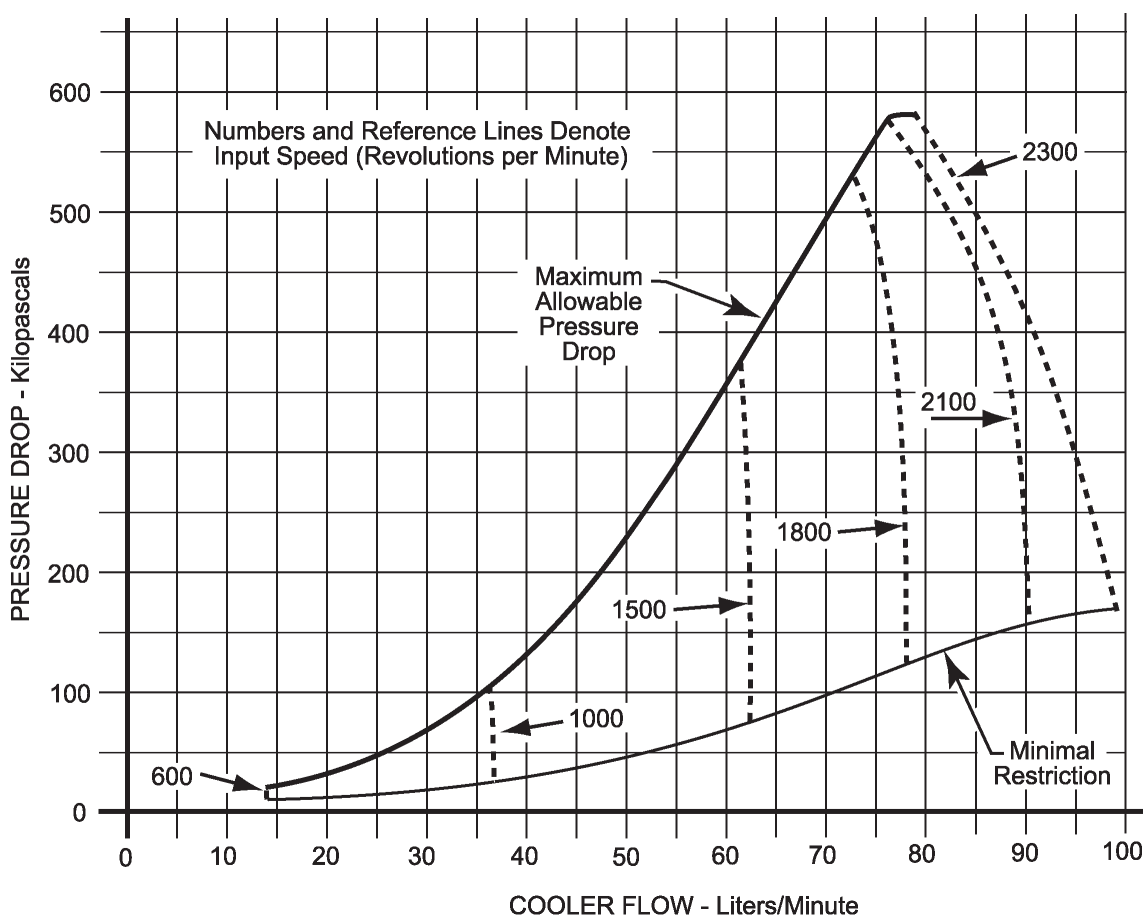
## 16.3 COOLER CIRCUIT FLOW AND RESTRICTION

### 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.

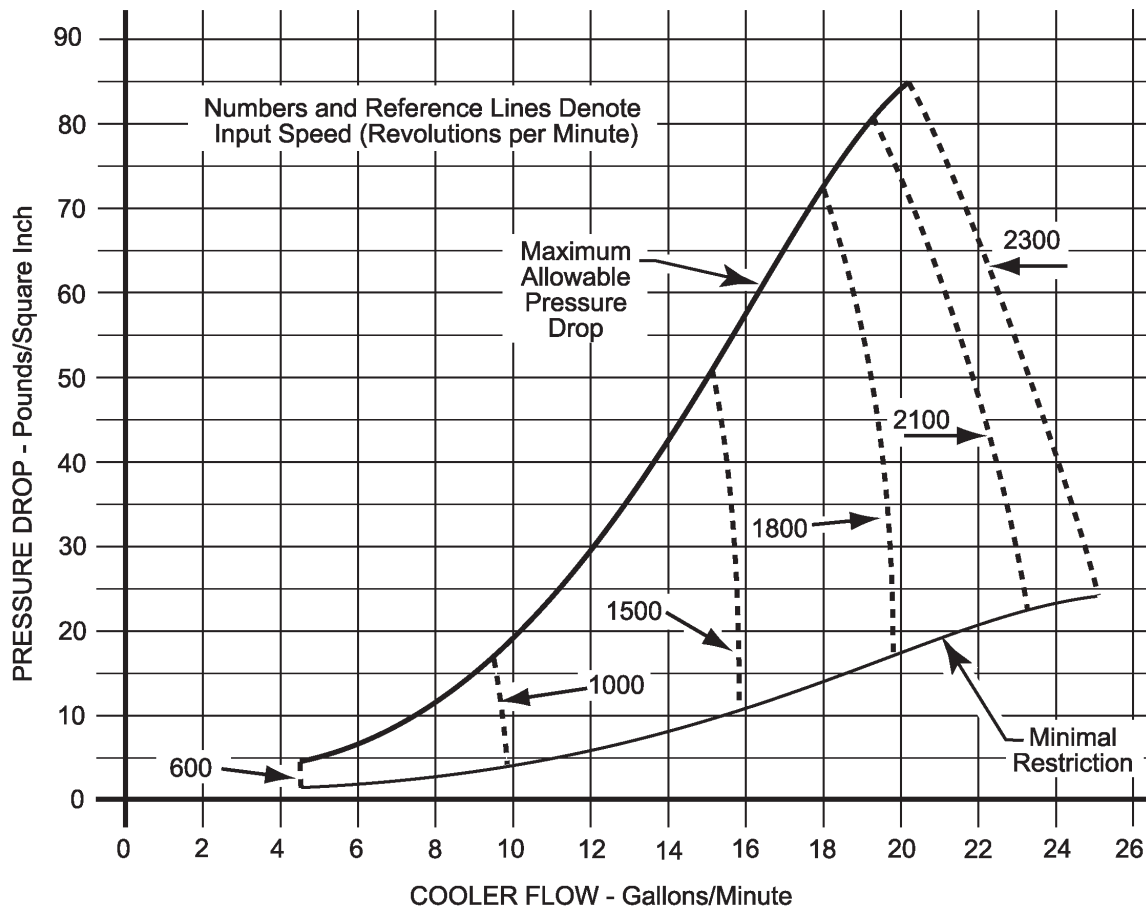
## 16.3 COOLER CIRCUIT FLOW AND RESTRICTION

### 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.

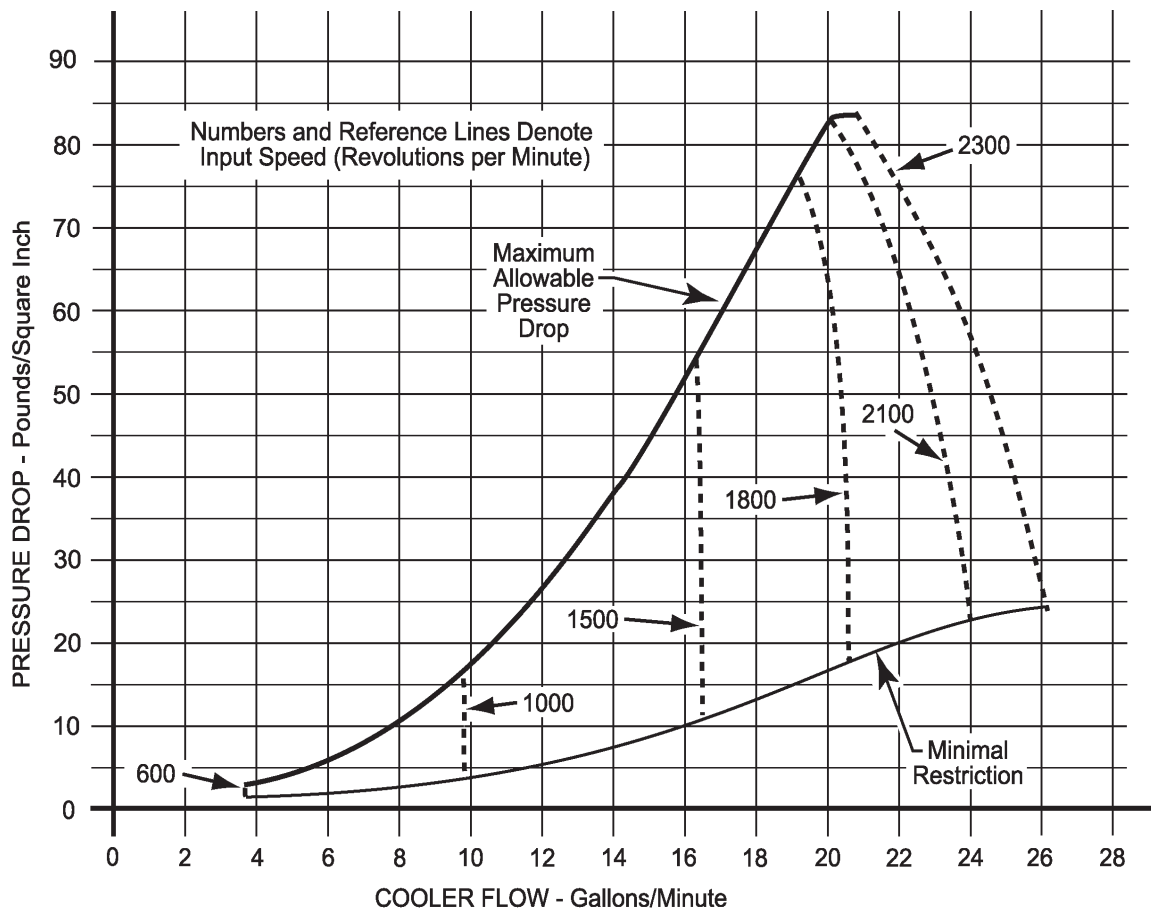
## 16.3 COOLER CIRCUIT FLOW AND RESTRICTION

### NON-RETARDER – LOCKUP OPERATION\* (U.S. UNITS)

#### COOLER FLOW VERSUS PRESSURE DROP

	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	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



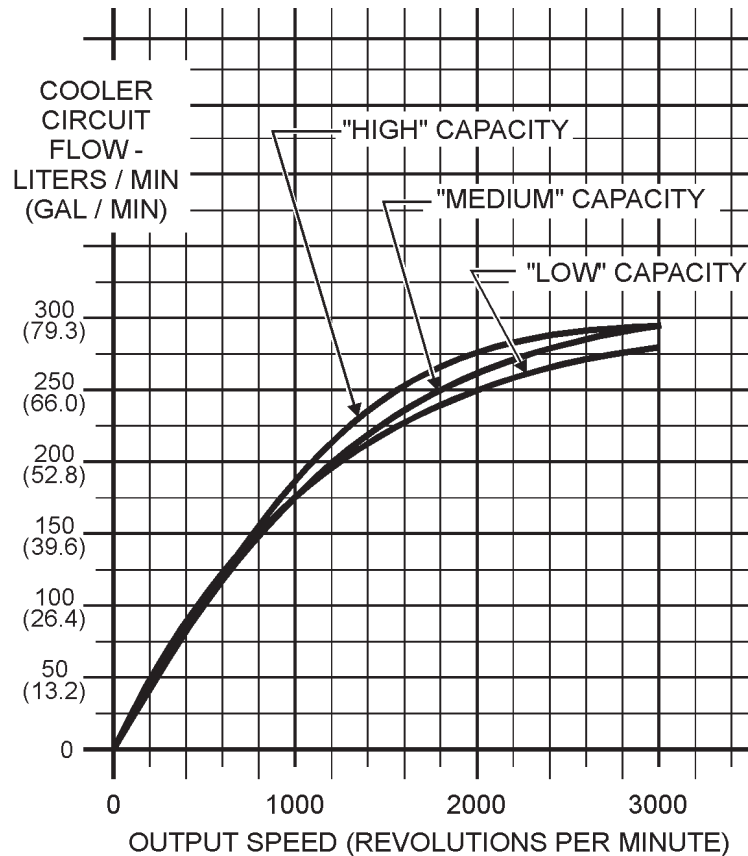
C314

**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 ( $\Delta P$ ) 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.

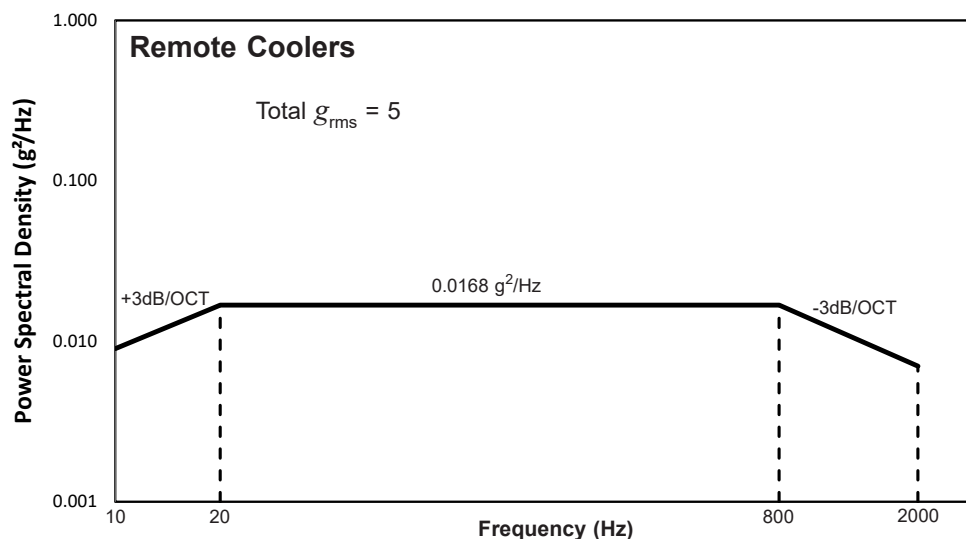
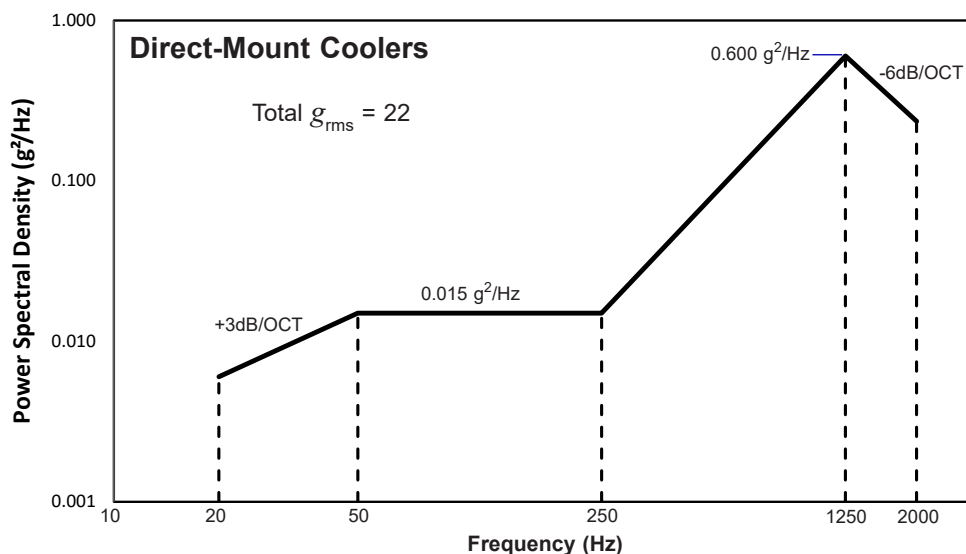
## 17.0 ALLISON OIL-TO-WATER COOLER CHARACTERISTICS

### 17.1 COOLANT FILL VOLUME FOR ALLISON COOLERS

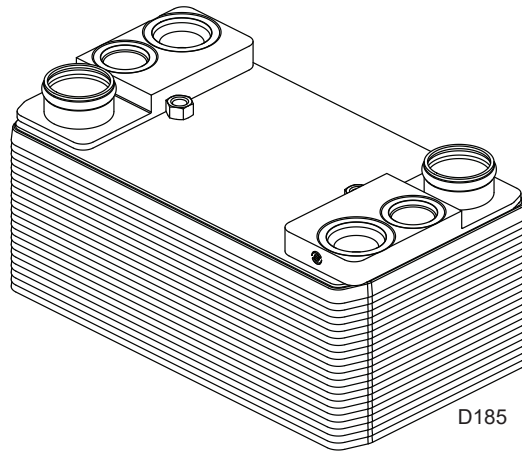
PARAMETER	VALUE	UNIT
<b>Coolant Fill Volume for Allison Coolers</b>		
Retarder / Sump Cooler	3.0 (3.2)	liters (quarts)
Direct-Mount, Standard-Capacity Cooler	2.0 (2.1)	liters (quarts)
Direct-Mount, High-Capacity Cooler	3.5 (3.7)	liters (quarts)

### 17.2 VIBRATION PROFILES FOR ALLISON COOLERS

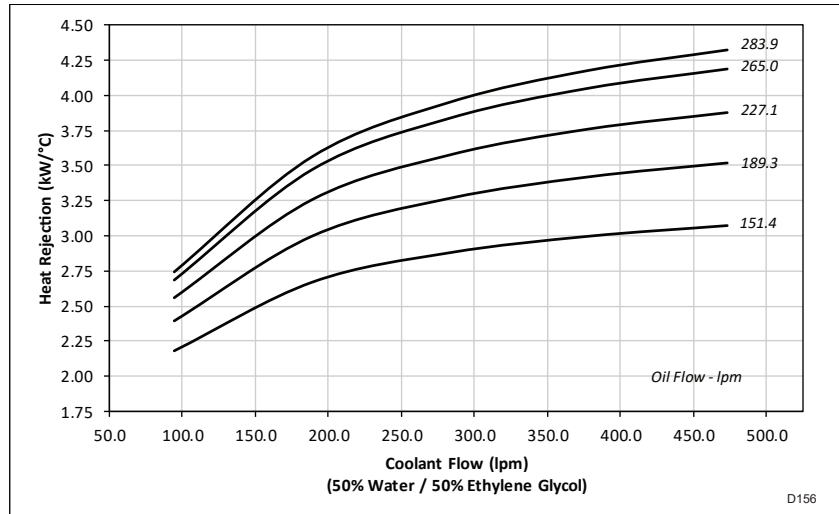
Allison Direct-Mount and Remote Coolers are designed to meet the random vibration profiles shown here. The vibration profiles are provided for vehicle builders to use in their installation design.



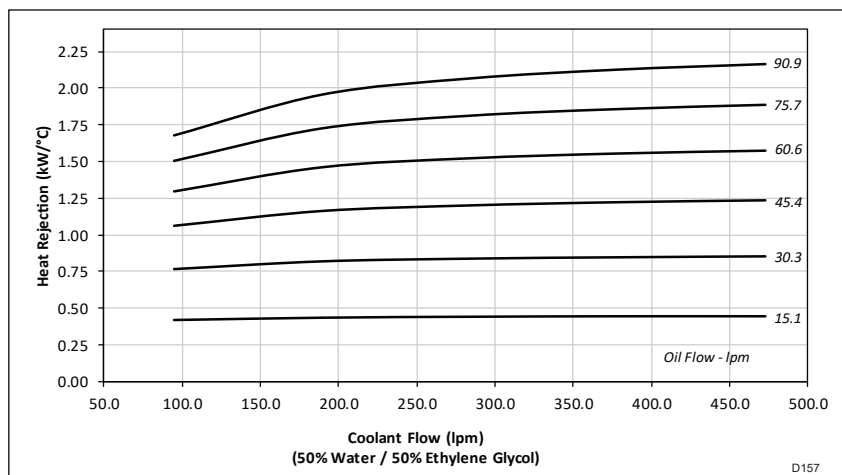
## 17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (METRIC UNITS)



### RETARDER-SIDE HEAT REJECTION RETARDER MODE



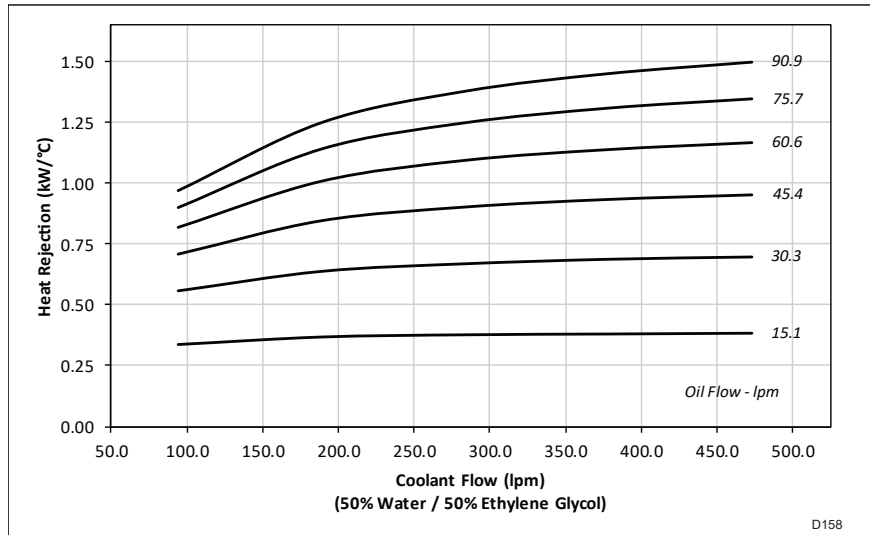
### RETARDER-SIDE HEAT REJECTION CONVERTER MODE



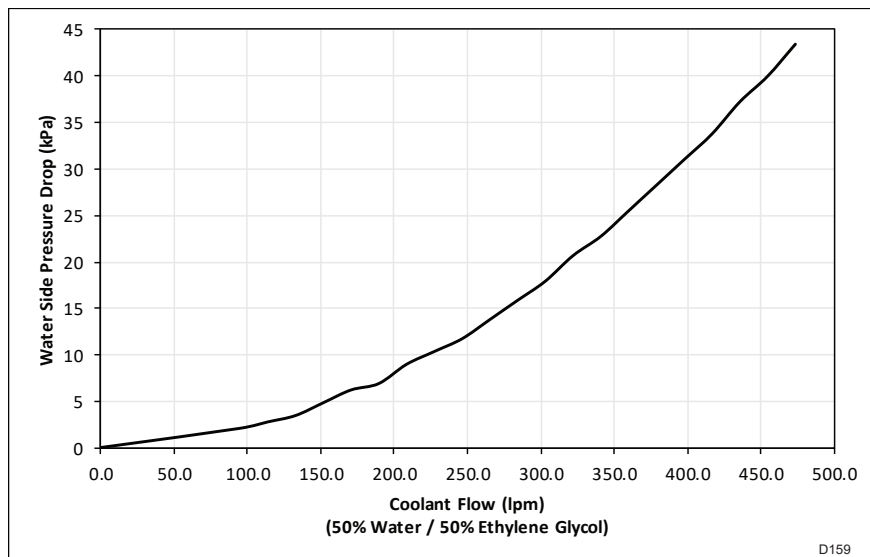
— continued on next page —

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

### SUMP-SIDE HEAT REJECTION



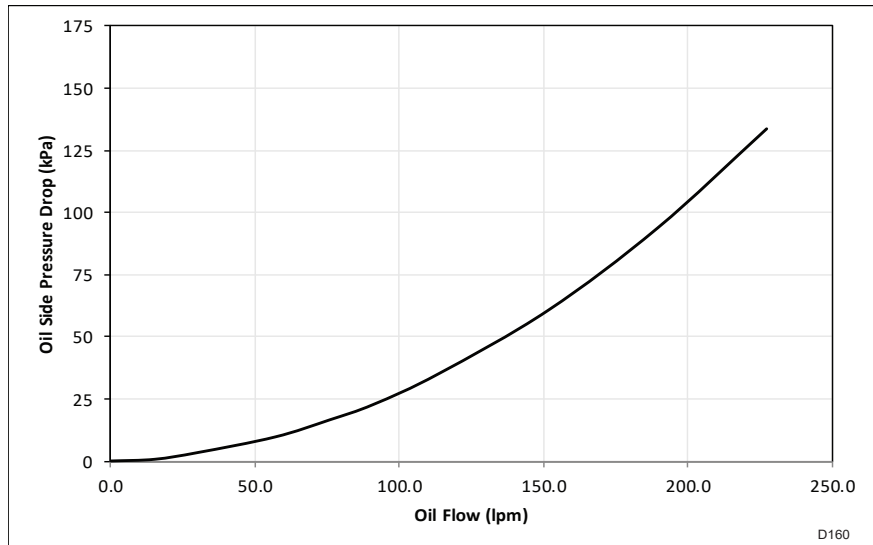
### COOLANT-SIDE PRESSURE DROP



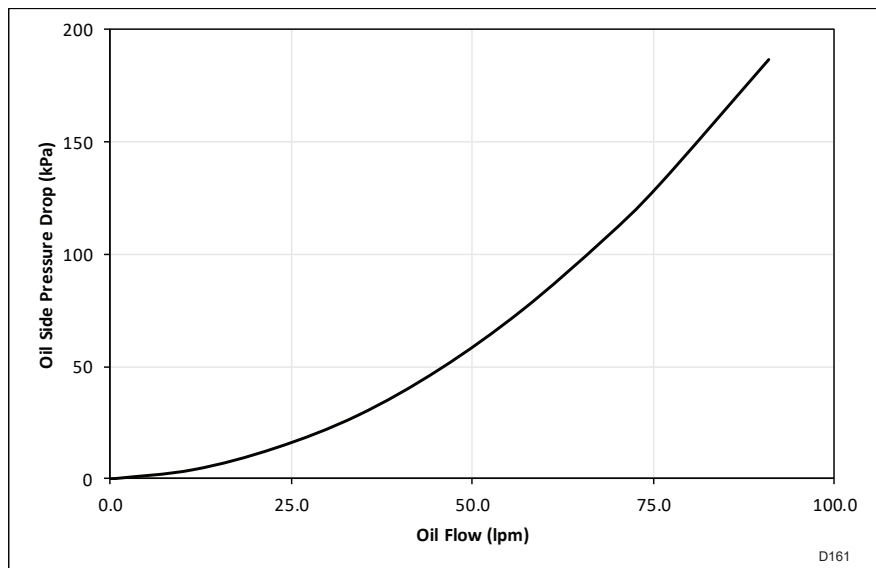
— continued on next page —

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

### RETARDER-SIDE OIL PRESSURE DROP



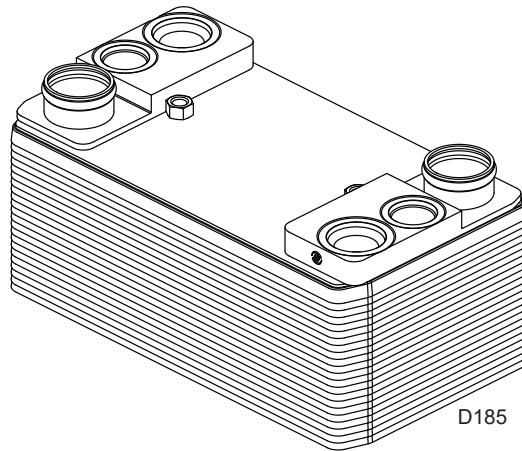
### SUMP-SIDE OIL PRESSURE DROP



— continued on next page —

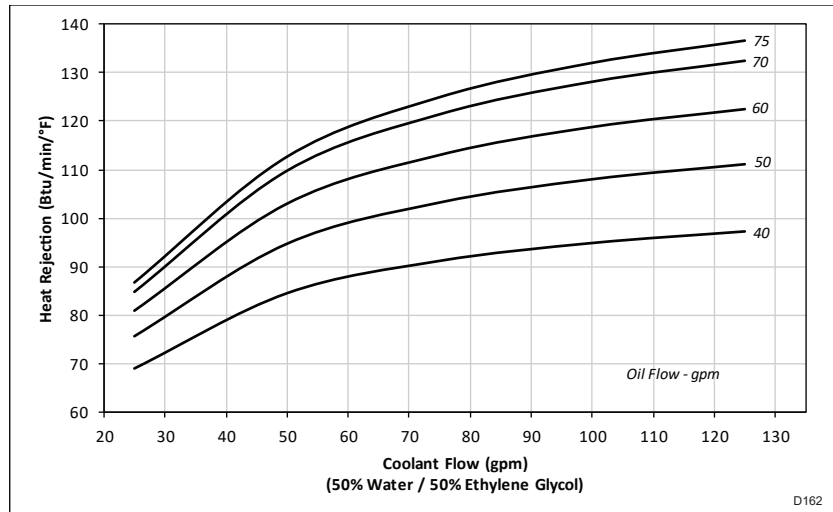


## 17.3 REMOTE RETARDER / SUMP COOLER (29536975) CHARACTERISTICS (U.S. UNITS)



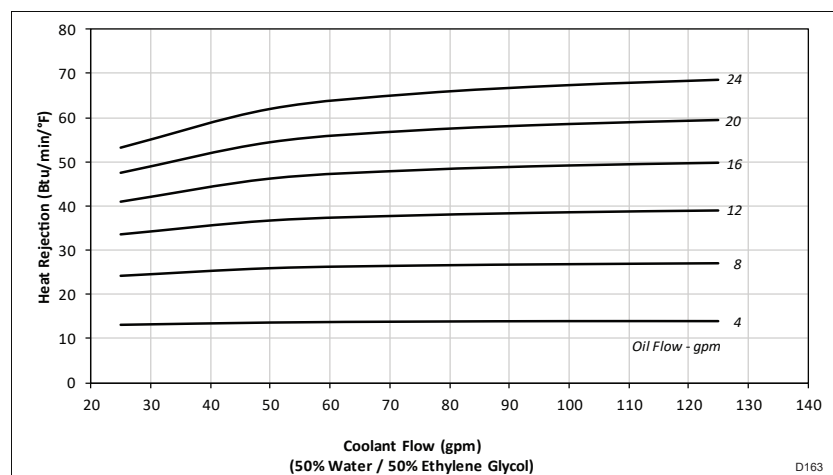
**RETARDER-SIDE  
HEAT  
REJECTION**

**RETARDER  
MODE**



**RETARDER-SIDE  
HEAT  
REJECTION**

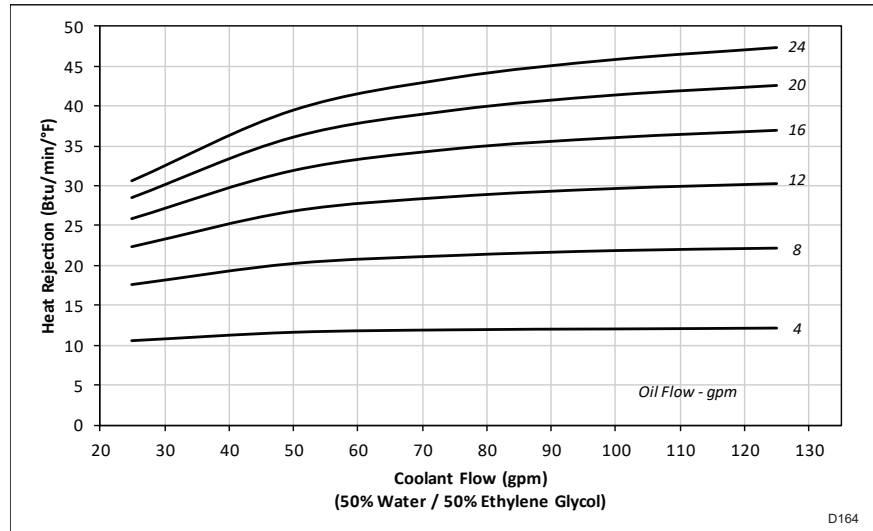
**CONVERTER  
MODE**



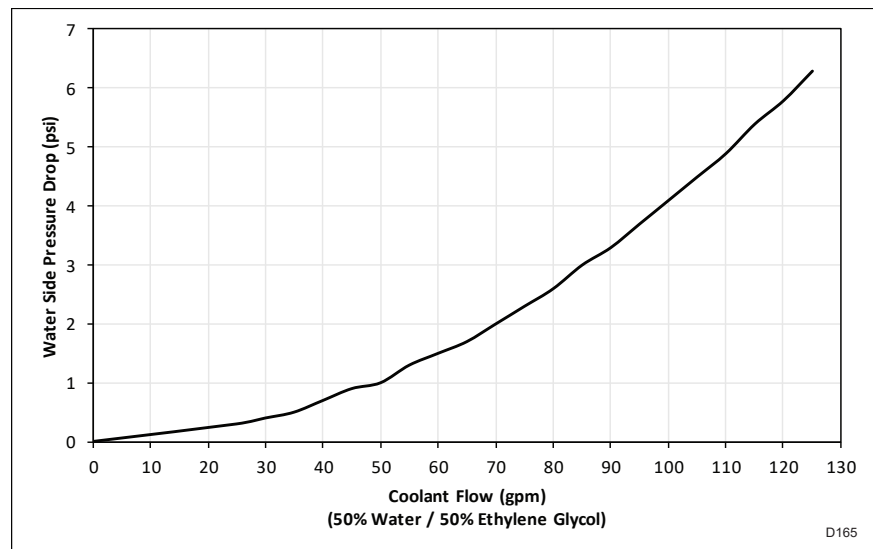
— continued on next page —

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

### SUMP-SIDE HEAT REJECTION



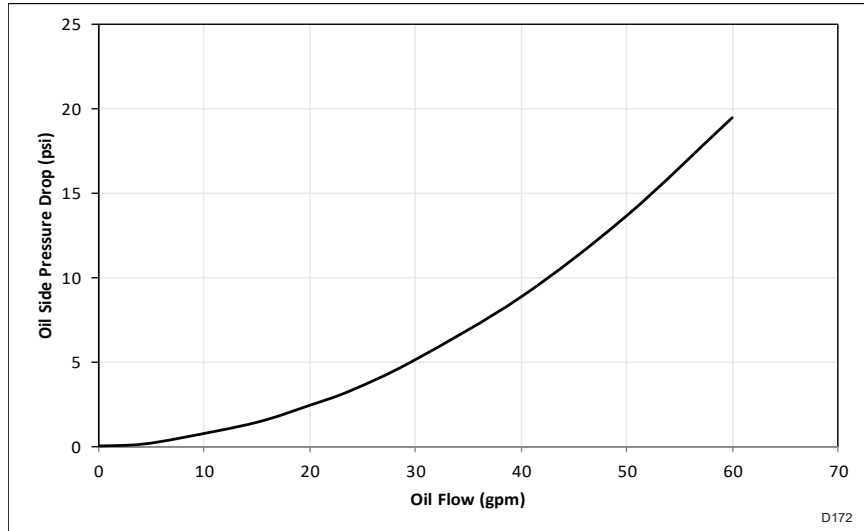
### COOLANT-SIDE PRESSURE DROP



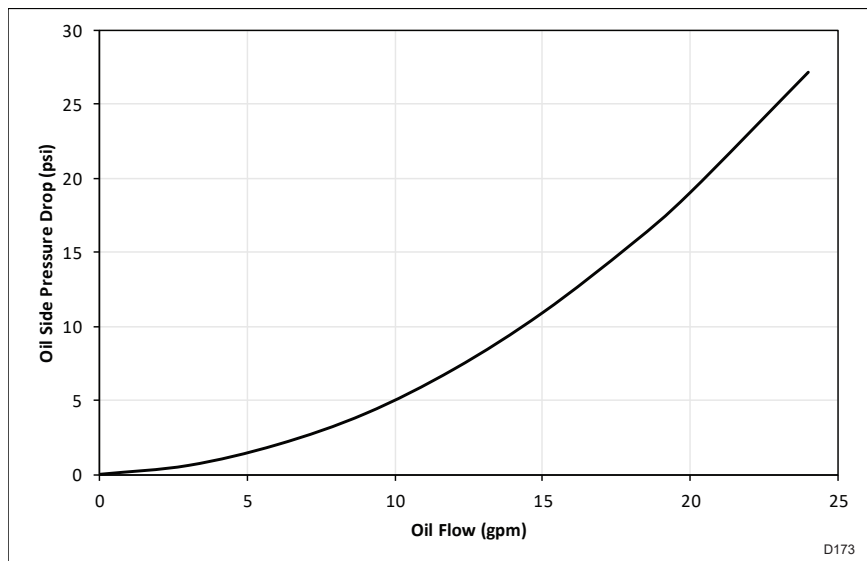
— continued on next page —

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

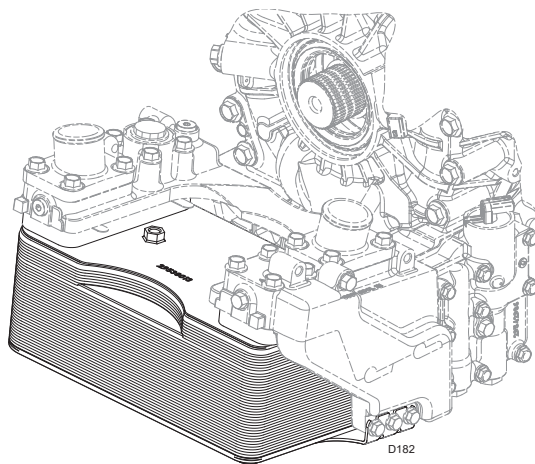
### RETARDER-SIDE OIL PRESSURE DROP



### SUMP-SIDE OIL PRESSURE DROP

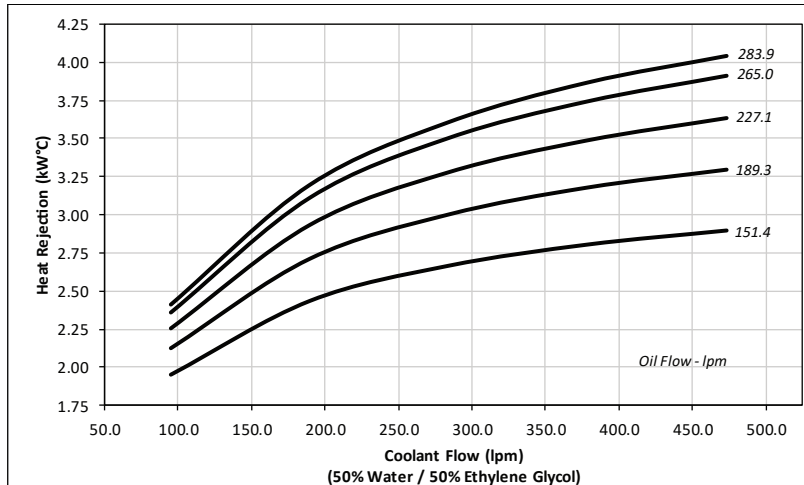


## 17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (METRIC UNITS)



### RETARDER-SIDE HEAT REJECTION

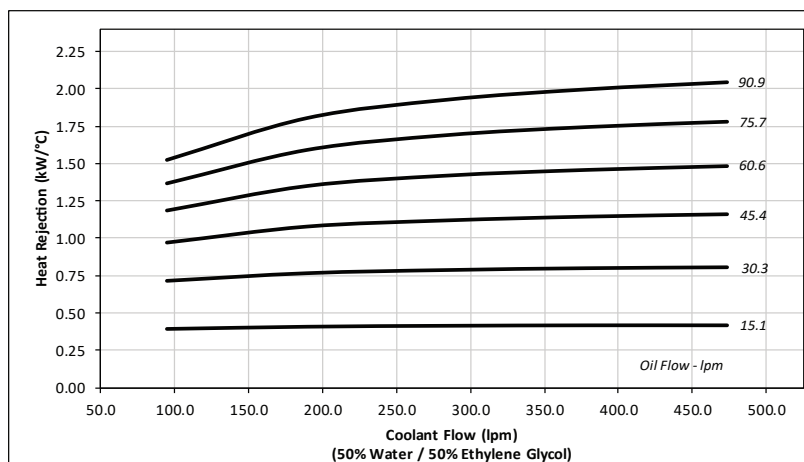
#### RETARDER MODE



D168

### RETARDER-SIDE HEAT REJECTION

#### CONVERTER MODE

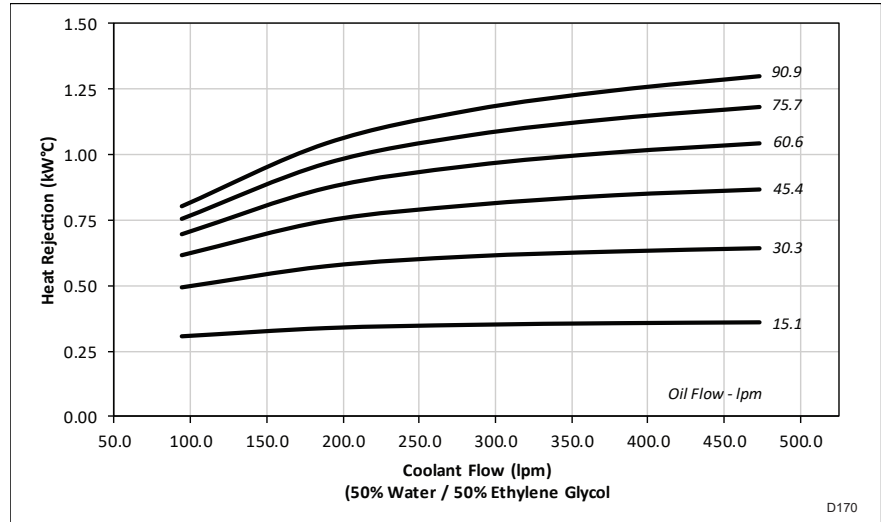


D169

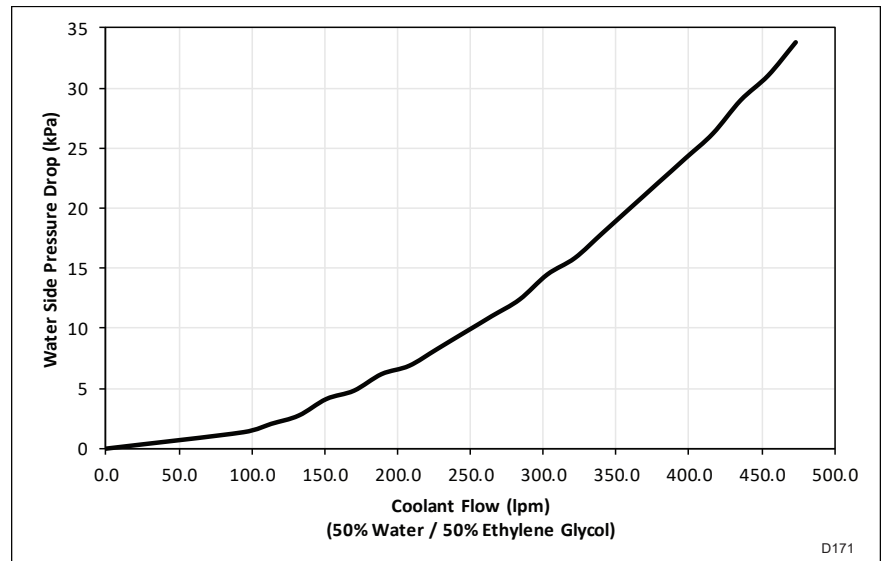
— continued on next page —

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

### SUMP-SIDE HEAT REJECTION



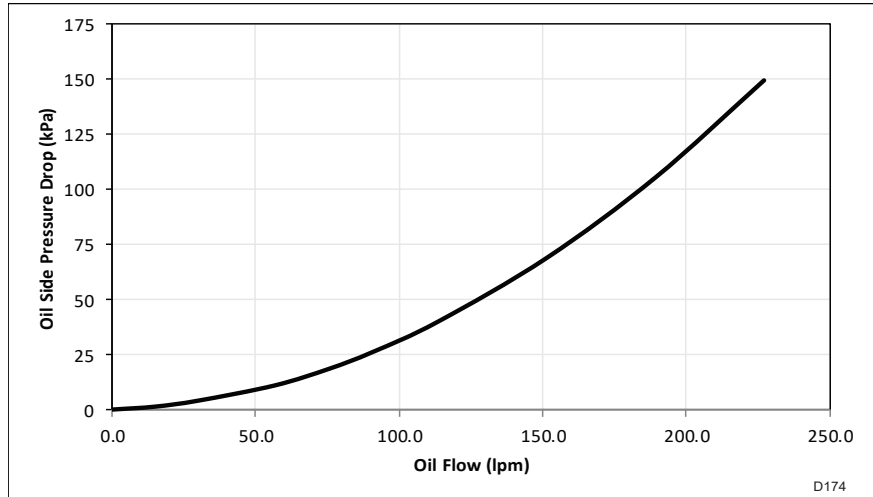
### COOLANT-SIDE PRESSURE DROP



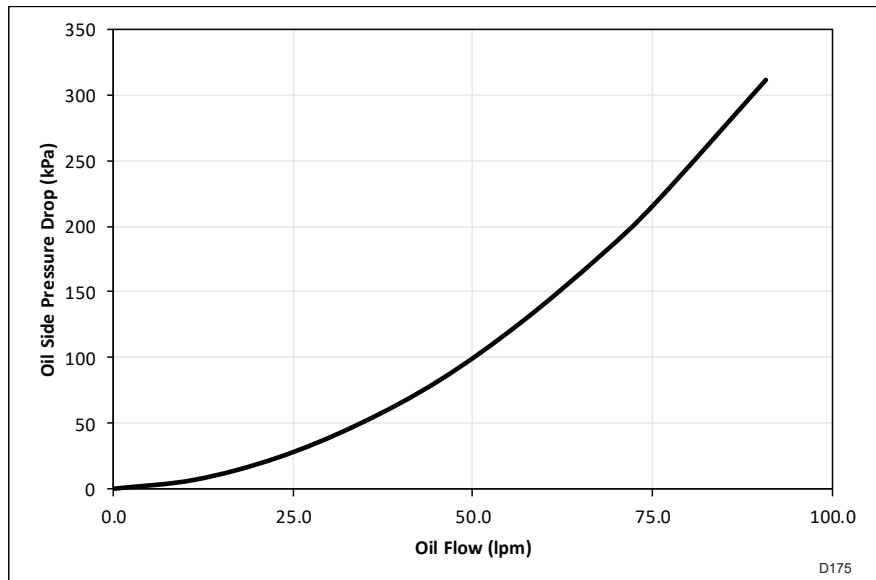
— continued on next page —

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

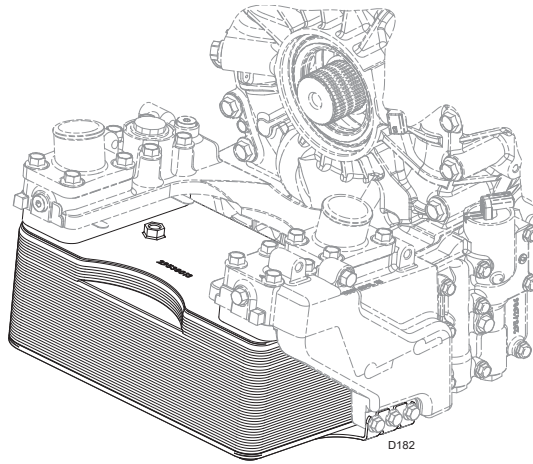
### RETARDER-SIDE OIL PRESSURE DROP



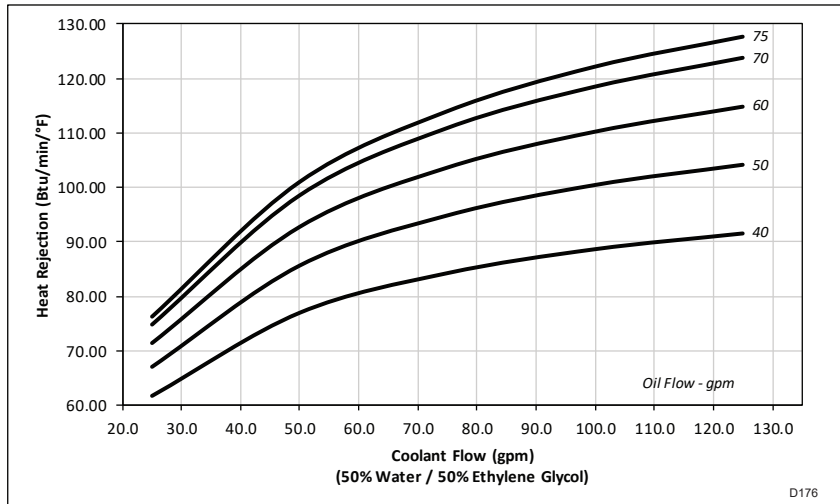
### SUMP-SIDE OIL PRESSURE DROP



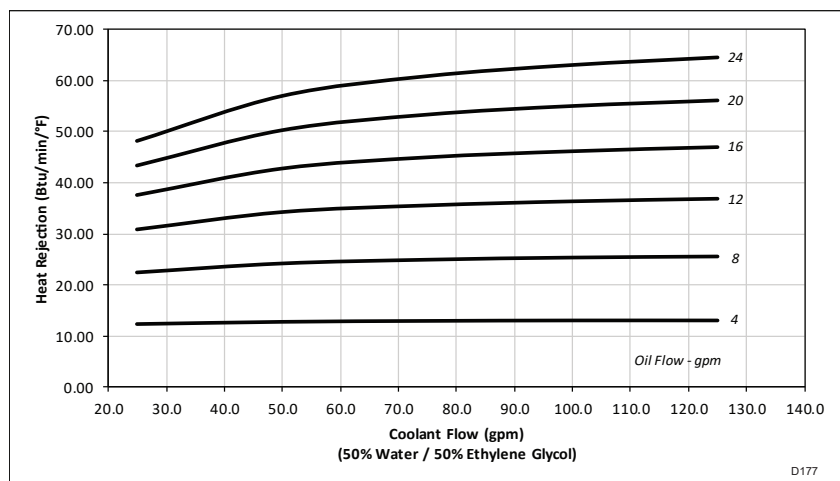
## 17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (U.S. UNITS)



### RETARDER-SIDE HEAT REJECTION RETARDER MODE



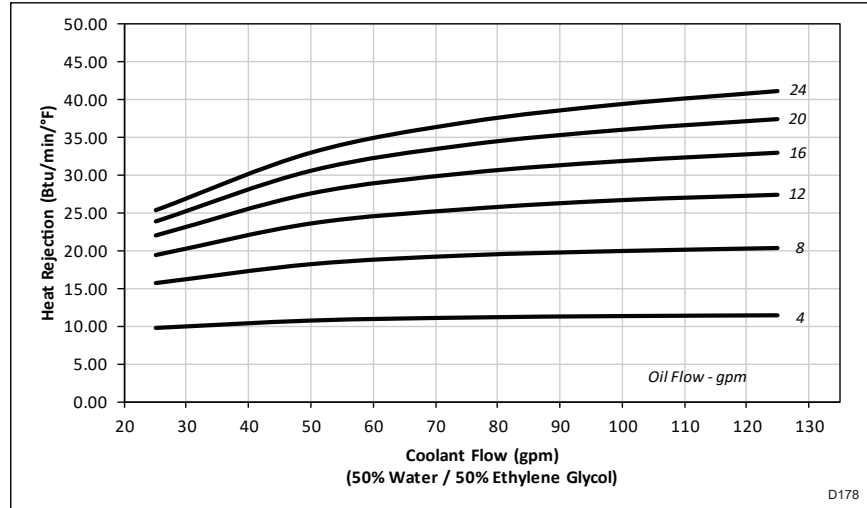
### RETARDER-SIDE HEAT REJECTION CONVERTER MODE



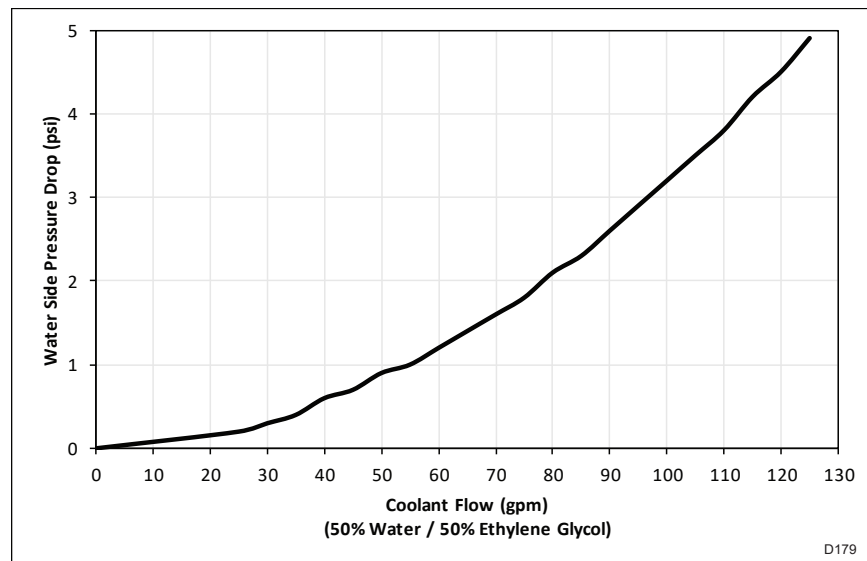
— continued on next page —

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

### SUMP-SIDE HEAT REJECTION



### COOLANT-SIDE PRESSURE DROP

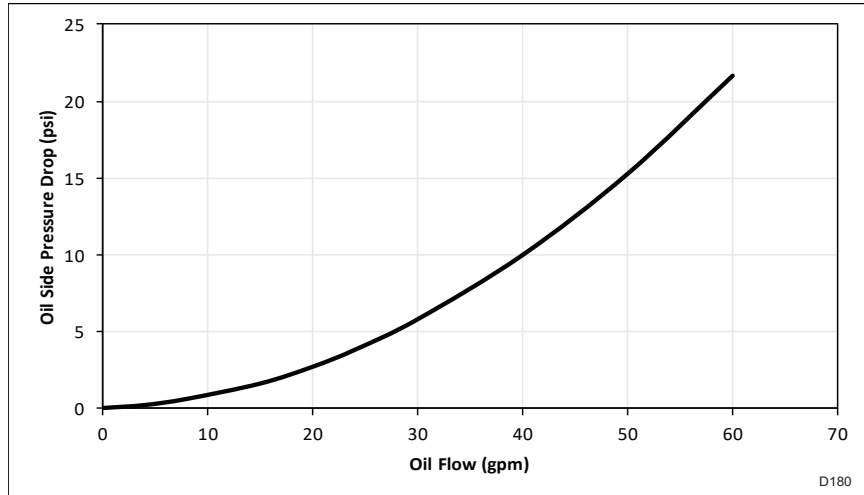


— continued on next page —

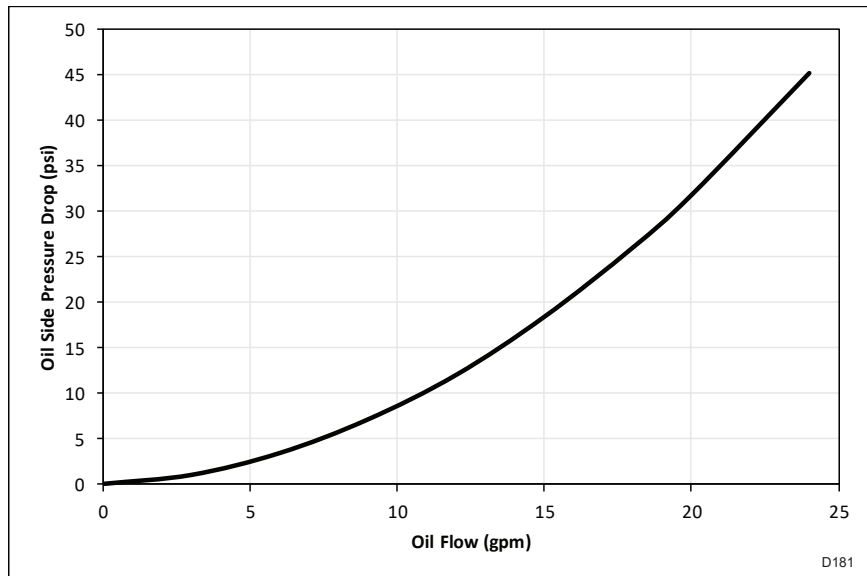


## 17.4 DIRECT-MOUNT RETARDER / SUMP COOLER (29538013) CHARACTERISTICS (U.S. UNITS - CONT'D)

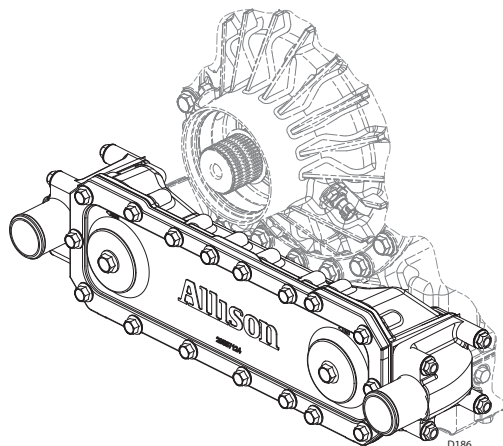
### RETARDER-SIDE OIL PRESSURE DROP



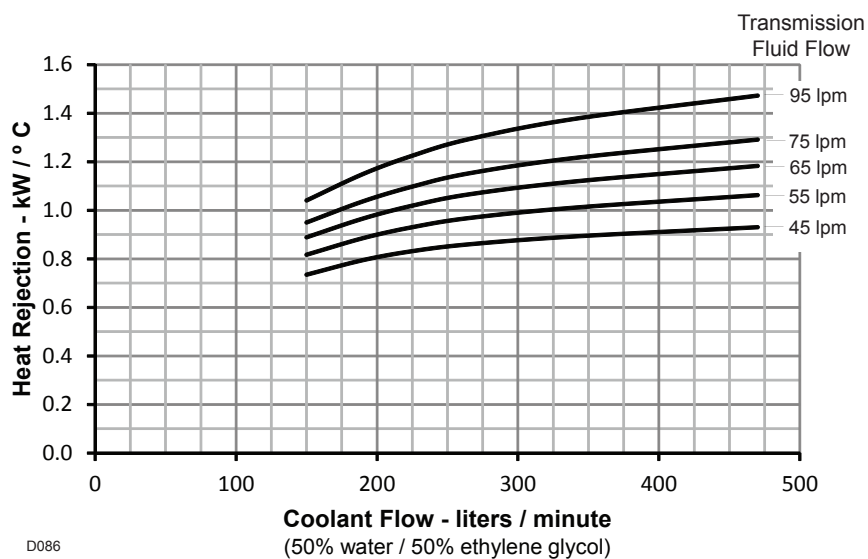
### SUMP-SIDE OIL PRESSURE DROP



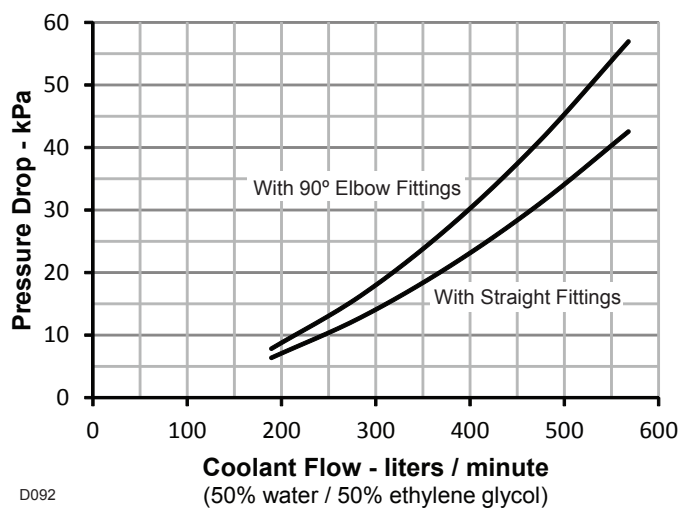
## 17.5 DIRECT-MOUNT, STANDARD-CAPACITY COOLER (29555184) CHARACTERISTICS, NON-RETARDER (METRIC UNITS)



### HEAT REJECTION



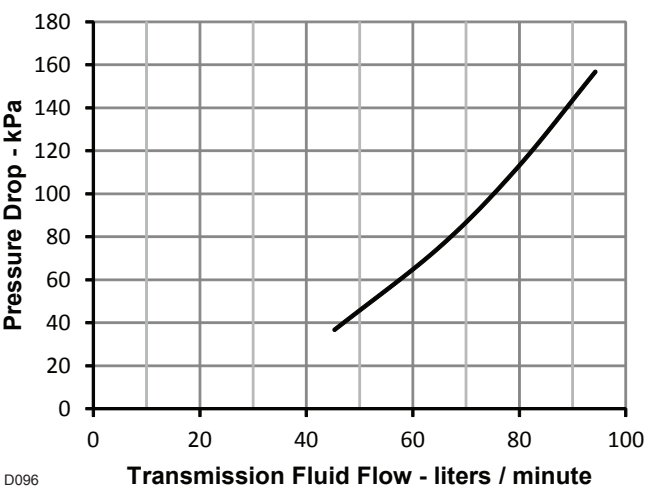
### COOLANT-SIDE PRESSURE DROP



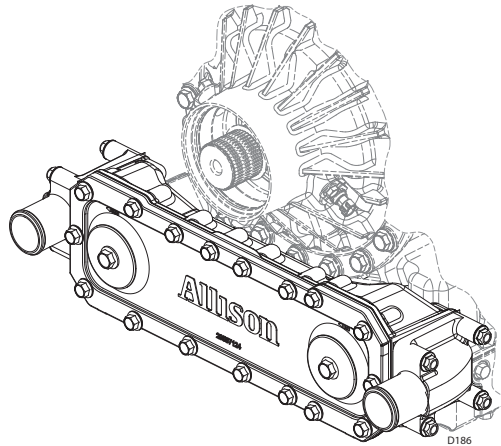
— continued on next page —

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

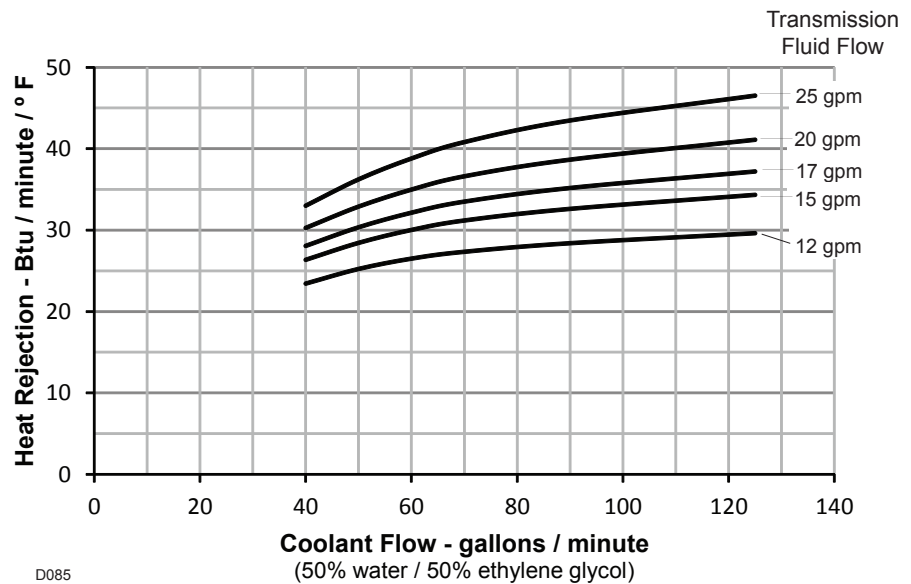
**OIL-SIDE  
PRESSURE  
DROP**



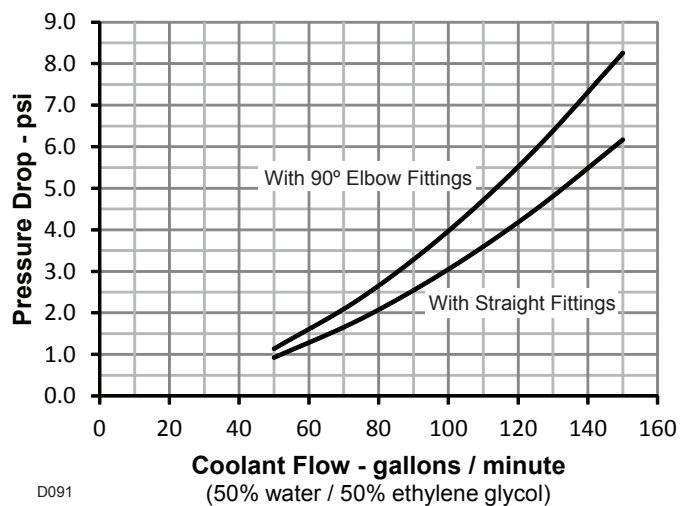
## 17.5 DIRECT-MOUNT, STANDARD-CAPACITY COOLER (29555184) CHARACTERISTICS, NON-RETARDER (U.S. UNITS)



### HEAT REJECTION



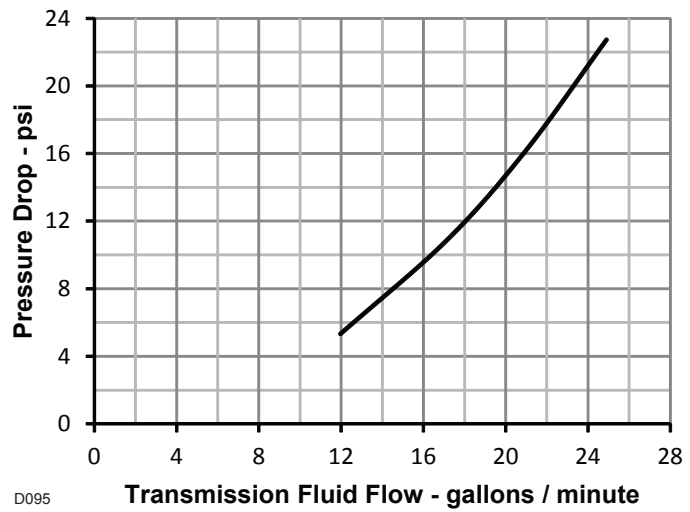
### COOLANT-SIDE PRESSURE DROP



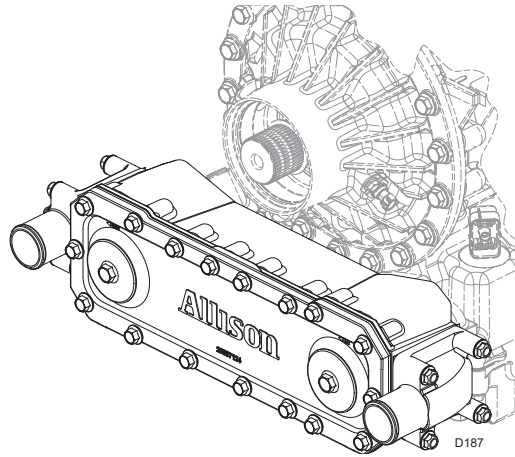
— continued on next page —

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

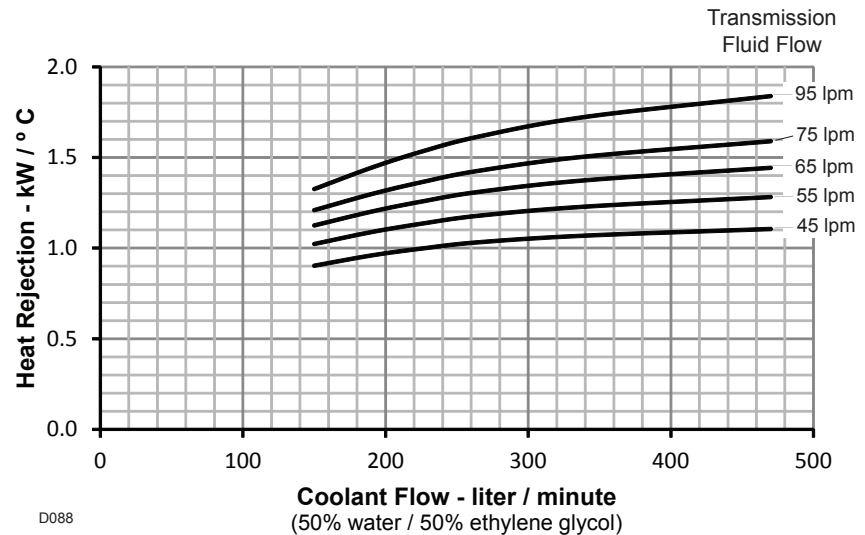
**OIL-SIDE  
PRESSURE  
DROP**



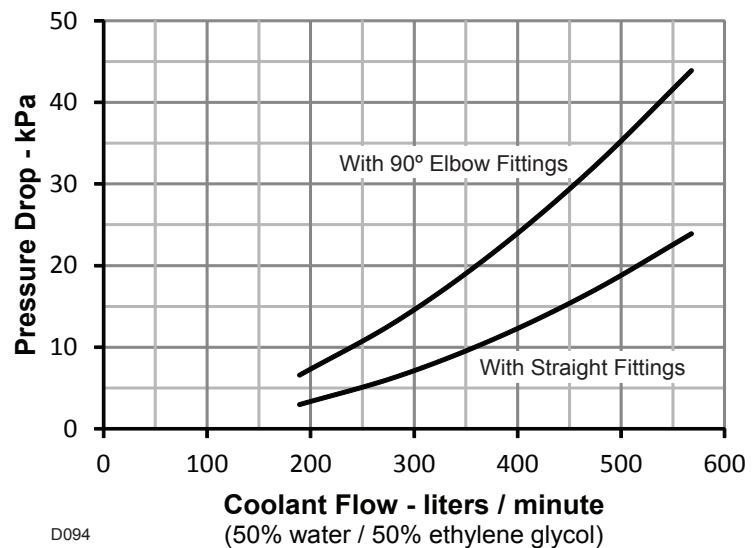
## 17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183) CHARACTERISTICS, NON-RETARDER (METRIC UNITS)



### HEAT REJECTION



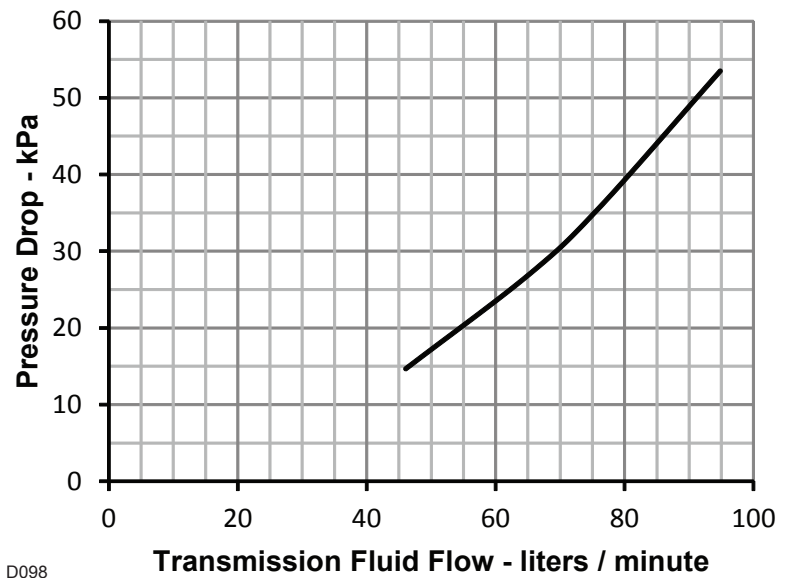
### COOLANT-SIDE PRESSURE DROP



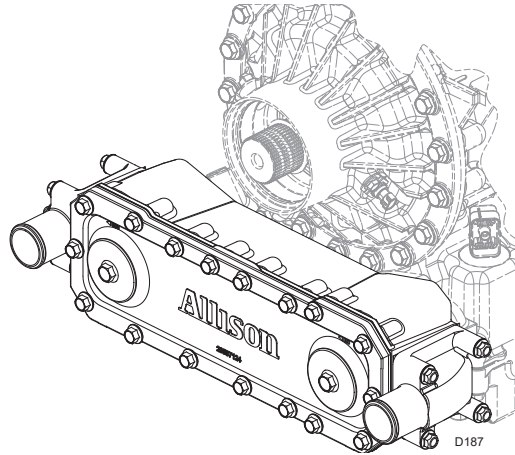
— continued on next page —

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

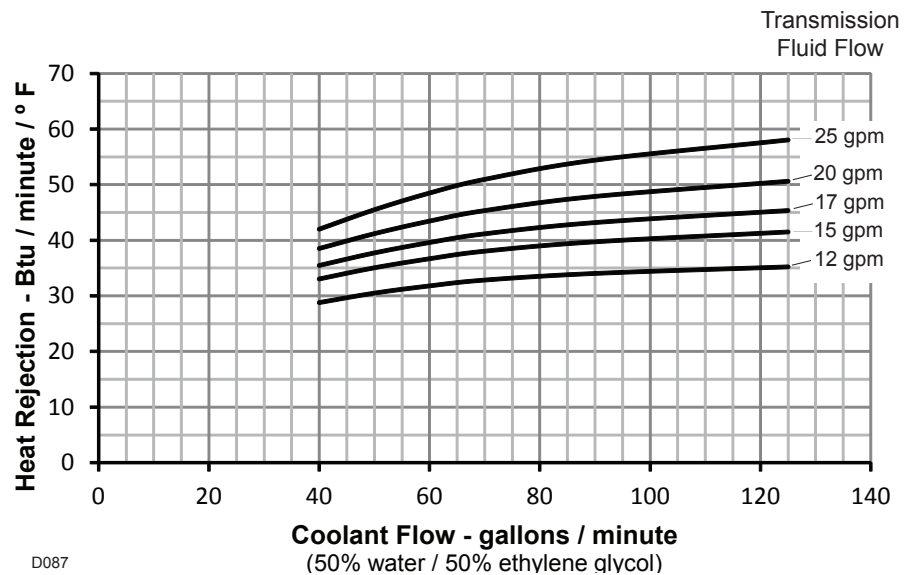
OIL-SIDE  
PRESSURE  
DROP



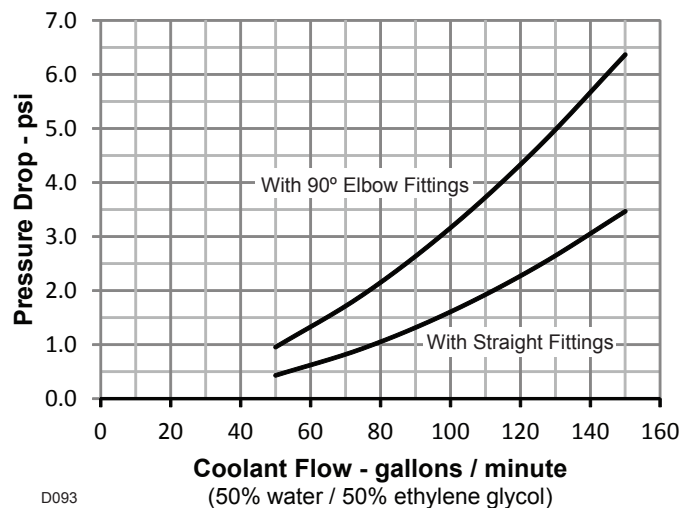
## 17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183) CHARACTERISTICS, NON-RETARDER (U.S. UNITS)



### HEAT REJECTION



### COOLANT-SIDE PRESSURE DROP

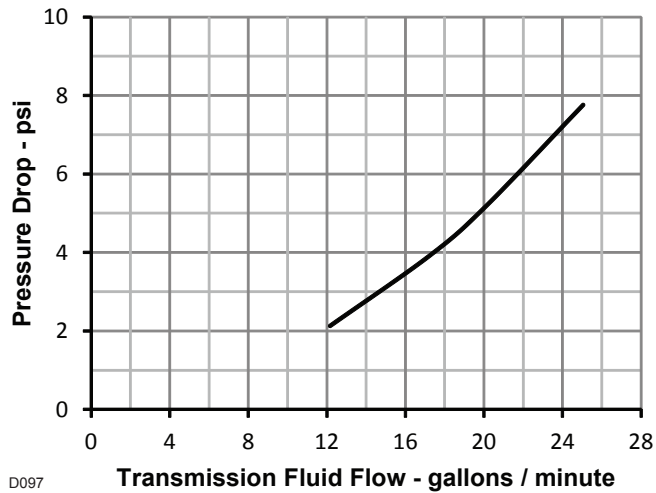


— continued on next page —

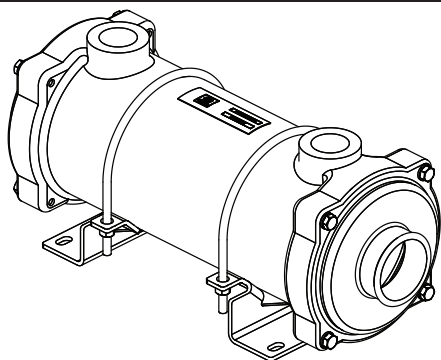


**17.6 DIRECT-MOUNT HIGH-CAPACITY COOLER (29555183)  
CHARACTERISTICS, NON-RETARDER (U.S. UNITS CONT'D)**

**OIL-SIDE  
PRESSURE  
DROP**



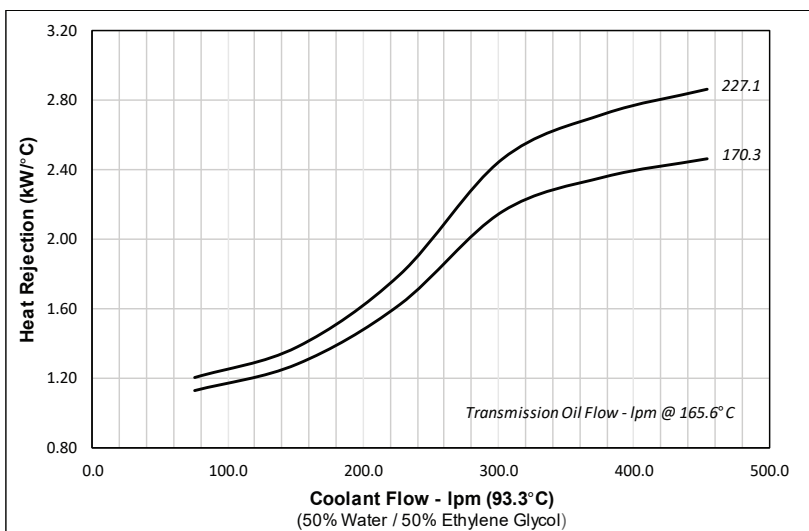
## 17.7 REMOTE-MOUNT TUBE & SHELL COOLER (29553529) CHARACTERISTICS NON-RETARDER & RETARDER (METRIC UNITS)



D184

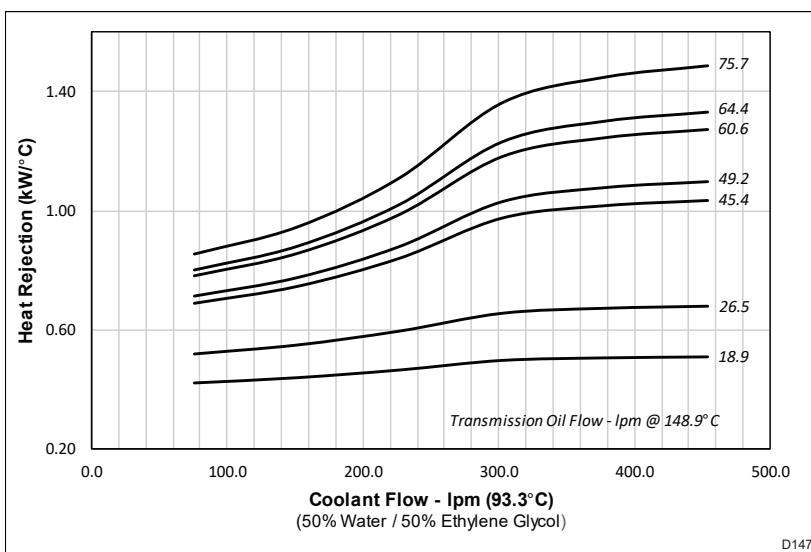
The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

### HEAT REJECTION



D146

### HEAT REJECTION

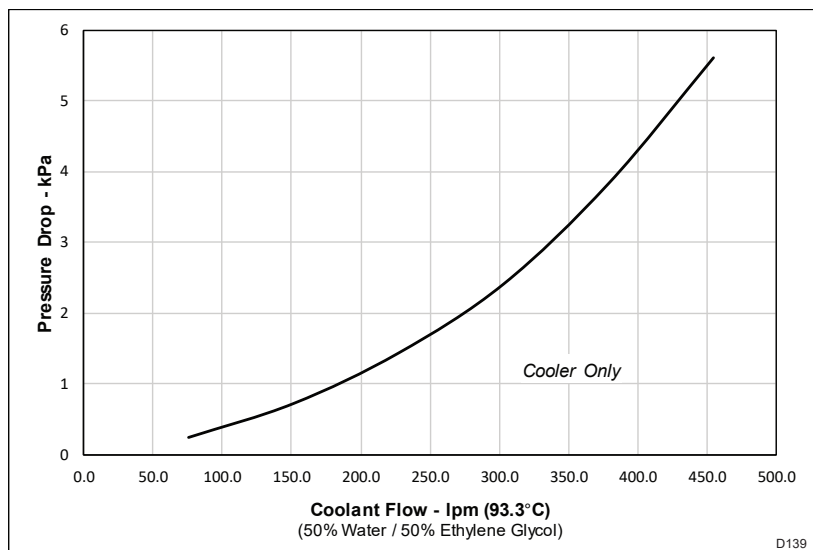


D147

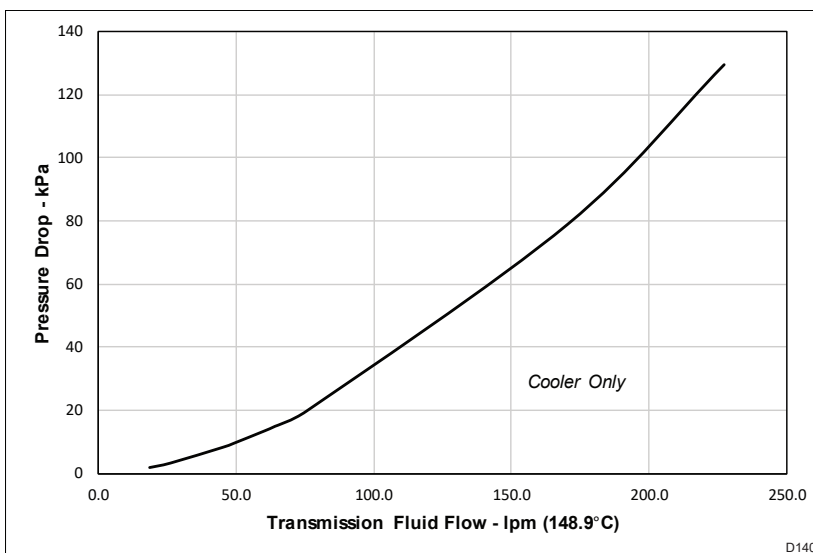
— continued on next page —

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

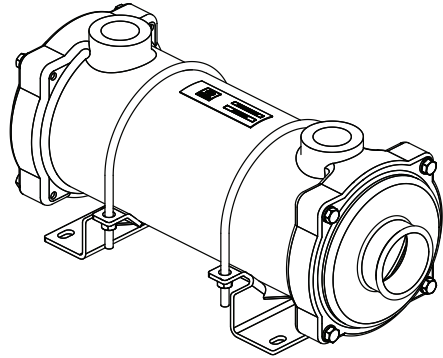
### COOLANT-SIDE PRESSURE DROP



### OIL-SIDE PRESSURE DROP



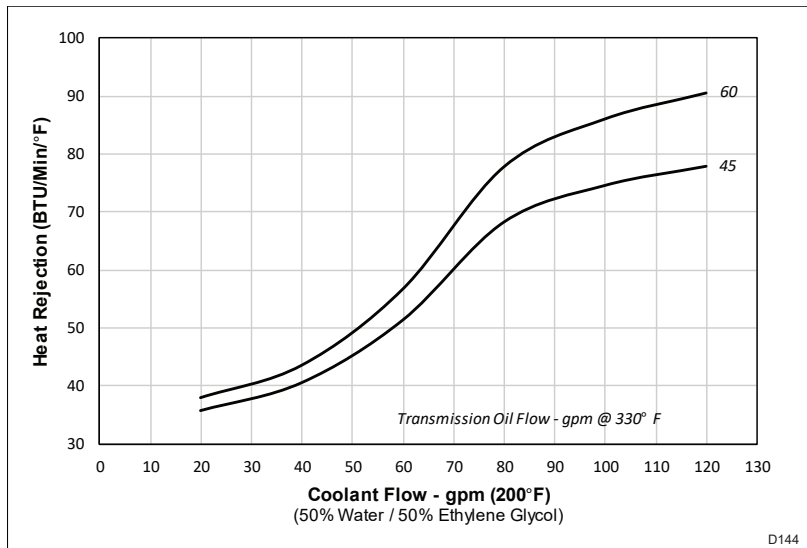
## 17.7 REMOTE-MOUNT TUBE & SHELL COOLER (29553529) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)



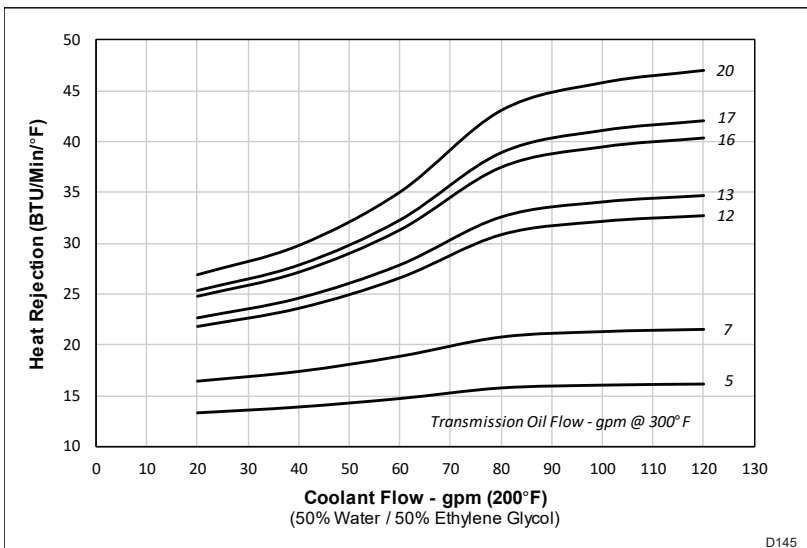
D184

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



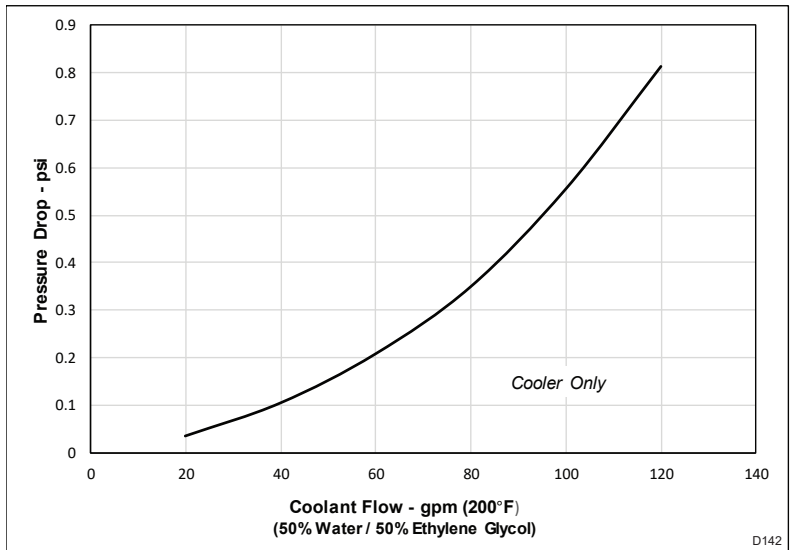
### HEAT REJECTION



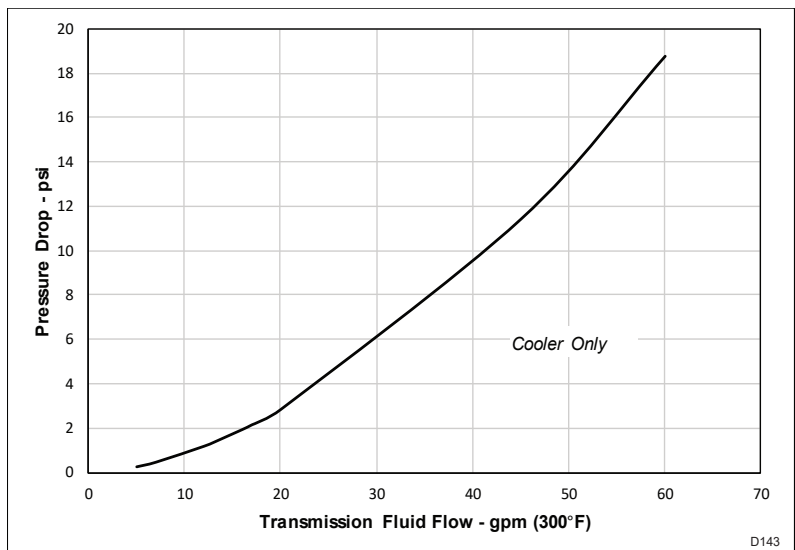
— continued on next page —

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

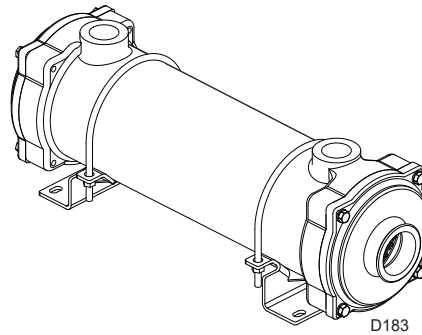
### COOLANT-SIDE PRESSURE DROP



### OIL-SIDE PRESSURE DROP

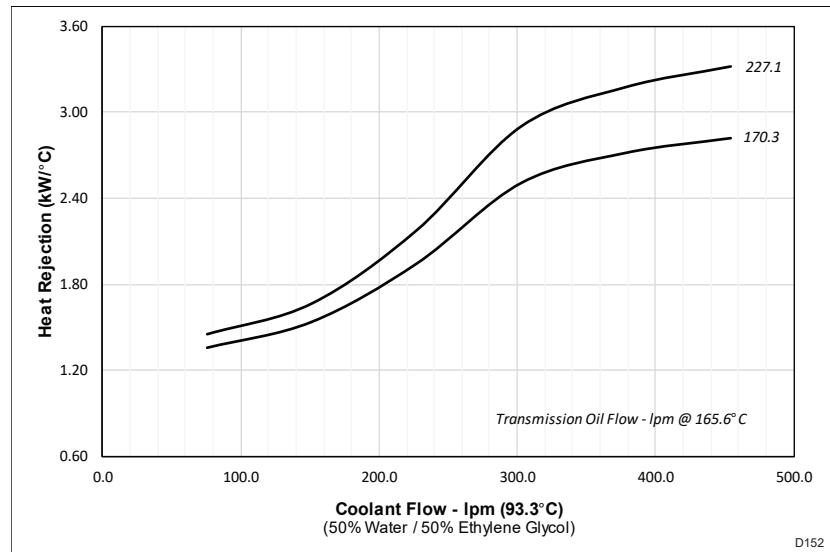


## 17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (METRIC UNITS)

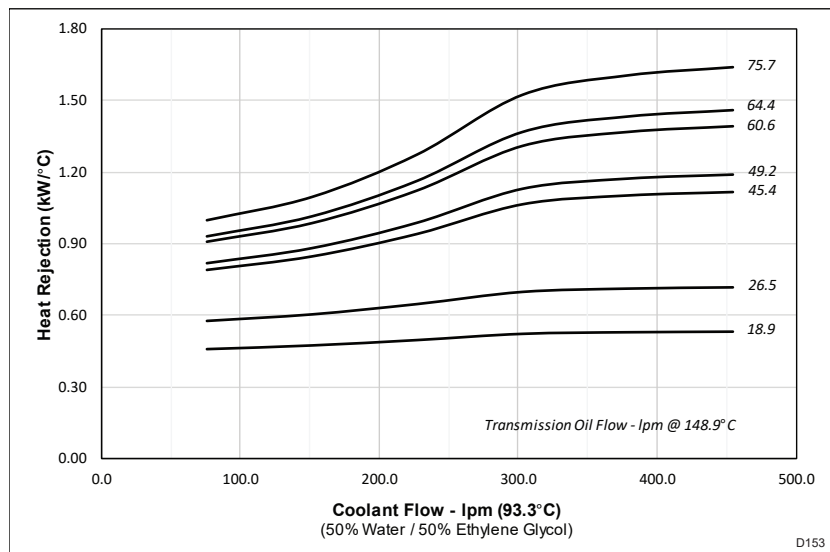


The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

### HEAT REJECTION



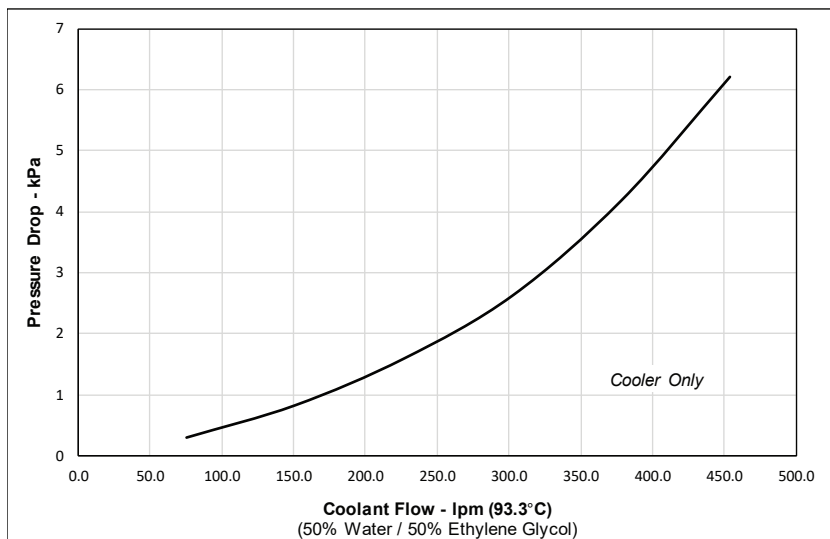
### HEAT REJECTION



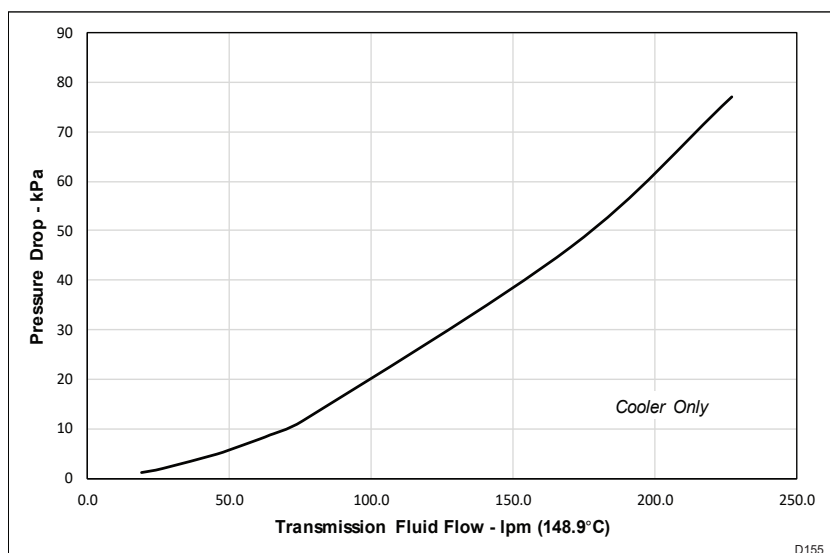
— continued on next page —

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

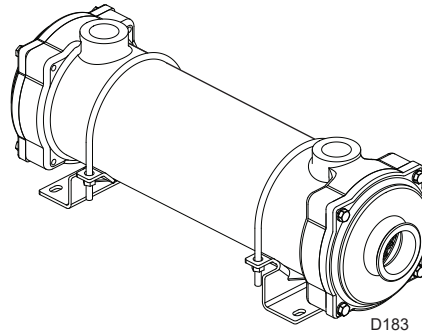
### COOLANT-SIDE PRESSURE DROP



### OIL-SIDE PRESSURE DROP

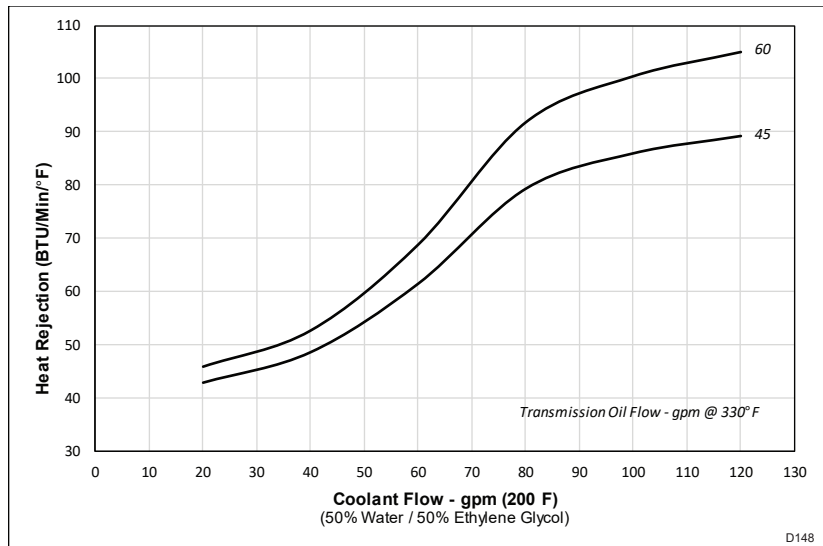


## 17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)

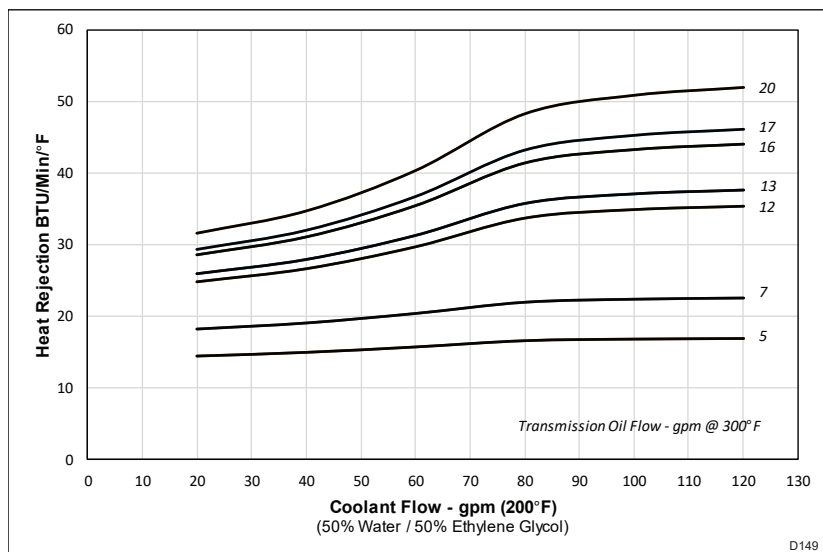


The following two charts represent the same cooler tested at different oil flows and temperatures. The first represents flow and temperature characteristics of retarder cooler circuit while the second represents transmission cooler circuit.

### HEAT REJECTION



### HEAT REJECTION

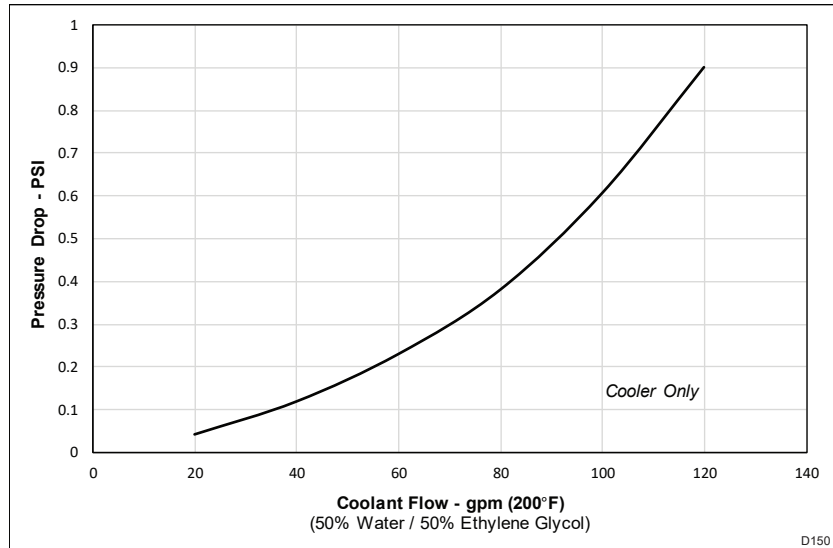


— continued on next page —

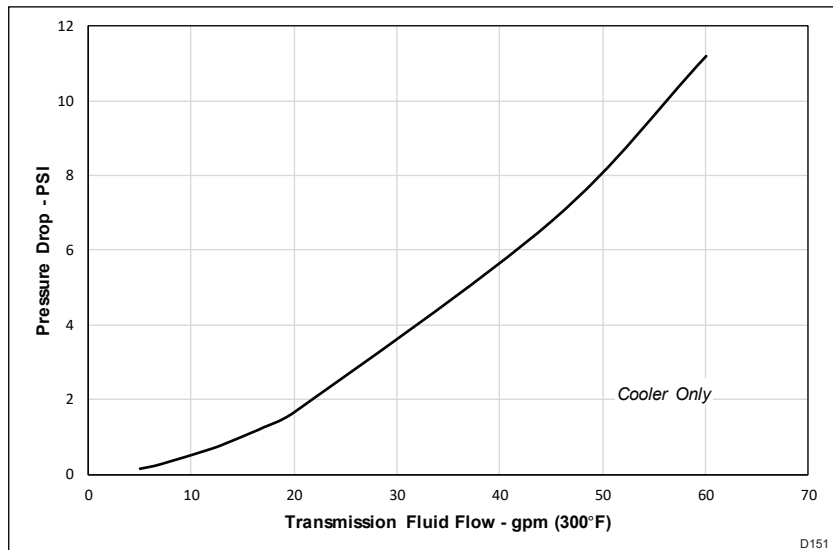


## 17.8 REMOTE-MOUNT TUBE & SHELL COOLER (29559270) CHARACTERISTICS NON-RETARDER & RETARDER (U.S. UNITS)

### 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

### **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

### **September 23, 2015**

- In 16.2, corrected typo/conversion error in Temperatures for Filters and Hydraulic Lines section. Maximum intermittent excursions values changed to "-40 to 149 °C". Previously, incorrectly showed "-40 to 165 °C".