

ENGINEERING
TOMORROW

Danfoss

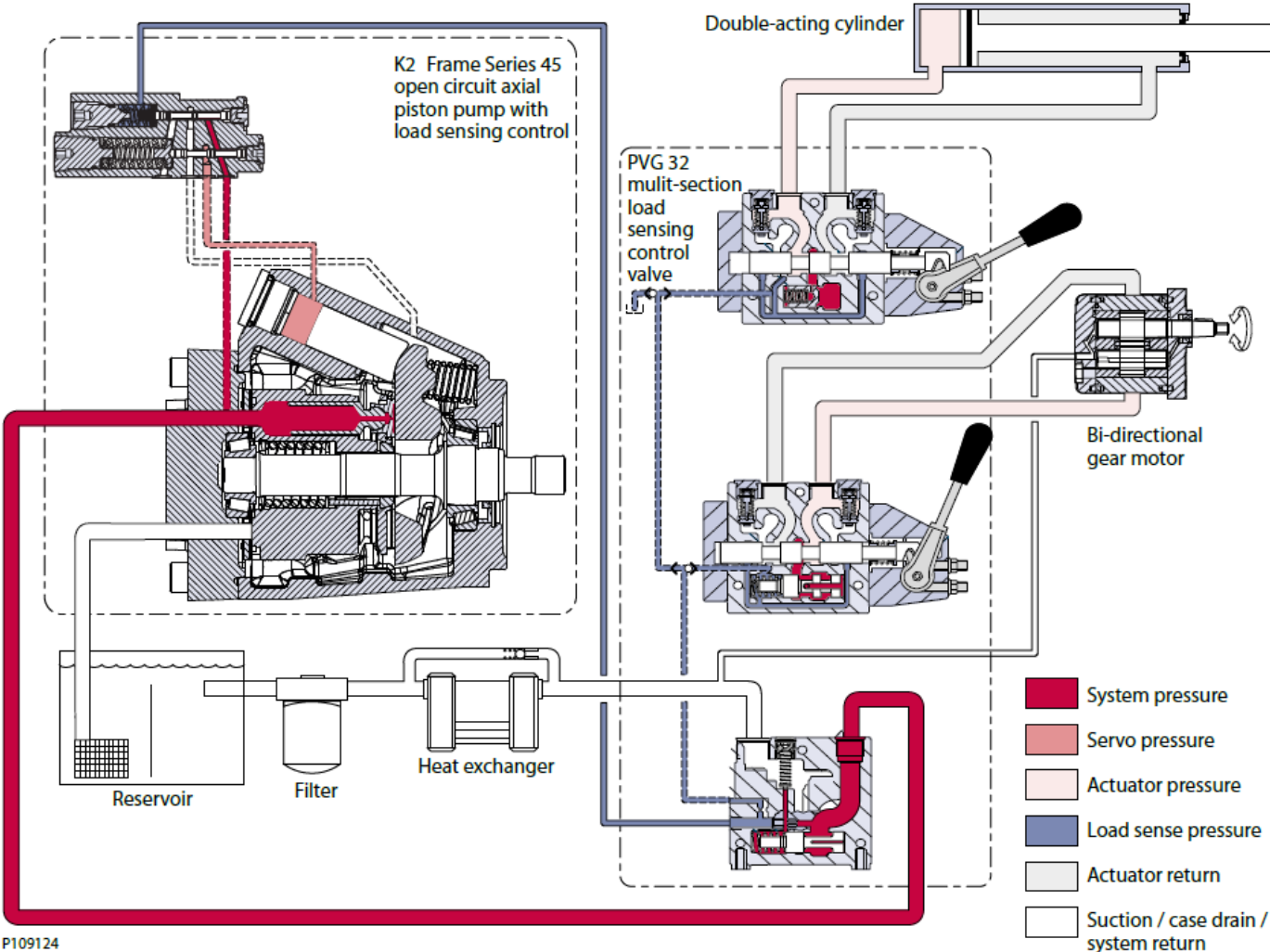
Series 45 Open Circuit Piston Pumps

Seminar CSS Praha_ Marec 7.

www.powersolutions.danfoss.com



Open circuit hydraulic system



P109124

Series 45 History

Strong Customer Demand for OC Products to Compliment CC Products



H-Frame is launched in tractor pump application

European Manufacturing Footprint Opens



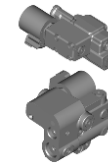
K-Frame 45CC pumps launched



F-Frame is Launched



E-Frame is Launched



Electronic Proportional (EPC) Control is Launched



Electric Torque Limiter



K2-Frame is launched

1990

57cc Kit Developed

1995

G-Frame 74CC is launched with external control



2000

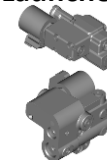
J-Frame is launched



25,000 Units Annual Reached

2005

Electronic On/Off Control is Launched



2010

Electronic Power Management



2015

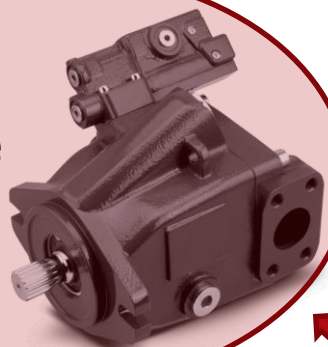
FDC control (Fan drive Control)



2017 Future

S45 - Product family

■ K2 Frame



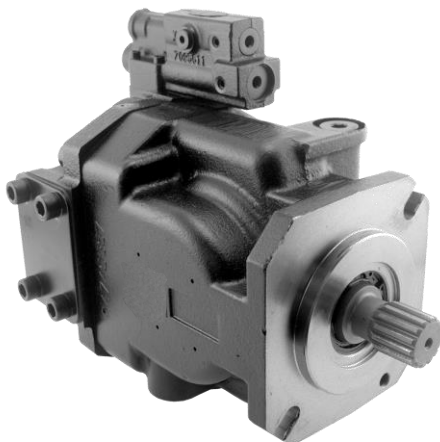
■ J Frame



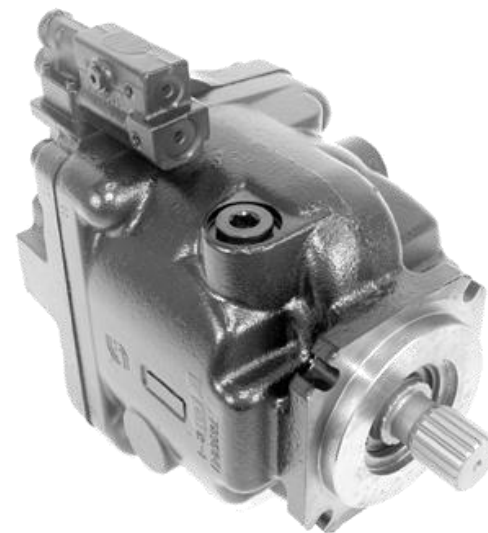
■ L/K Frame



■ F Frame

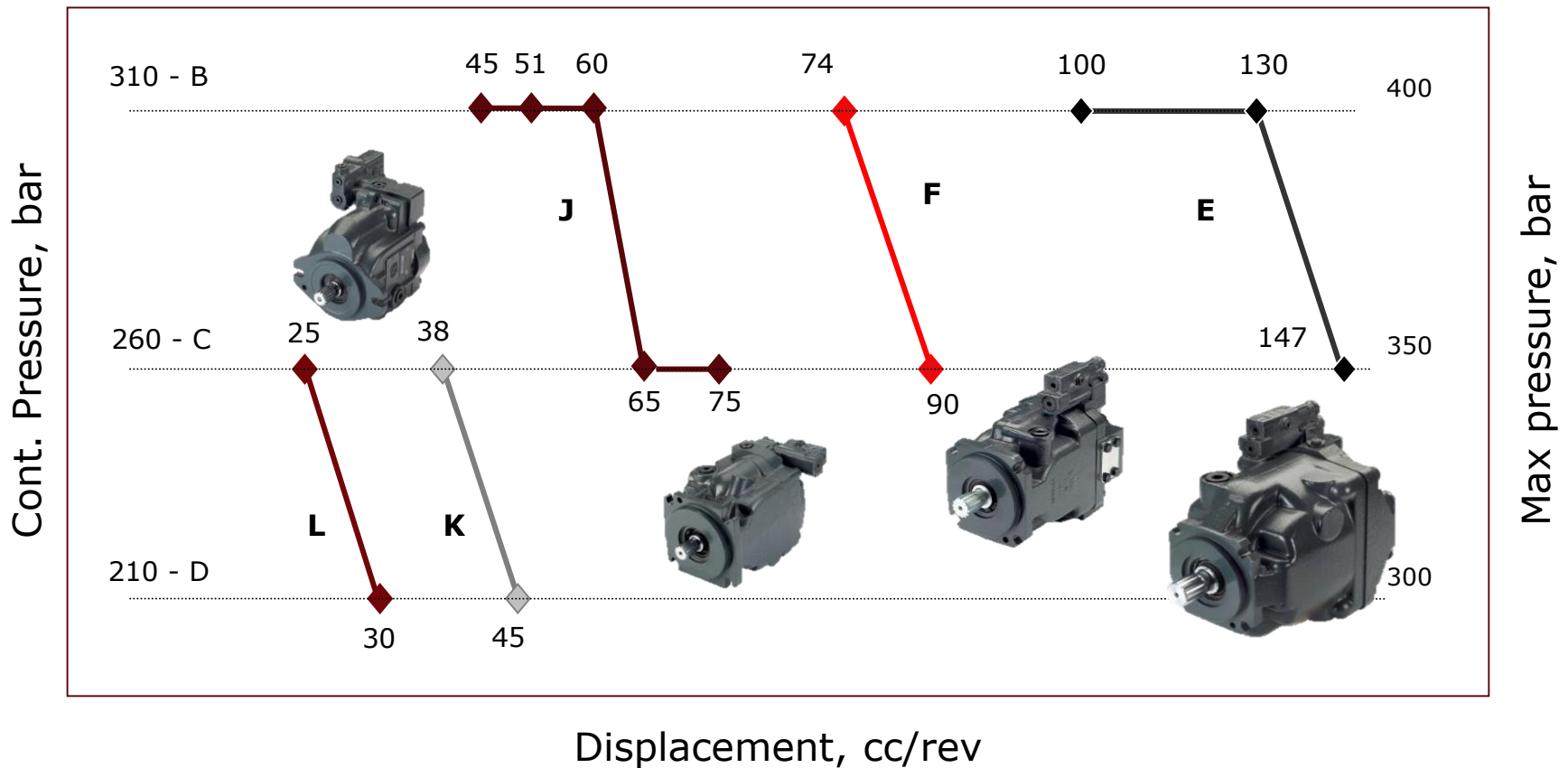


■ E Frame



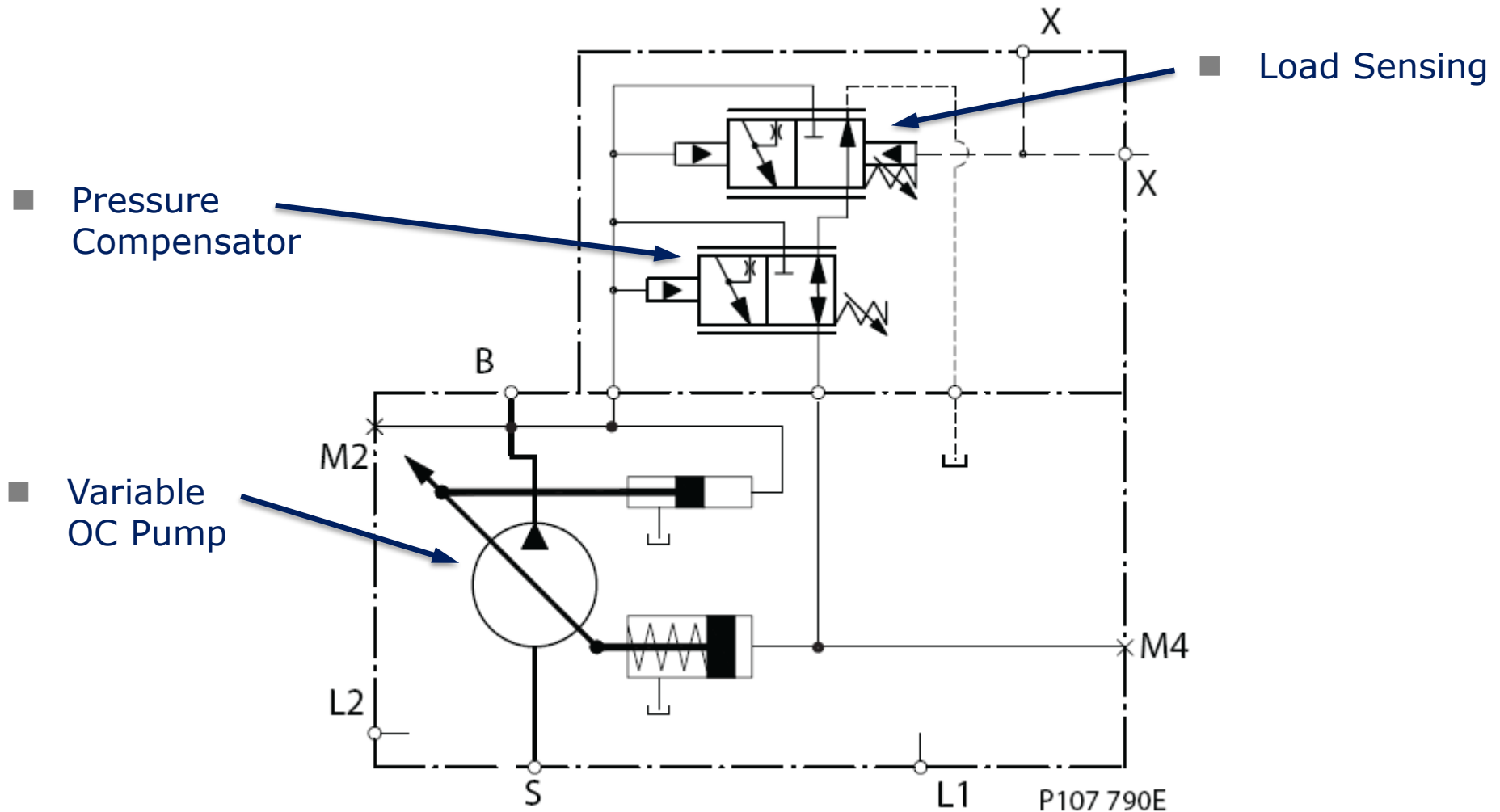
Introduction - Product family

- Pressure ratings: 210 – 310 bar



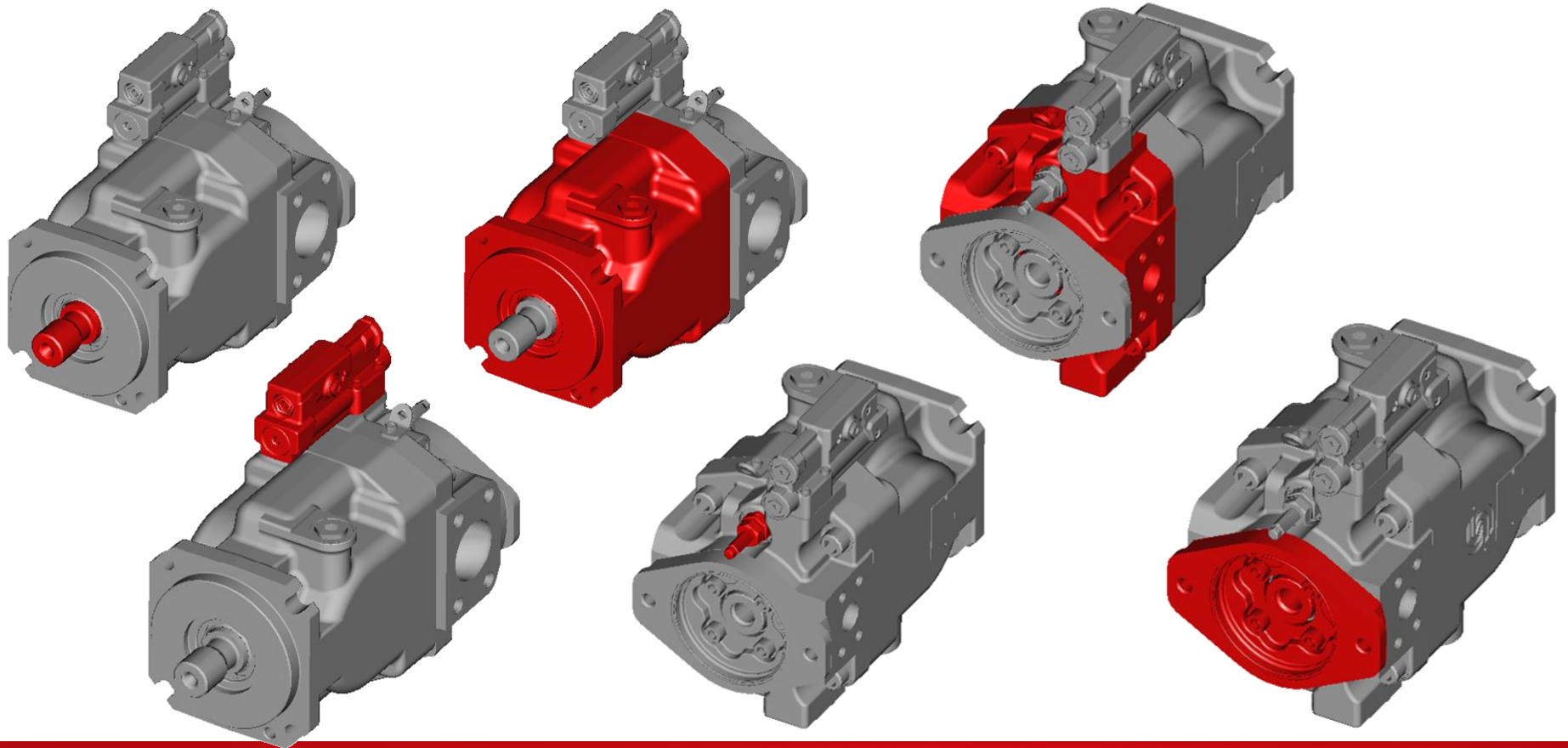
Product and system information

Hydraulic Schematic – PC/LS Control

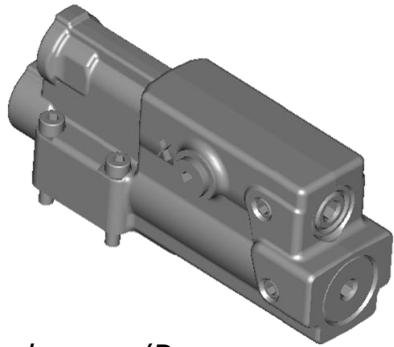


Technical Details – Globally Consistent Master Model Code

R	S	P	C	D	E	F	G	H	J	K	L	M	N																																
F	R	-	R	-	0	7	4	B	-	L	S	-	2	0	-	2	0	-	N	N	-	N	-	3	-	S	1	B	2	-	A	1	N	-	A	A	A	-	N	N	N	-	N	N	N

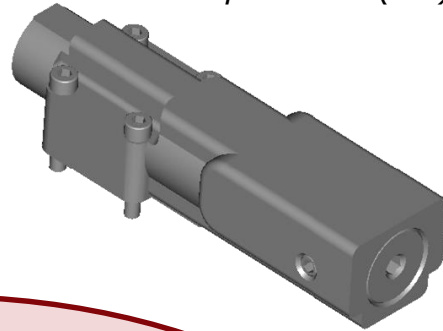


S45 Control options

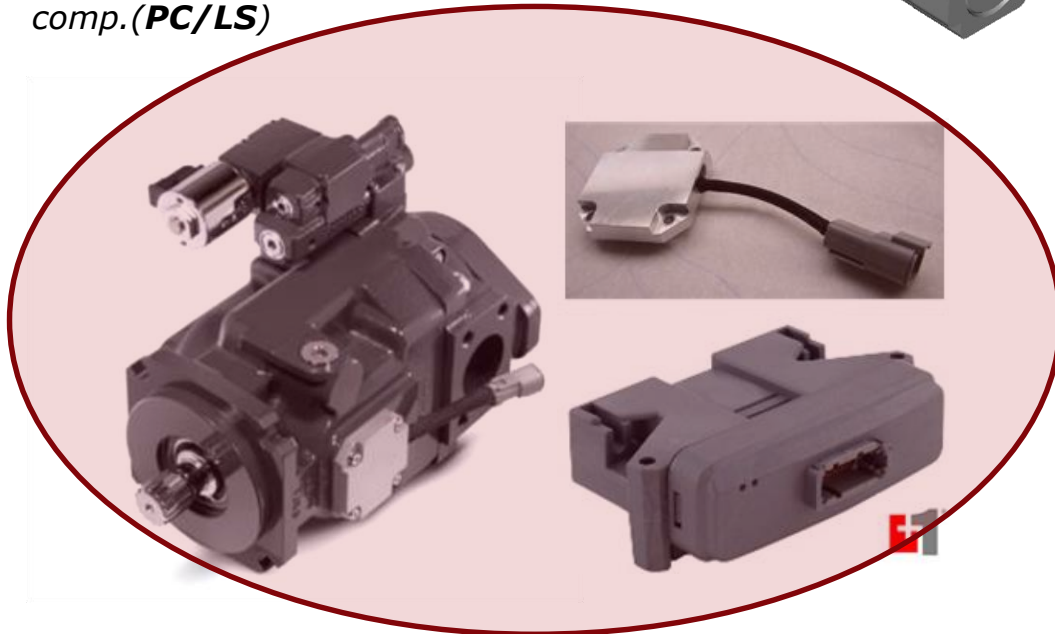
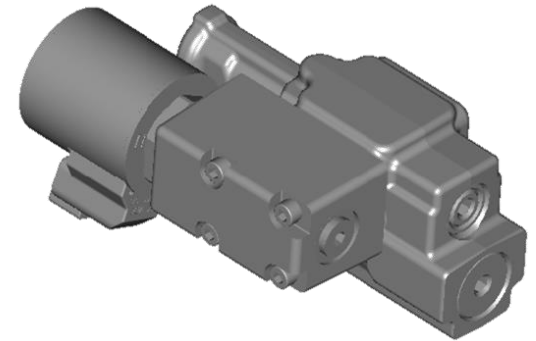


Load sense/Pressure comp. (**PC/LS**)

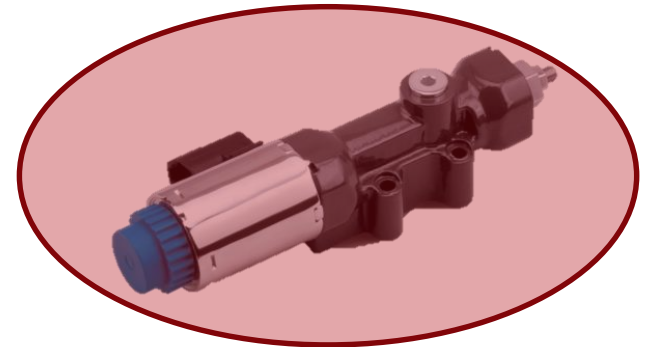
Pressure compensator (**PC**)



Electric solenoid Pressure relieve valve :
- Proportional PRV (EPC)
- On/Off PRV



Ele.torque Limitation (**ETL**)



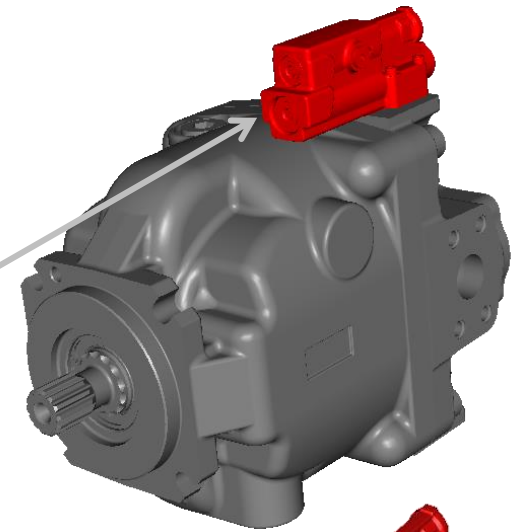
Fan Drive Control (**FDC**)- single spool

Technical Details

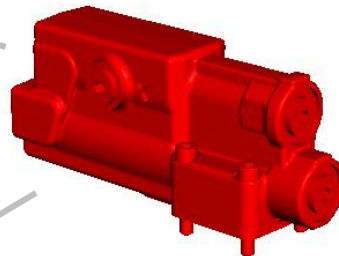
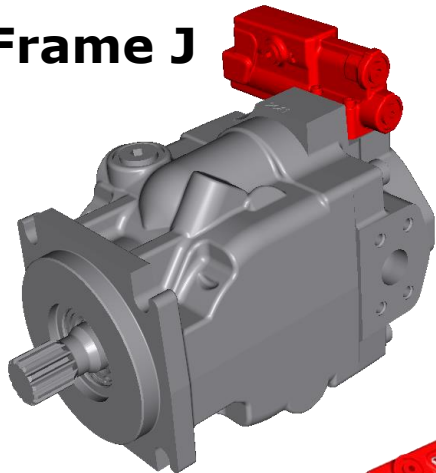
Control universality

- One controls interface for all S45 :

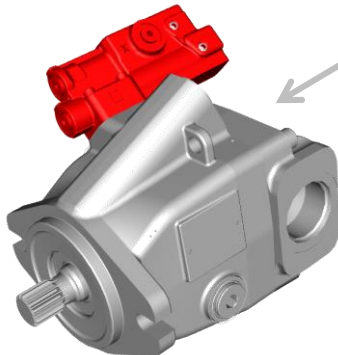
Frame E



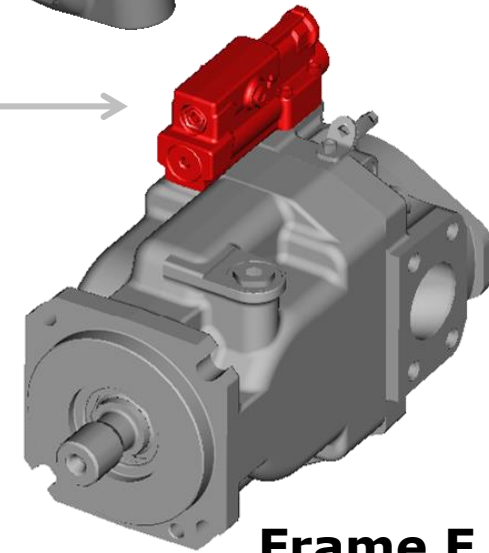
Frame J



Frame K2



Frame F



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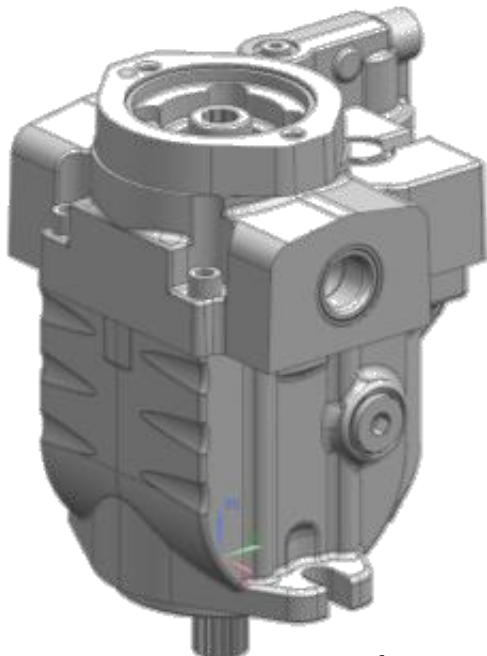
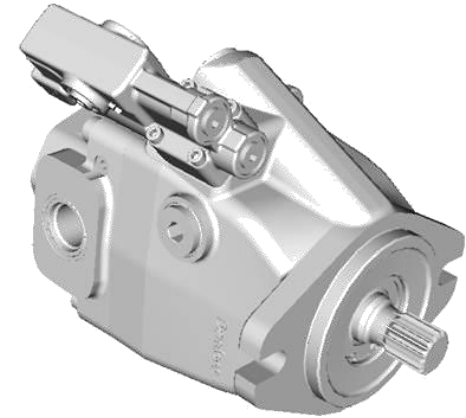
New Product Development Series 45- K2



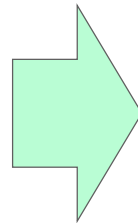
What is K2?

Youngest member of S45 family with:

- Reduce size & weight
- New Control Options
- Maintain Sound Level
- Increase pressure and speed rating
- Lower installed costs



Current L/K

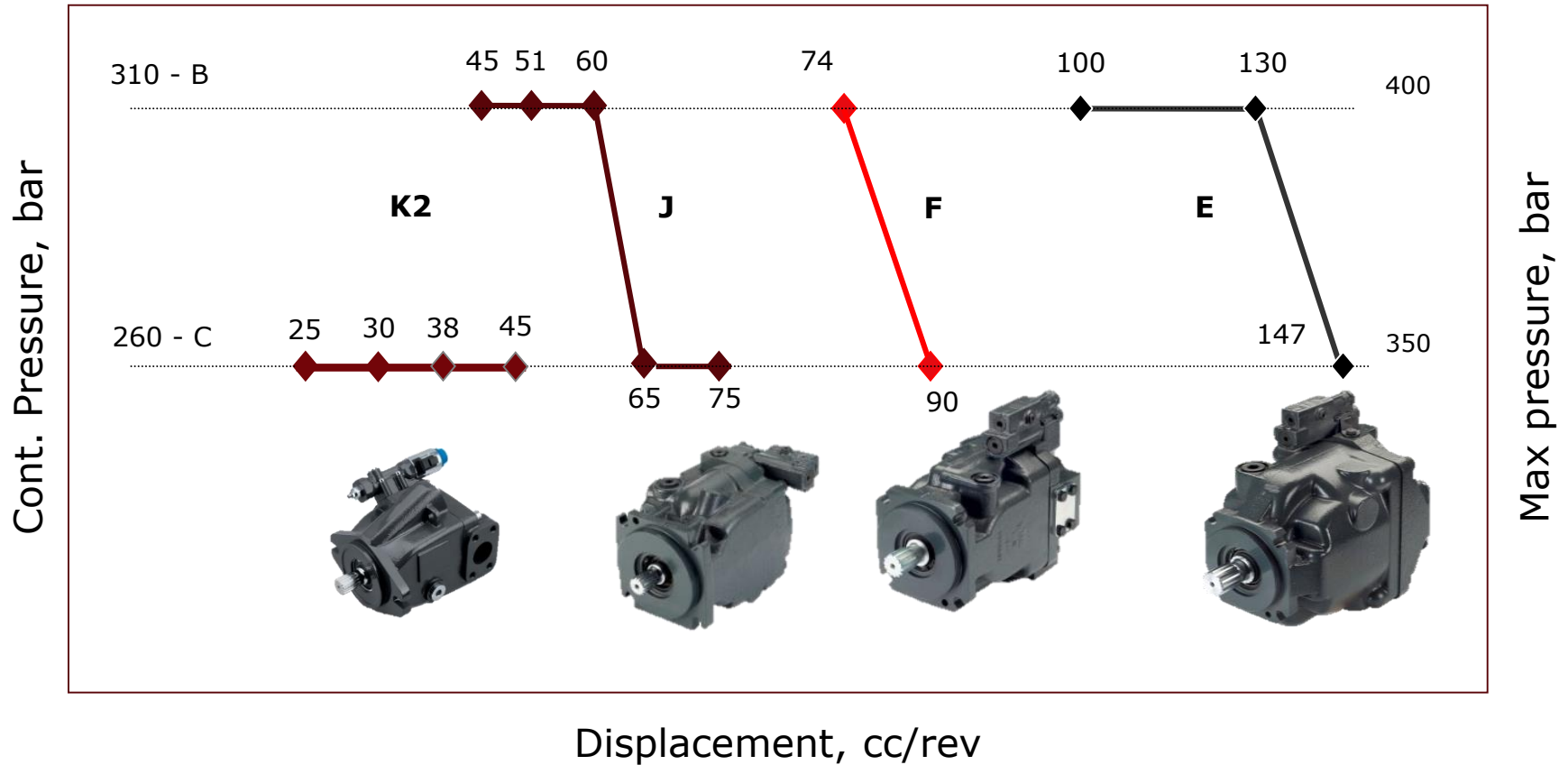


K2 Final

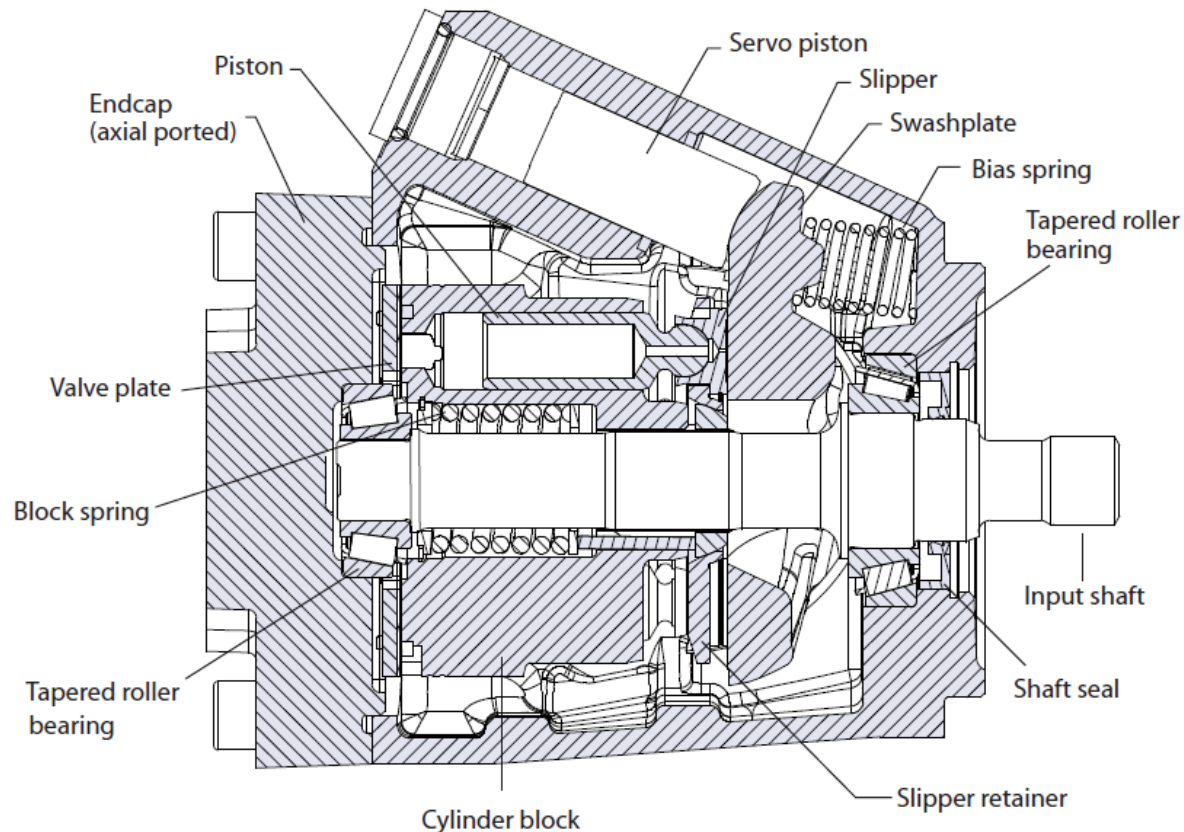
Series 45 Product Family

- **Frame K2 - serial production started by April 2017 !!!!**

Pressure ratings: 260 – 310 bar

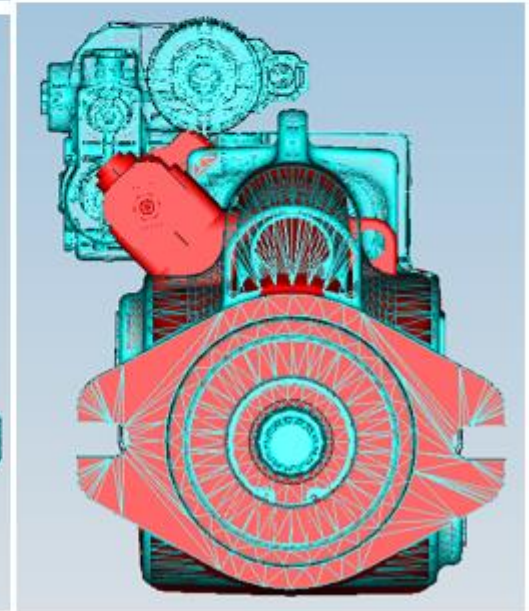
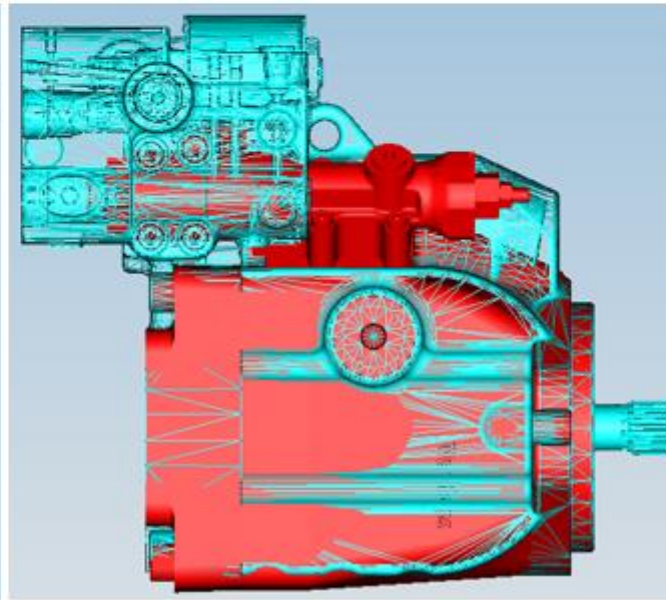
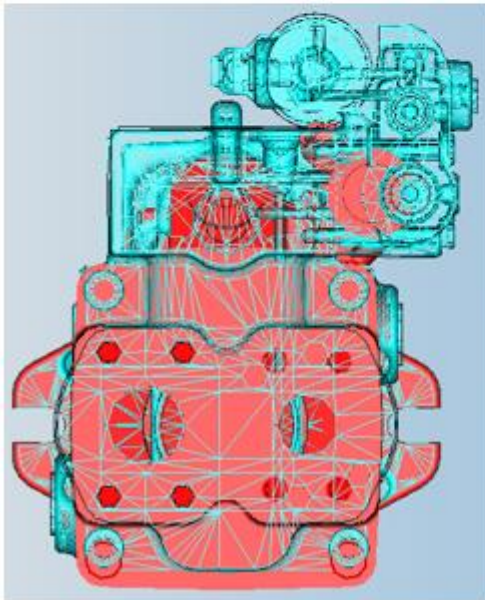
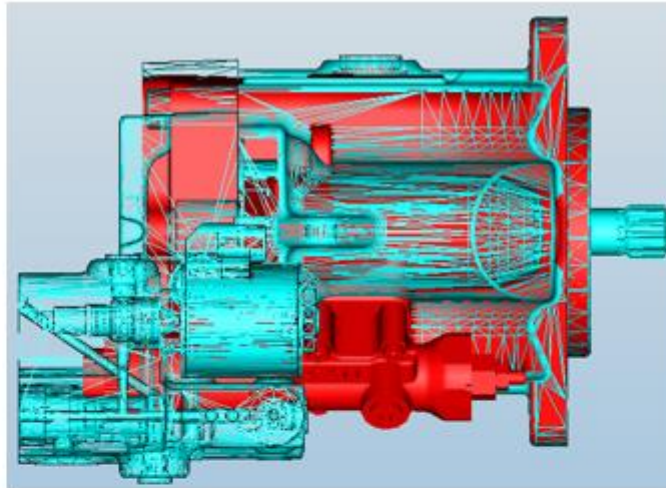


K2 Servo Design



- Servo Piston is packaged inside the housing
- Allows for access to servo through plug
- Servo system piston similar as today's K/L frame

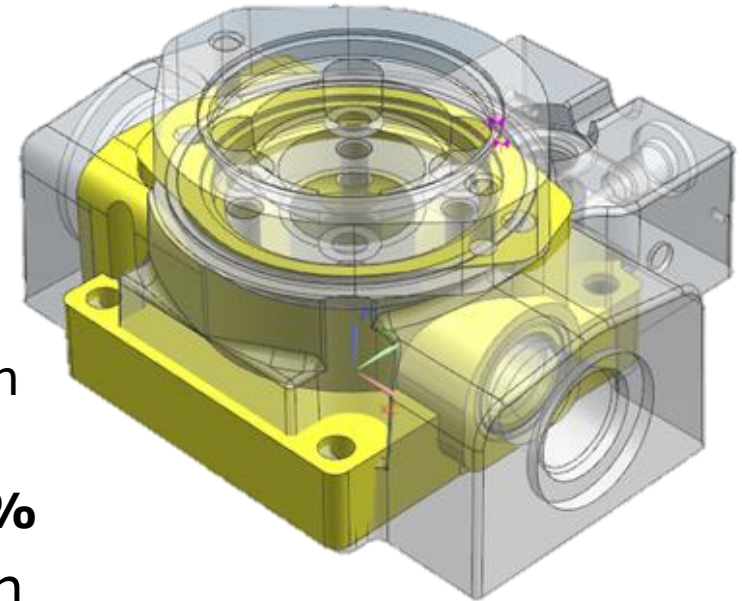
K vers K2 design overlap



Endcap Concept

Best Combination of Package and Weight (45cc)

- **Servo piston and control mounting relocated** to pump housing
- **Reduced Length up to 20%**
 - Better installation Package for tandem installation
- **Total weight reduction of up to 30%**
 - Weight often an Customer concern



L/K-Frame vs. K2

Speed upgrade

General performance specifications for the series 45 pump family

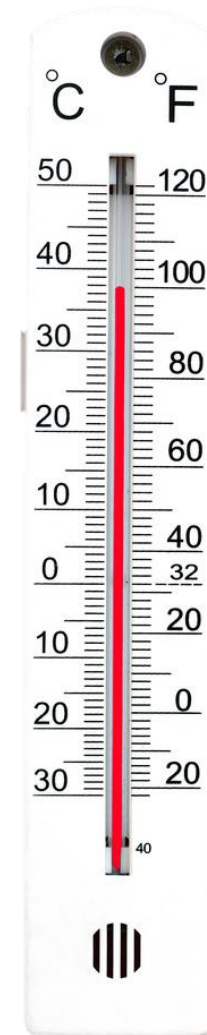
Pump		Displacement		Speed			Pressure				Theoretical flow (at rated speed)		Mounting
Frame	Model	cm3	in3	Continuous min-1 (rpm)	Max. min-1 (rpm)	Min. min-1 (rpm)	Cont.		Max.		US gal/min	l/min	Flange
							bar	psi	bar	psi			
Frame L	L25C	25	1.53	3200	3600	500	260	3770	350	5075	21.0	80.0	SAE B - 2 bolt
	L30D	30	1.83	3200	3600	500	210	3045	300	4350	25.4	96.0	SAE B - 2 bolt
Frame K	K38C	38	2.32	2650	2800	500	260	3770	350	5075	26.6	100.7	SAE B - 2 bolt
	K45D	45	2.75	2650	2800	500	210	3045	300	4350	31.5	119.3	SAE B - 2 bolt

K2 pump Displacement	25cc	30cc	38cc	45cc
K2 Speed Continuous (RPM)	3450	3200	2900	2900

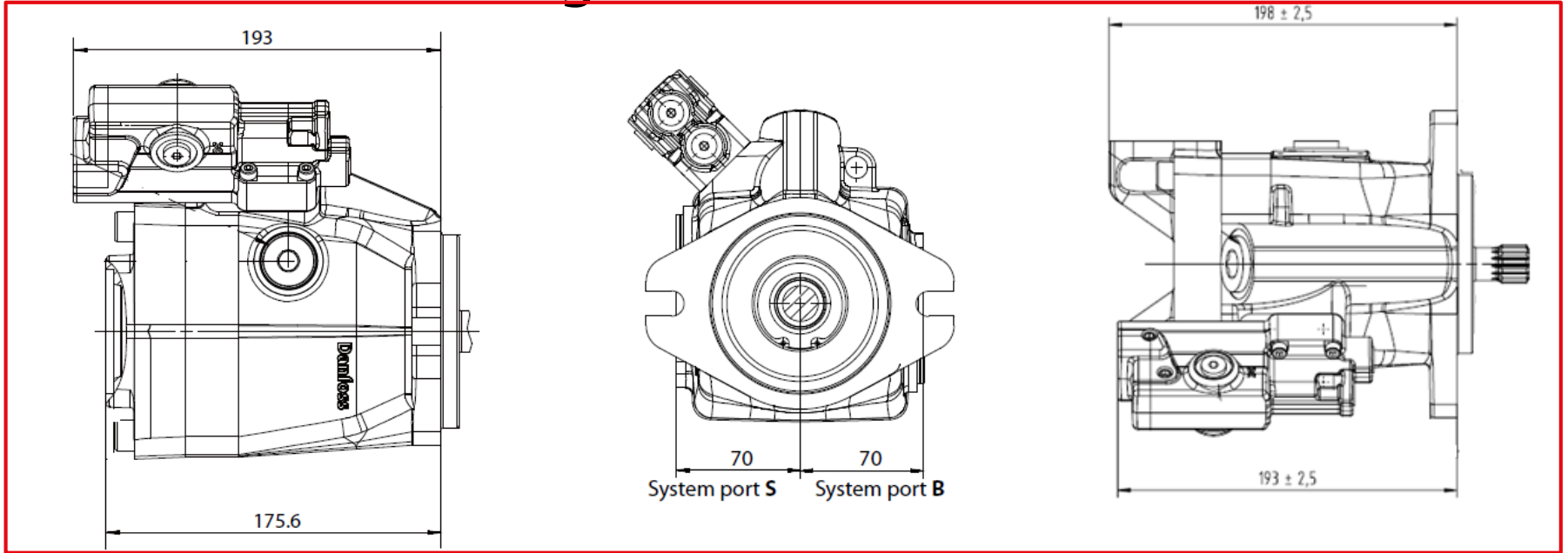
Increased Temperature Ratings

Offers for K2 improved case temperature limits:

- Minimum - 40° C (intermittent, cold start)
- **Continuous 104° C** (previously 82° C)
- **Maximum Intermittent 115° C**

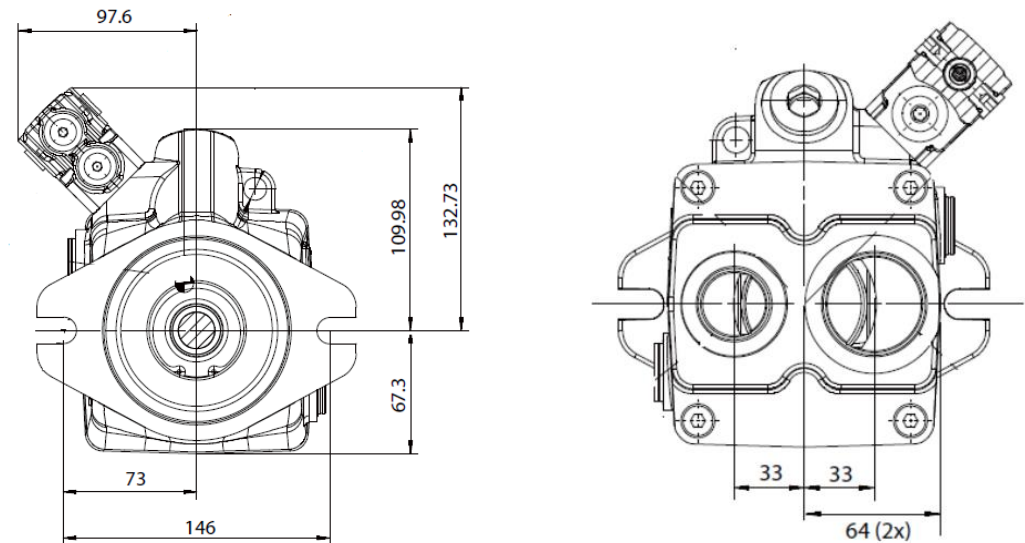


K2 - Best Package Size



Weight :

- 16,27 kg _axial , LS
- 17,14 kg _Rad NTD_LS



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Electronic Torque Limitation (ETL) System Solution

Work Function training



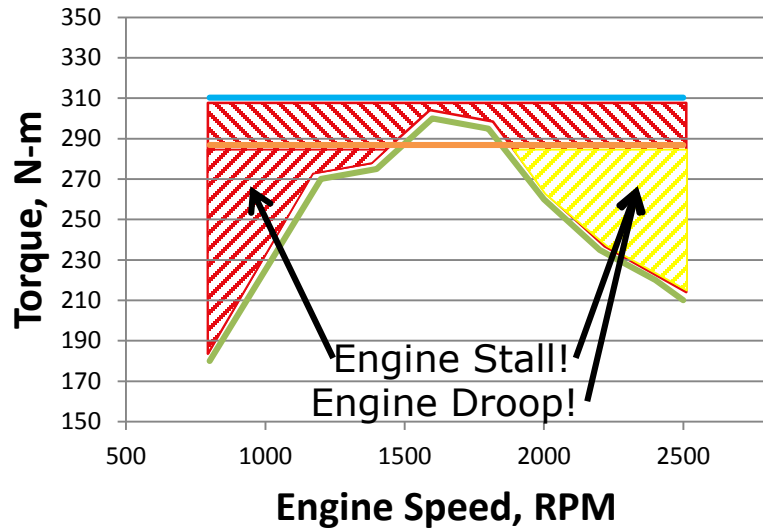
How does it work?

ETL Theory

Traditional Non-ETL & mechanical torque limiting (MTC) solutions

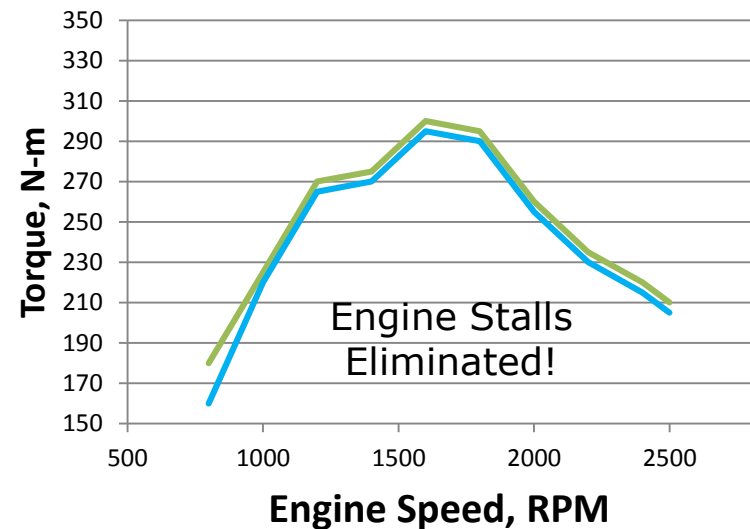
Electronic Torque Limiting solution

No ETL & MTC



— QSF2.8 Engine Torque (N-m) — Pump Torque - NO ETL (N-m)
— Pump Torque - MTC (N-m)

ETL Active

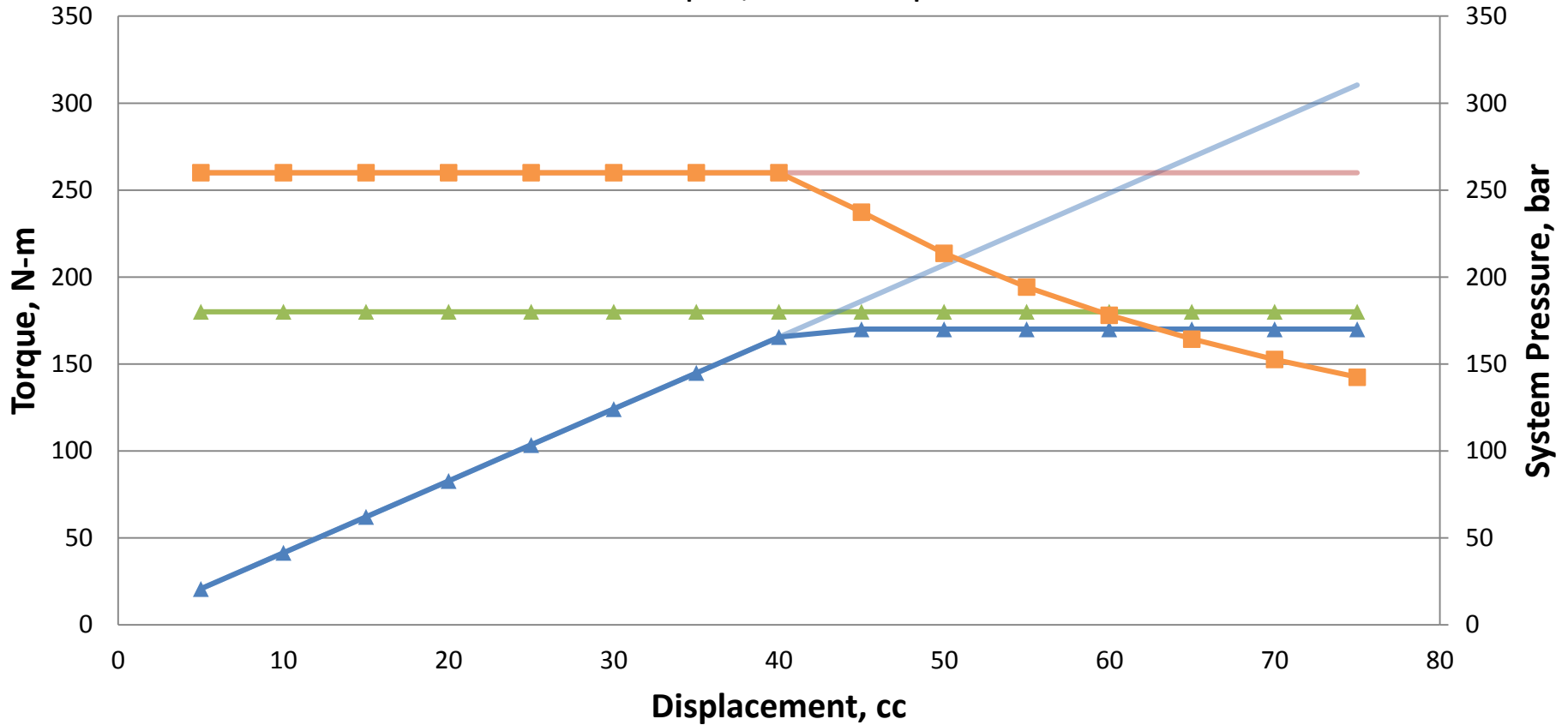


— QSF2.8 Engine Torque (N-m) — Pump Torque - ETL (N-m)

How does it work?

ETL Theory

Torque Required (ETL Active) Constant Speed, Maximum Displacement



—▲— Engine Torque Available (N-m)

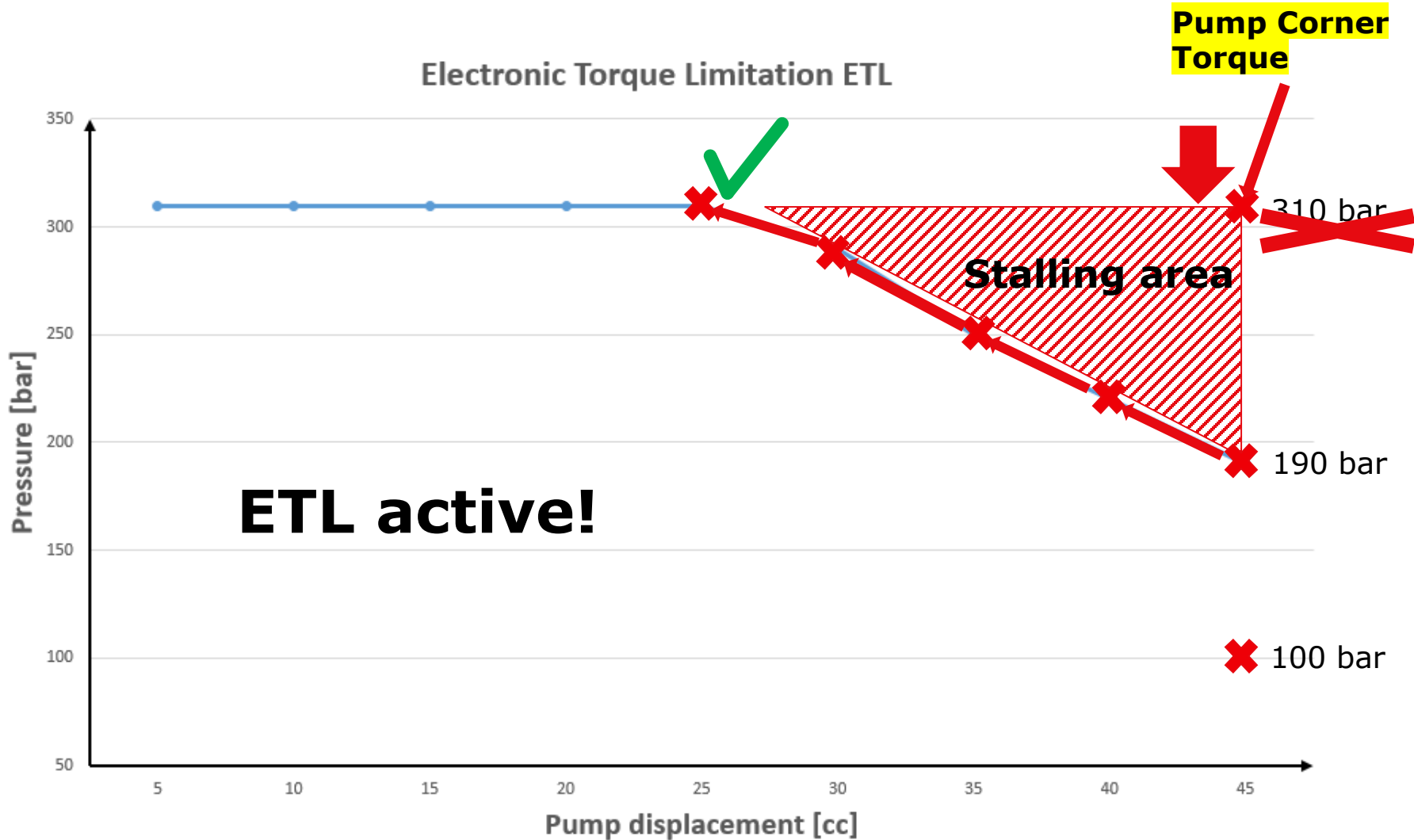
— Pump Torque - NO ETL (N-m)

—▲— Pump Torque ETL Active - (N-m)

— PC Setting (bar)

—■— LS Signal line + margin (bar)

ETL - How does it work?



Remember: $T_{\text{orque}} = k \times P \text{ [bar]} \times D_{\text{isplacement}} \text{ [cc]}$

K= constant, P = pump pressure

How does it work?

System Components

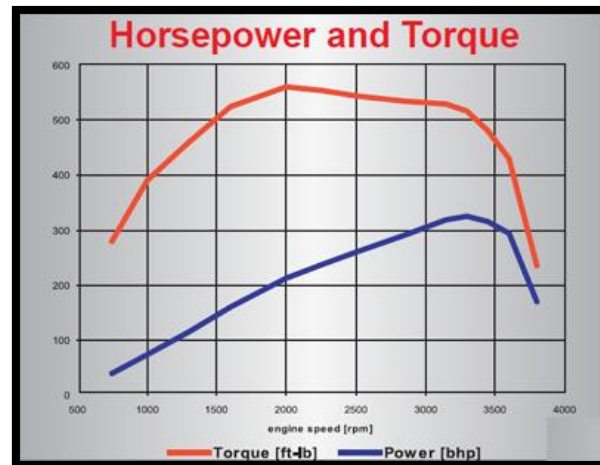
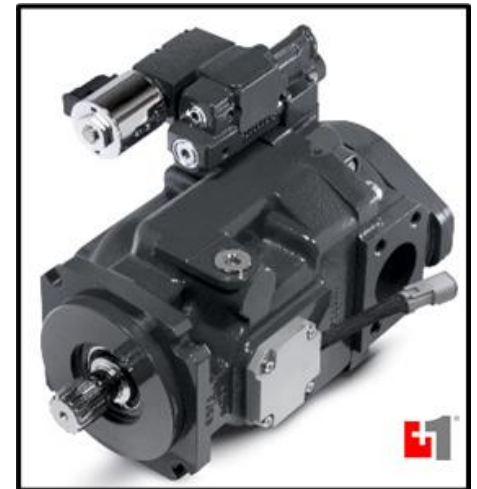
Engine Information



Software Logic



Pump Hardware Control & Monitoring



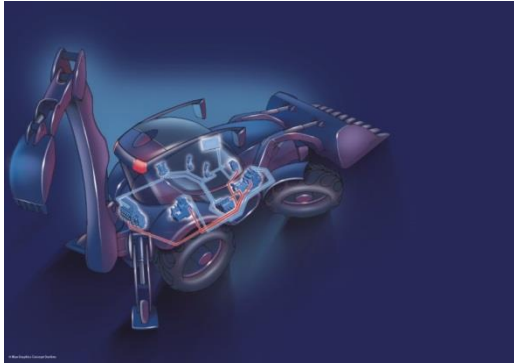
Real World Benefits

1. ETL can increase productivity
2. ETL can increase fuel efficiency
3. ETL performance is as good as a MTC
4. ETL can help reduce sound dBA levels
5. ETL provides additional inherent advantages



Key applications

World-class technology that serves a range of different market segments:



Backhoe Loaders



Rough Terrain/ Large Truck
Chassis Cranes



Rough Terrain Forklifts/ Tele-
handlers



Specialty Harvesters



Excavators

NEW ETL Information

ETL Microsite

New Danfoss Micro-Site

- powersolutions.danfoss.com
- Links to Video
- Links to Data Sheets

New Danfoss ETL Video

- System Animation

New Danfoss ETL Brochure

- Contains Value Prop statements
- System Overview

New Danfoss ETL Poster

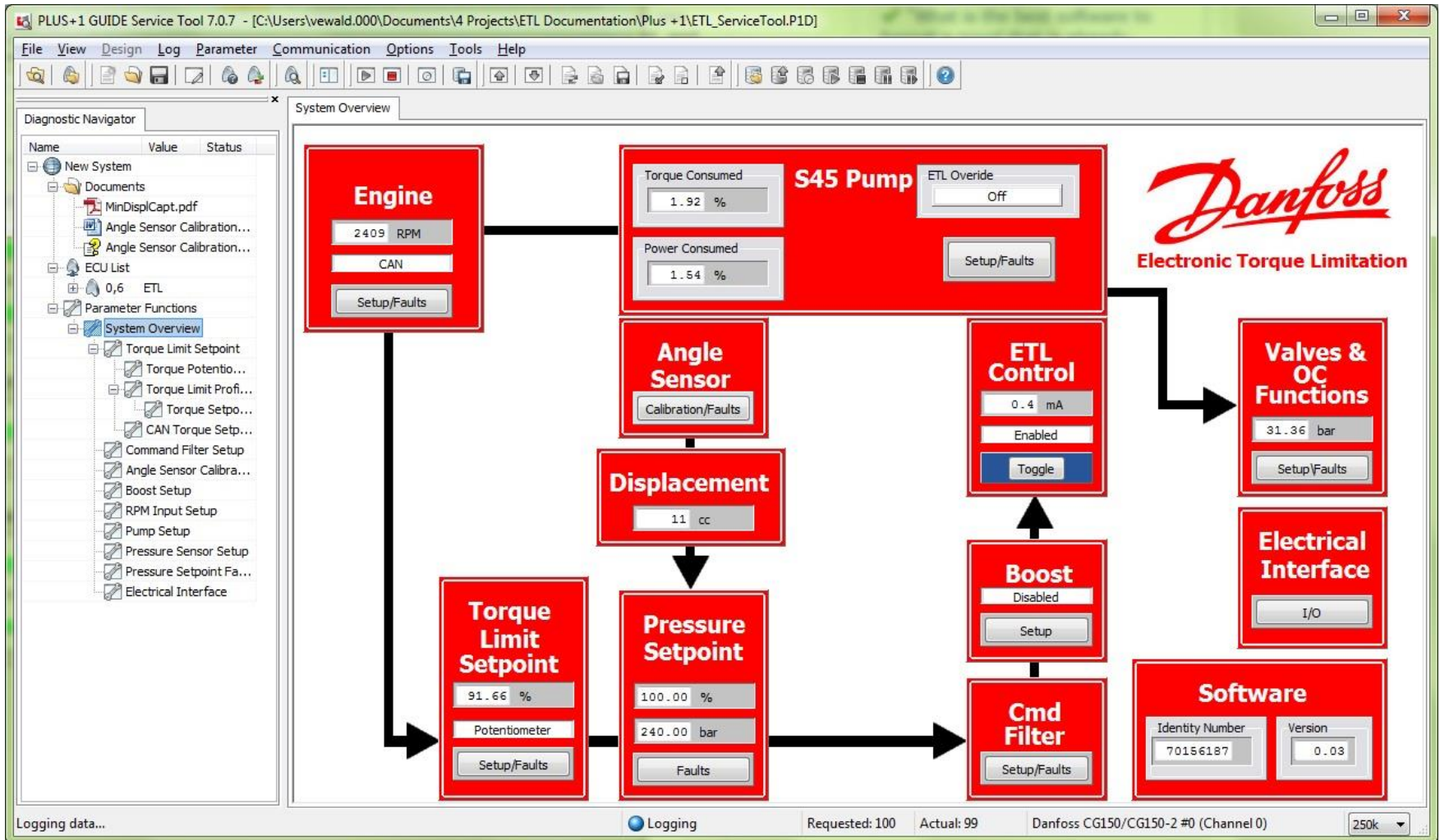
- System Overview graphic

The screenshot shows the Danfoss ETL Microsite homepage. At the top is the Danfoss logo and the tagline "ENGINEERING TOMORROW". Below this is a navigation menu with the following items: "Global application development centers", "Hydrostatics", "Automotive control solutions", "Best Point Control", "Electronic Torque Limiting", "Steering", "Work functions", "Fan drives", and "PLUS+1 platform". To the right of the menu is a large image of a city skyline. Below the menu, there is a section titled "Electronic torque limiting control" which includes a sub-header "Using technology to drive productivity" and a small image of a pump. The text in this section describes the Danfoss Series 45 pressure-compensating load sensing (PCLS) pump with Electronic Torque Limiting (ETL) control, highlighting its benefits for productivity and fuel efficiency.

This graphic is a system overview for the Danfoss ETL system. It features a large yellow and black excavator in the background. The text "SERIES 45" is prominently displayed in red. The main heading is "EFFICIENCY & PRO". The graphic is divided into several sections: "FUNCTIONALITY" on the left, "SYSTEM" on the right, and "ETL" in the center. The "ETL" section includes a diagram of the pump and motor assembly, with a callout box stating "Up to 22% more productivity per hour per hour". The "SYSTEM" section includes a diagram of the pump and motor assembly, with a callout box stating "Simple integration means immediate value". The "FUNCTIONALITY" section includes a diagram of the pump and motor assembly, with a callout box stating "Increase productivity up to 22% over alternative torque controls". The "SYSTEM" section includes a diagram of the pump and motor assembly, with a callout box stating "Move up to 34% more material with the same amount of fuel". The "FUNCTIONALITY" section includes a diagram of the pump and motor assembly, with a callout box stating "Increase fuel efficiency by 16% while achieving the same or better productivity".

Service Tool Functionality

Introduction – System Overview



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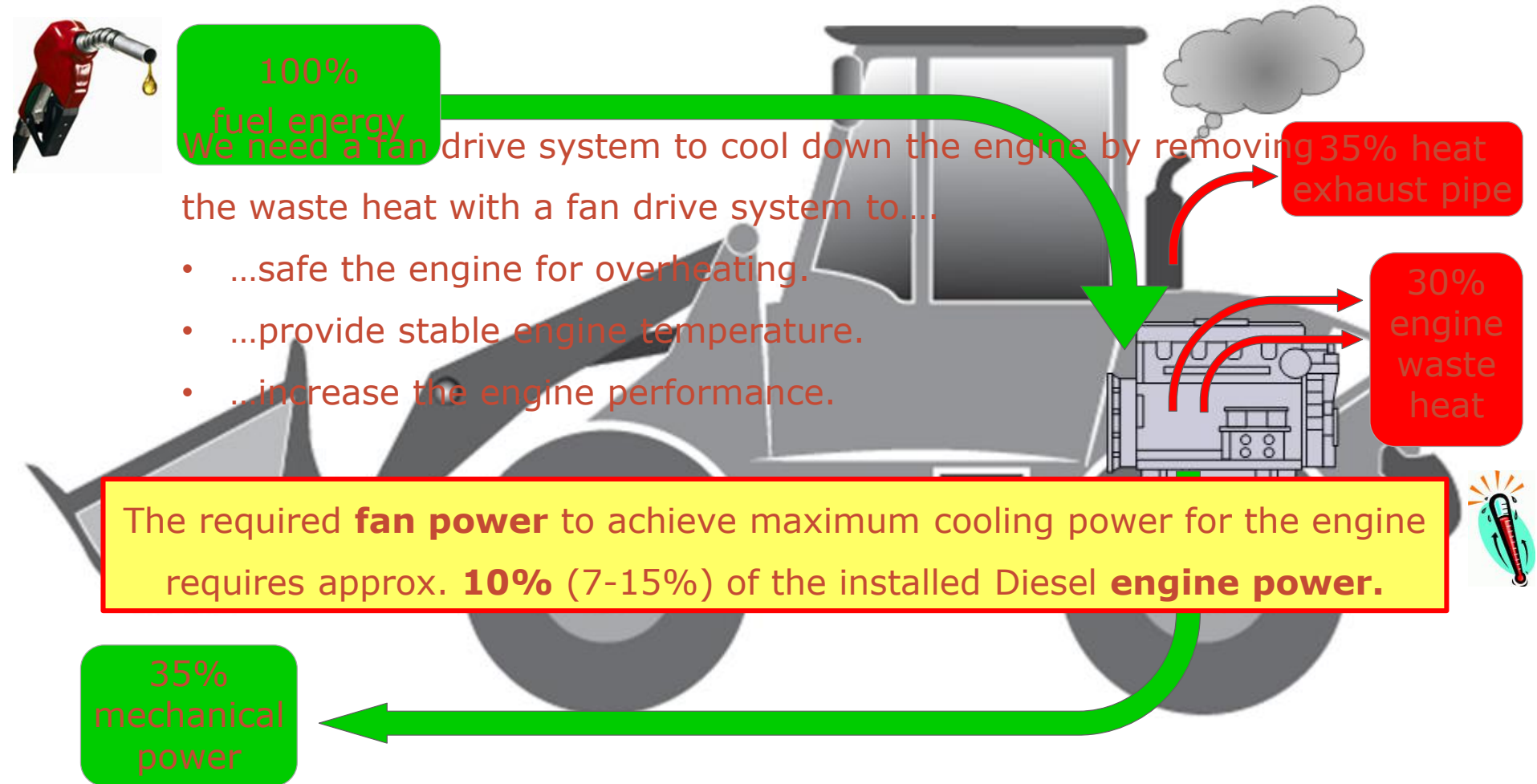
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Fan Drive Solutions Overview

www.powersolutions.danfoss.com

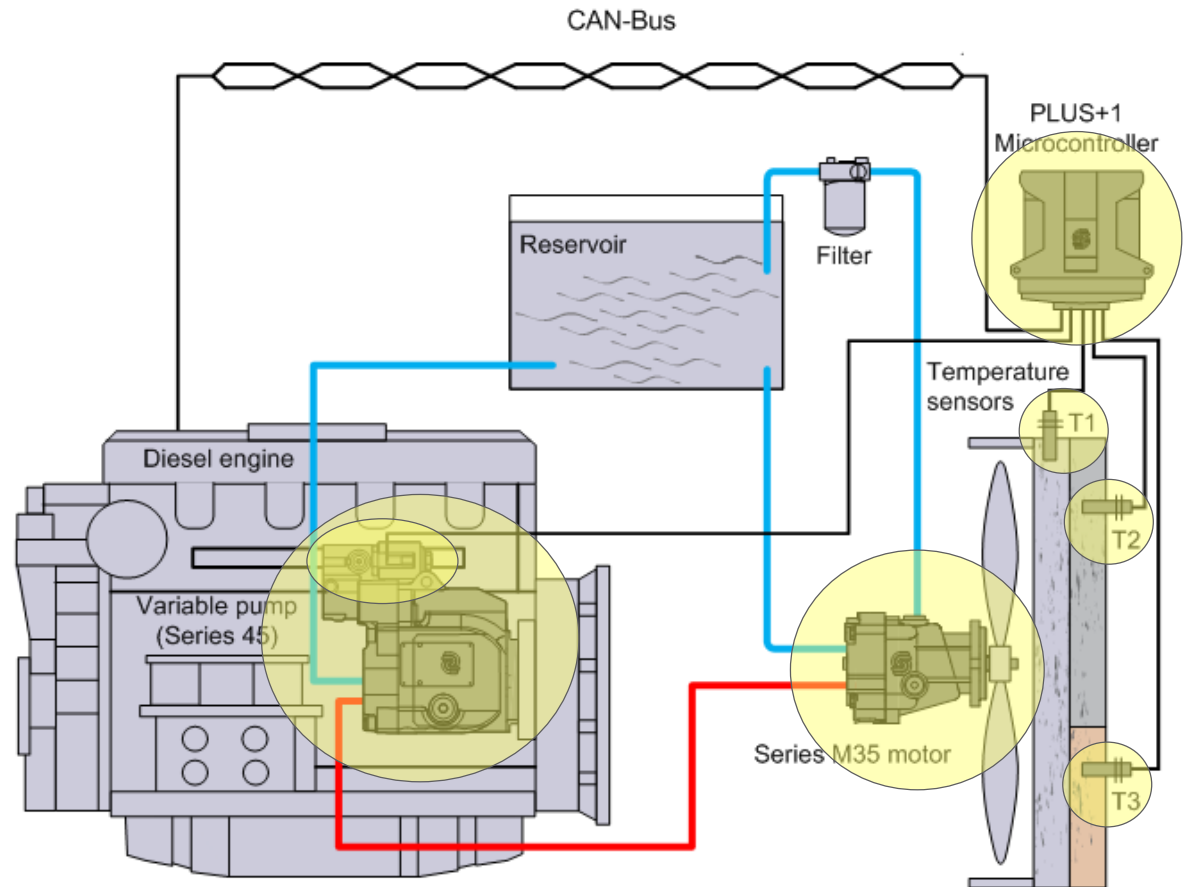


Why do we need Fan Drives for cooling?

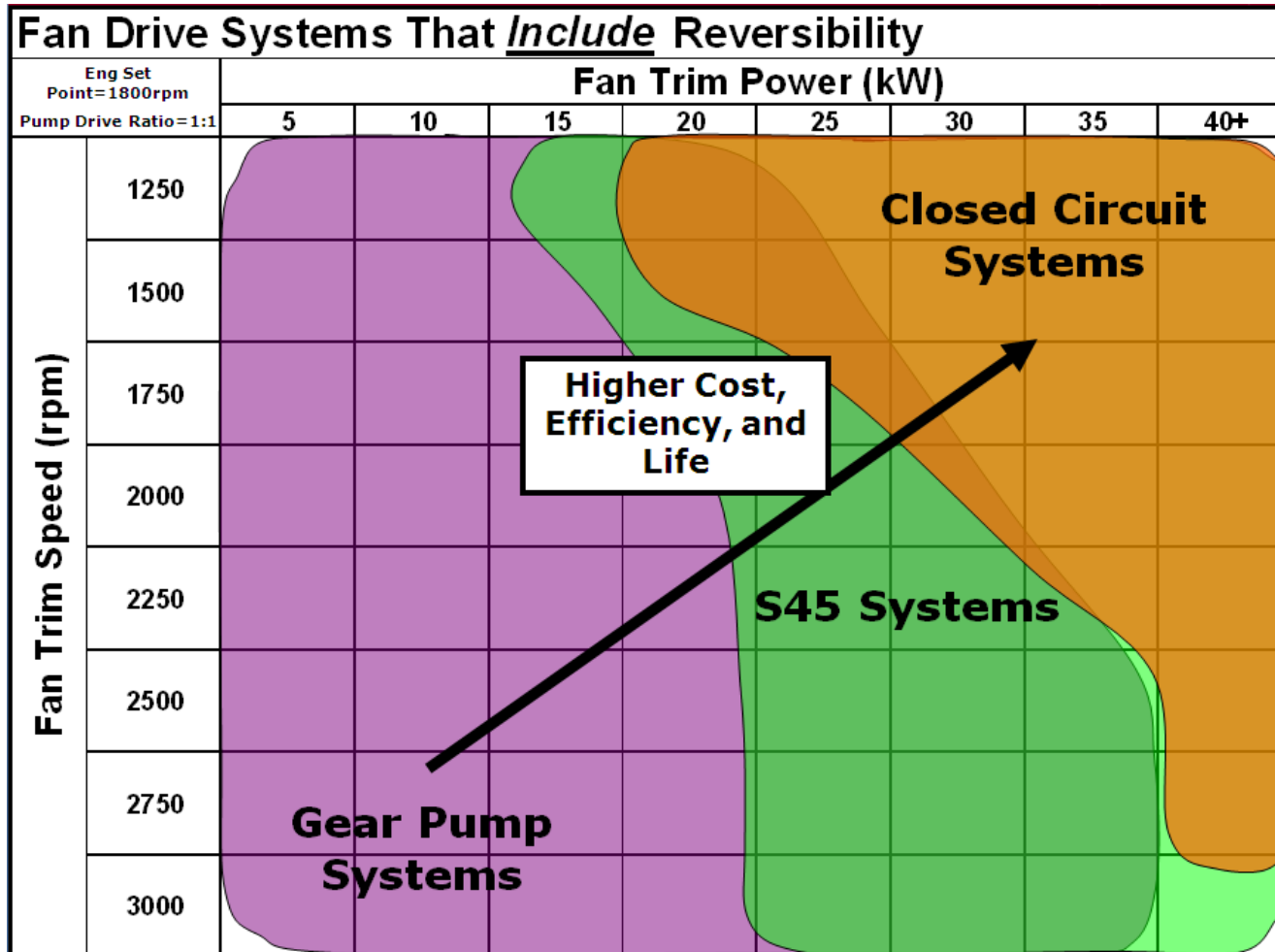


What makes up a Fan Drive System?

- Hydraulic Pump
- Hydraulic Motor
- A Control Device
- Sensors

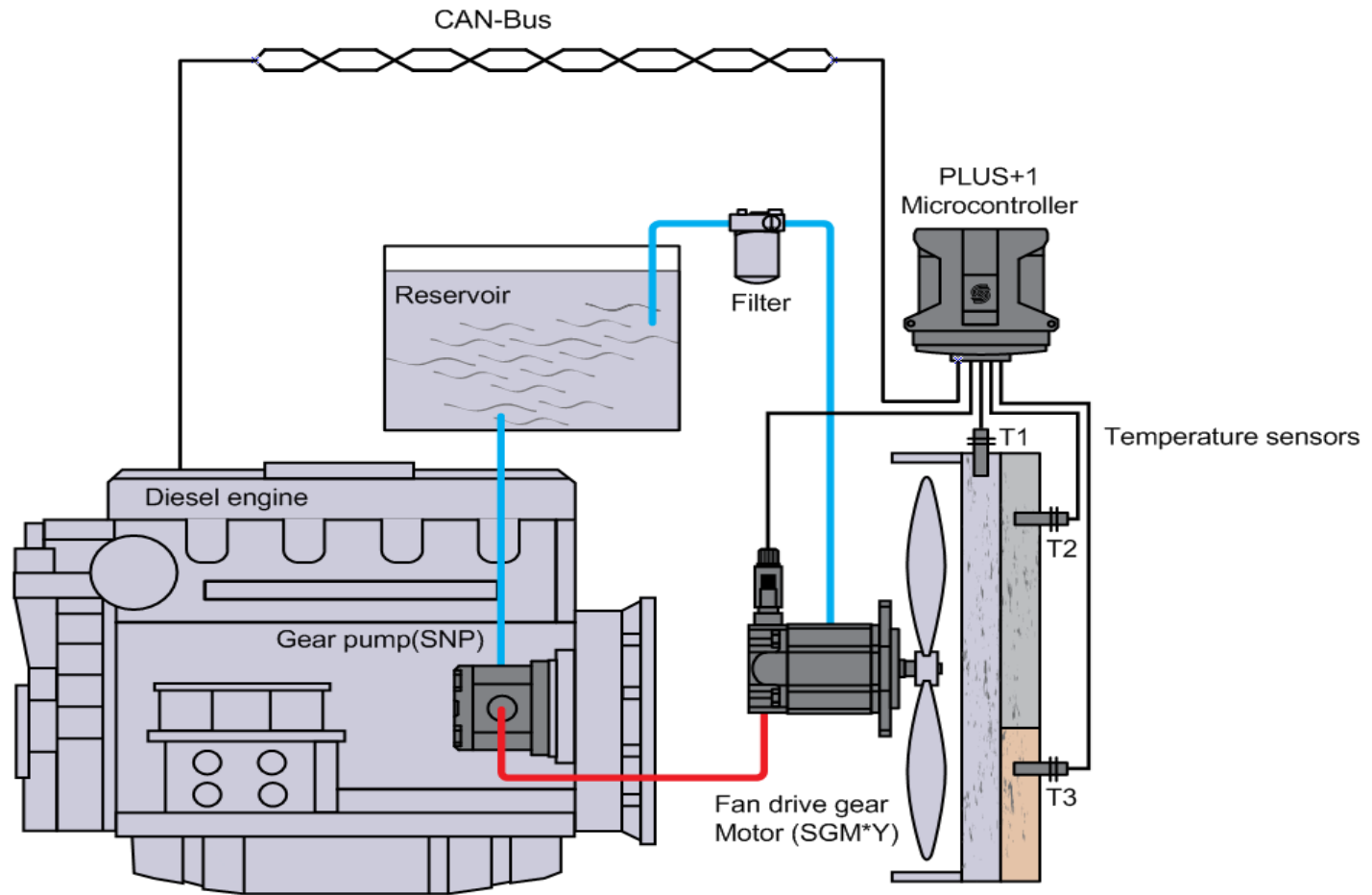


Fan Drive Systems



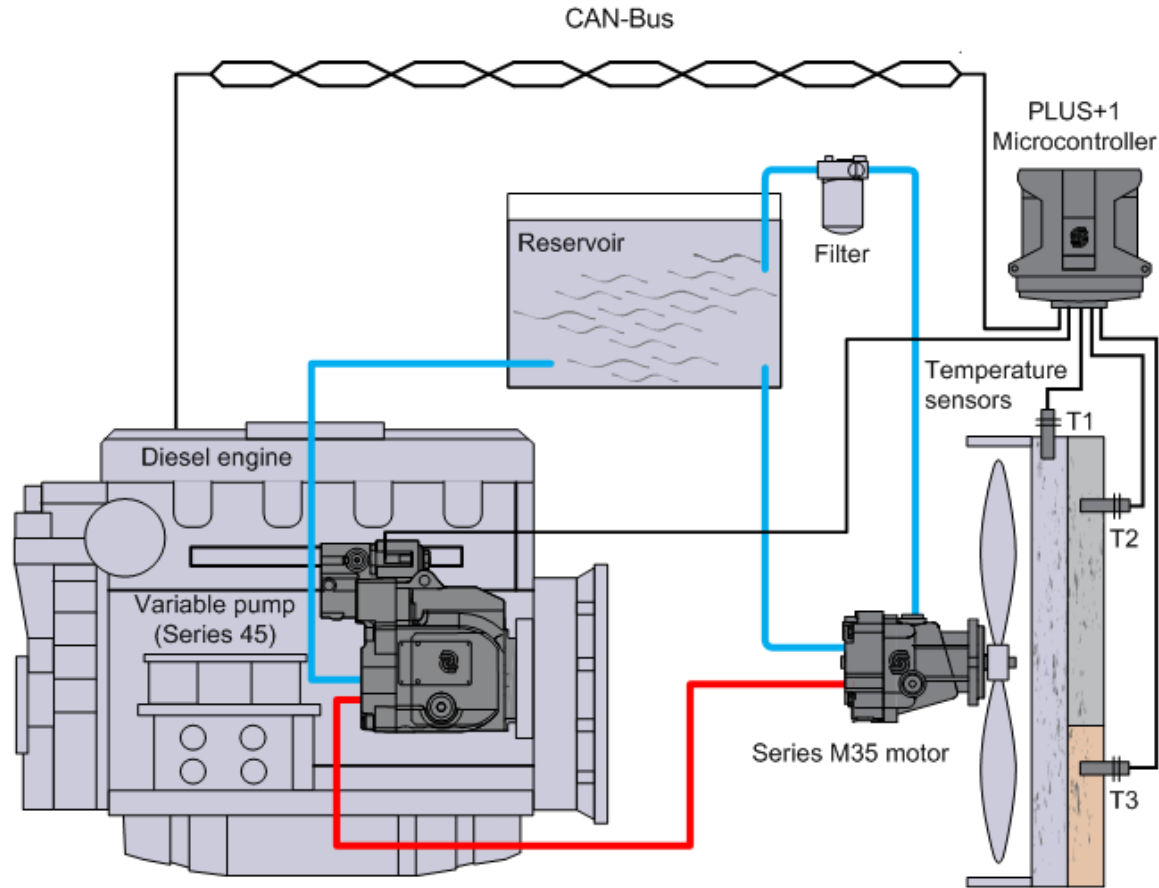
Fan Drive Systems

Gear Pump + Gear Motor



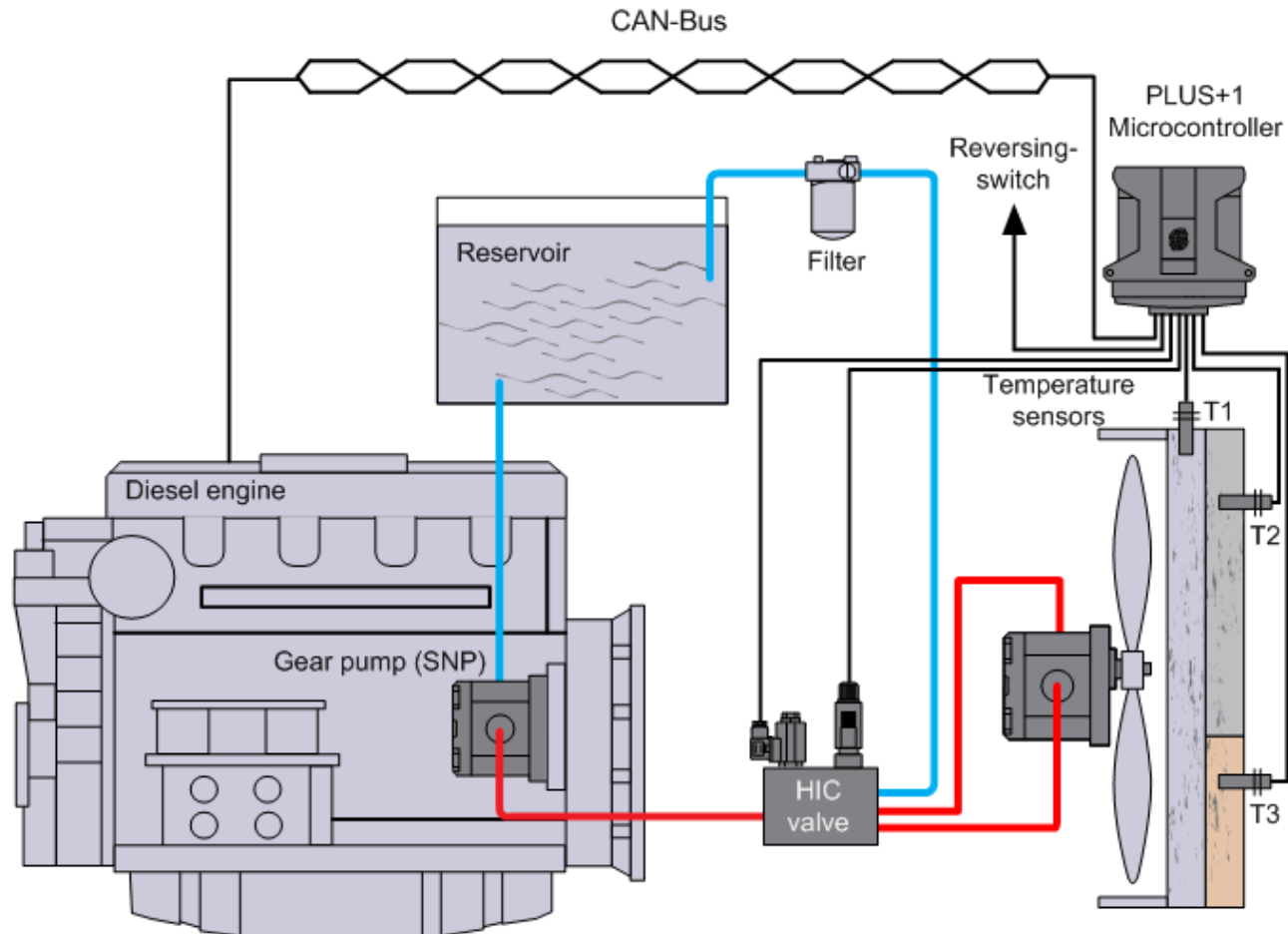
Fan Drive Systems

Open Circuit Piston Pump + Axial Piston Motor



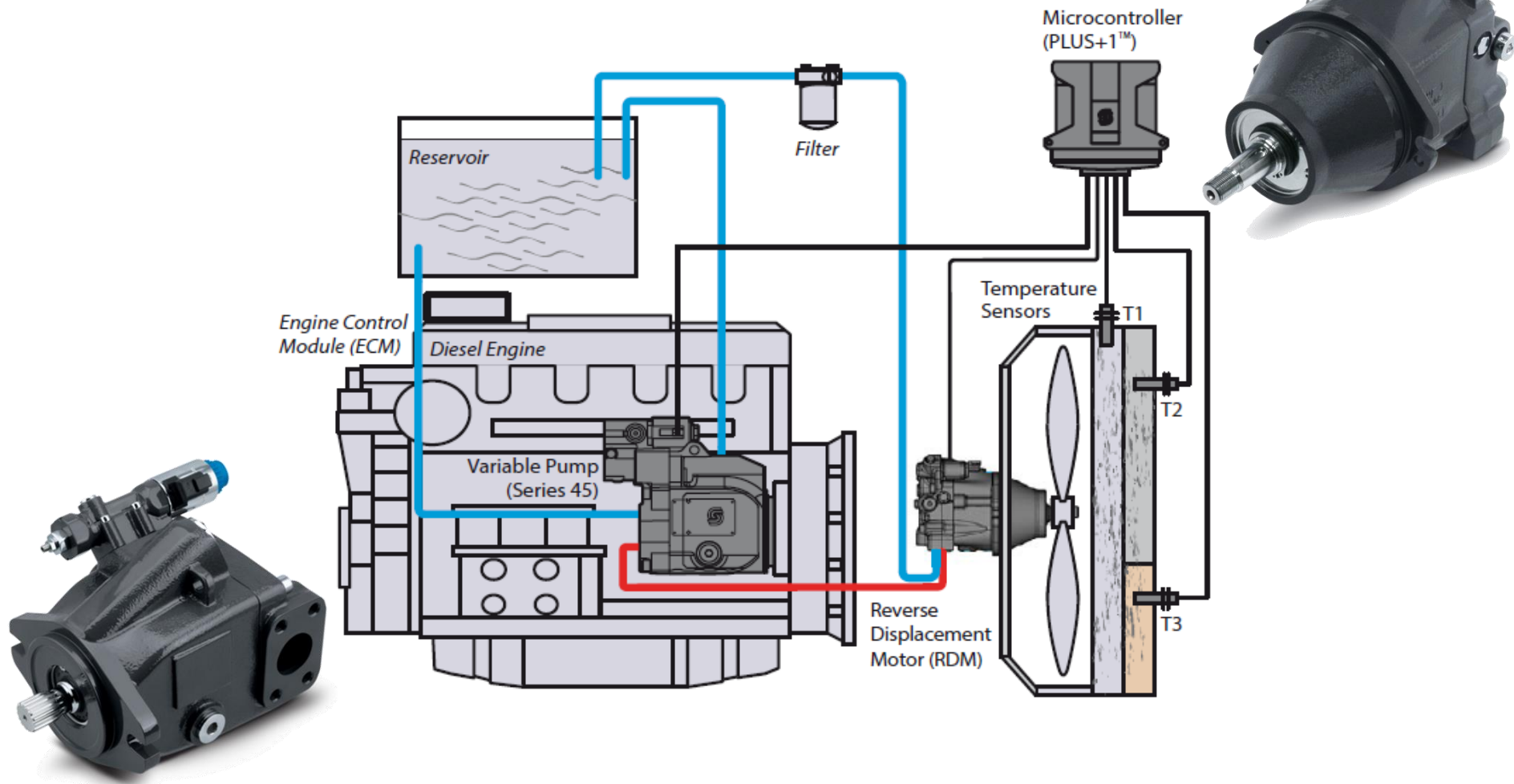
Fan Drive Systems with reverse functionality

Gear Pump + Gear Motor + HIC



Fan Drive Systems with reverse functionality

Open Circuit Piston Pump + RDM Motor



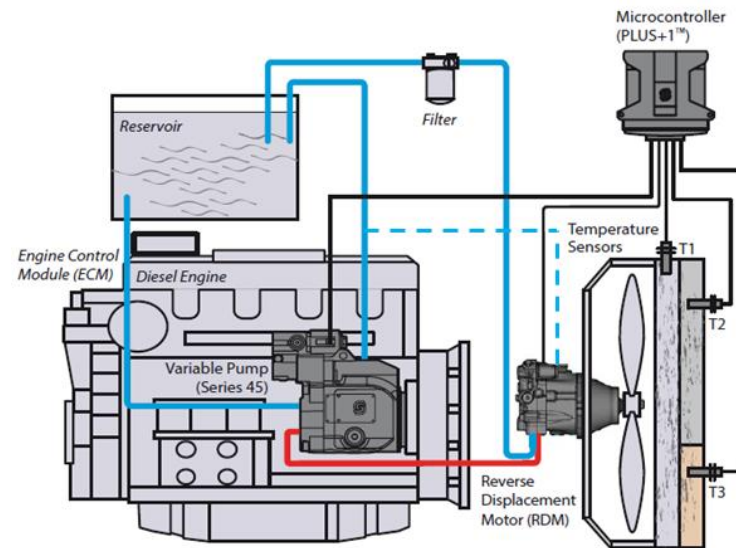
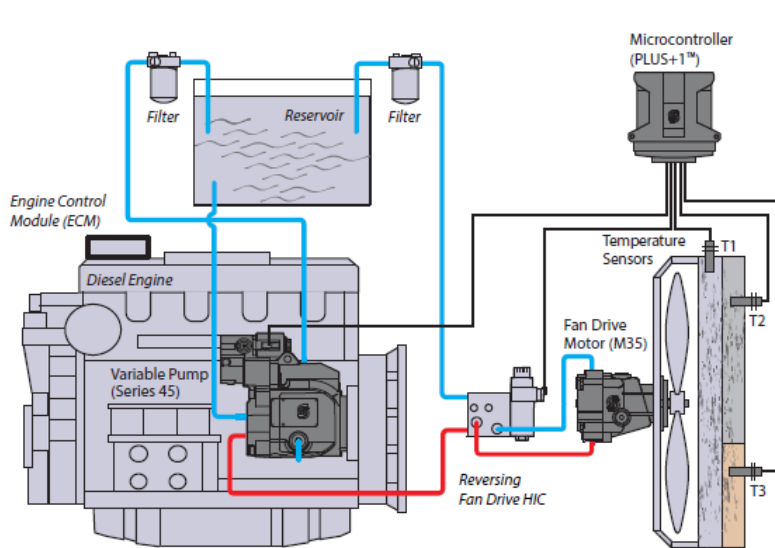
Features and Benefits

Features

Integrated Shift Valve

Benefits

- Reduces system complexity
 - Less system components (hoses, valves, fittings, etc.)
 - Lower assembly/installation and component costs



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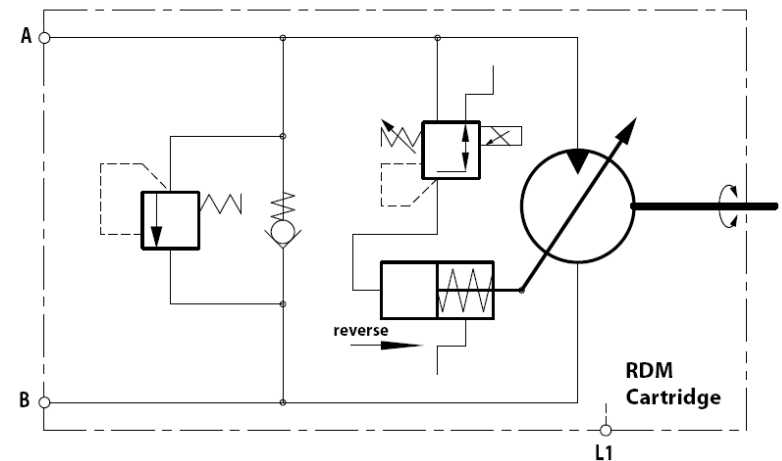
Fan Drive Solutions Medium Power – Products & Systems

www.powersolutions.danfoss.com



Reverse Displacement Motor RDM

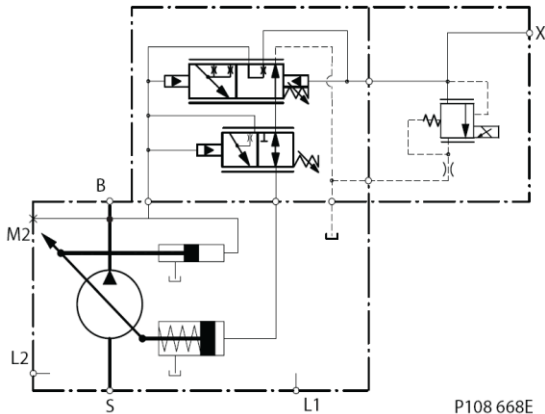
- 25cc, 30cc, 35cc (38cc, 45cc coming soon)
- Dedicated open circuit motor
- **Reversing** functionality
 - Integrated shift valve
 - Using system pressure
- Robust fan drive options:
 - Tapered shaft with dust seal
 - High capacity bearings
 - Anti-Cavitation and shock valve
- Cartridge mounting



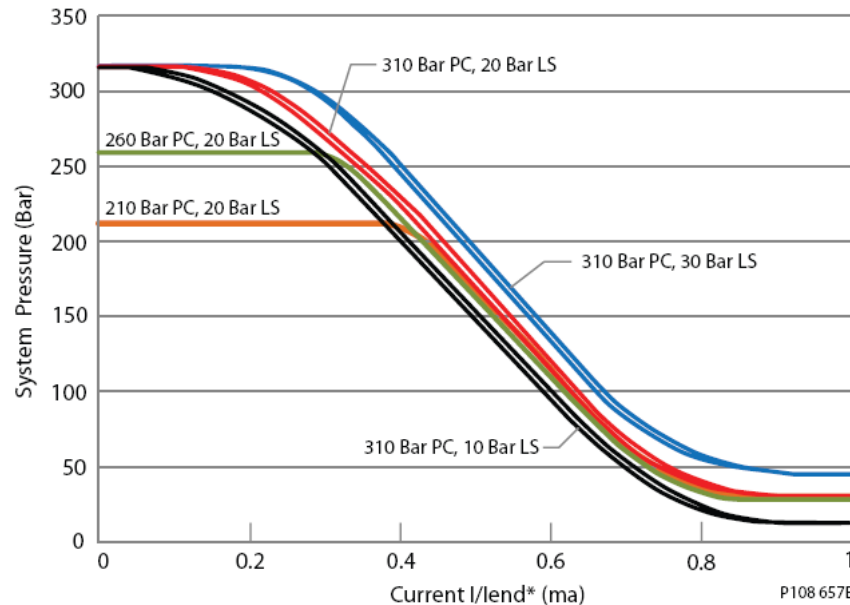
Today's Fan Drive Control (EPC)

- Control of maximum pump outlet pressure electronically
 - Vary pump pressure between PC and LS settings
- "Fail safe" – system goes to max pressure in case of electrical failure

Operating Pressure vs. Input Current (N.C. EPC)



Normally Closed



* End currents found in each frame section



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Fan Drive Solutions PLUS+1

www.powersolutions.danfoss.com



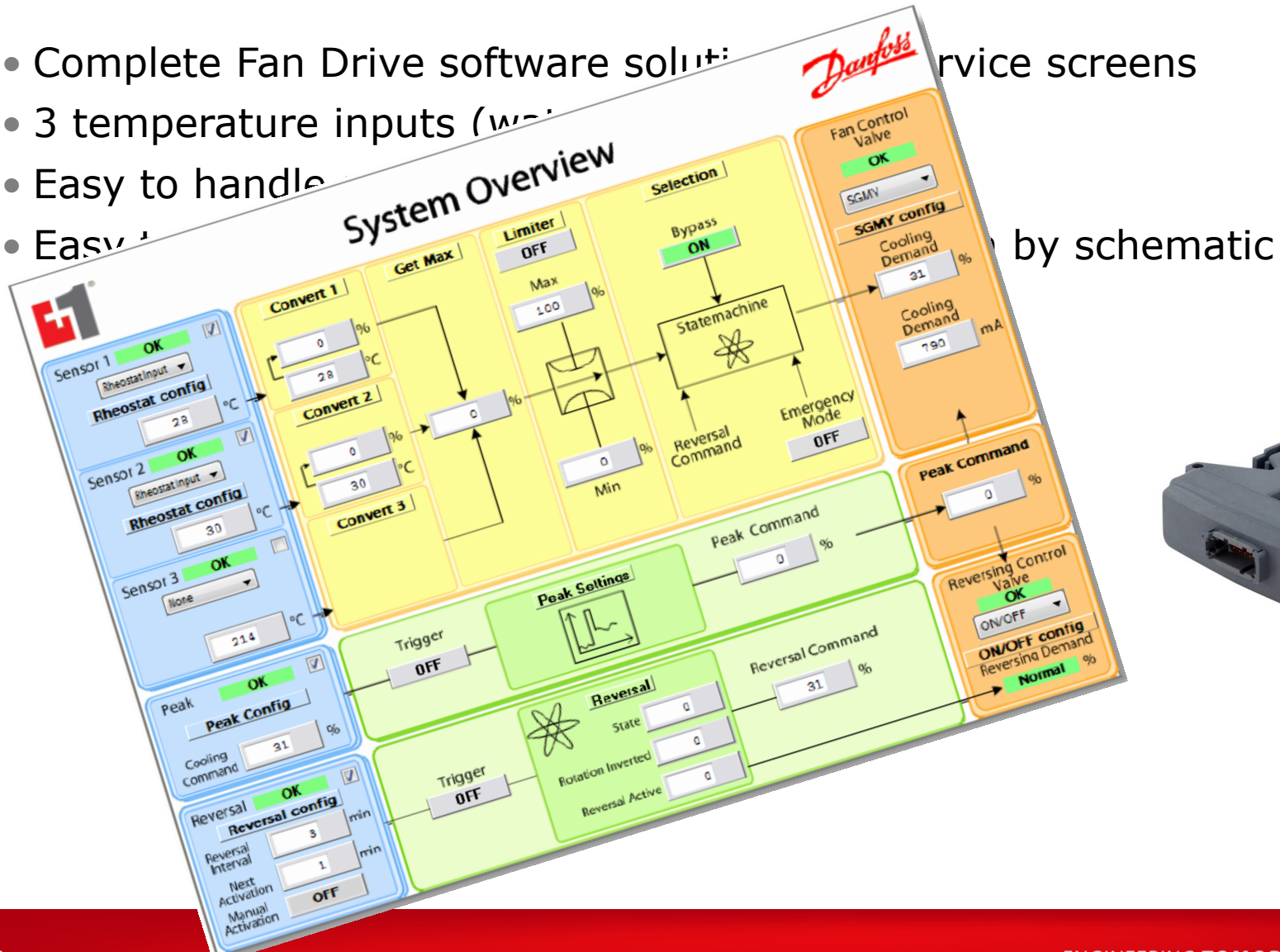
PLUS+1 Fan Control

- PLUS+1 GUIDE Service Tool
- PLUS+1 Diagnostic File (P1D)
- Fan Drive Application File (LHX)
- CAN Gate CG 150
- MC 012-14 for FD Application
- Temperature Sensors



PLUS Fan Control

- Complete Fan Drive software solution with service screens
- 3 temperature inputs (with rheostat)
- Easy to handle
- Easy to install

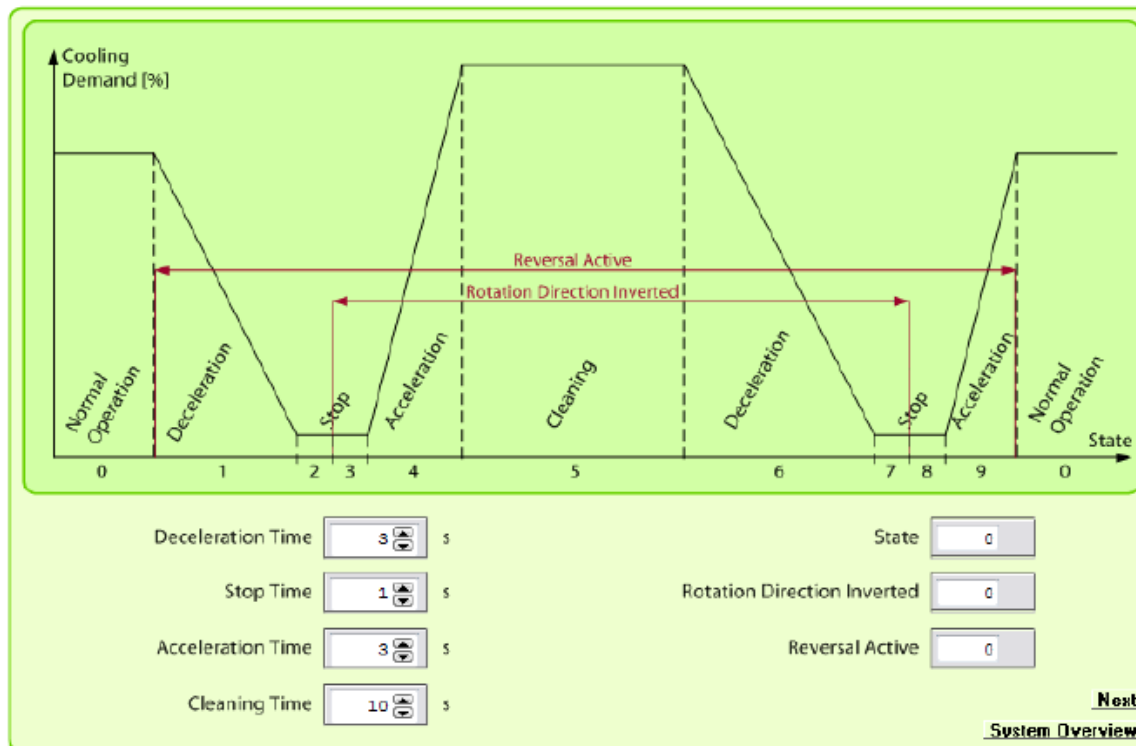


PLUS Fan Control

- Preconfigured complete reversing cycle
- Time trigger and manual trigger



Reversal Sequence



Benefits of Variable Fan Drives

- Fan power matches the specific cooling demand
- Increased productivity/performance - more power available for work functions and/or propel
- Less fuel consumption, reduced CO₂ production
- Reduced noise - easier to meet noise emission legislation
- Reversibility as an option to clean the fan and to maintain high fan drive efficiency
- Reduced fan tip clearance improves fan performance
- Higher operator comfort
- Reduced “Total Cost of Ownership”
- Increased lifetime of components
- Increased design/mounting flexibility
- Improved vehicle warm up phase

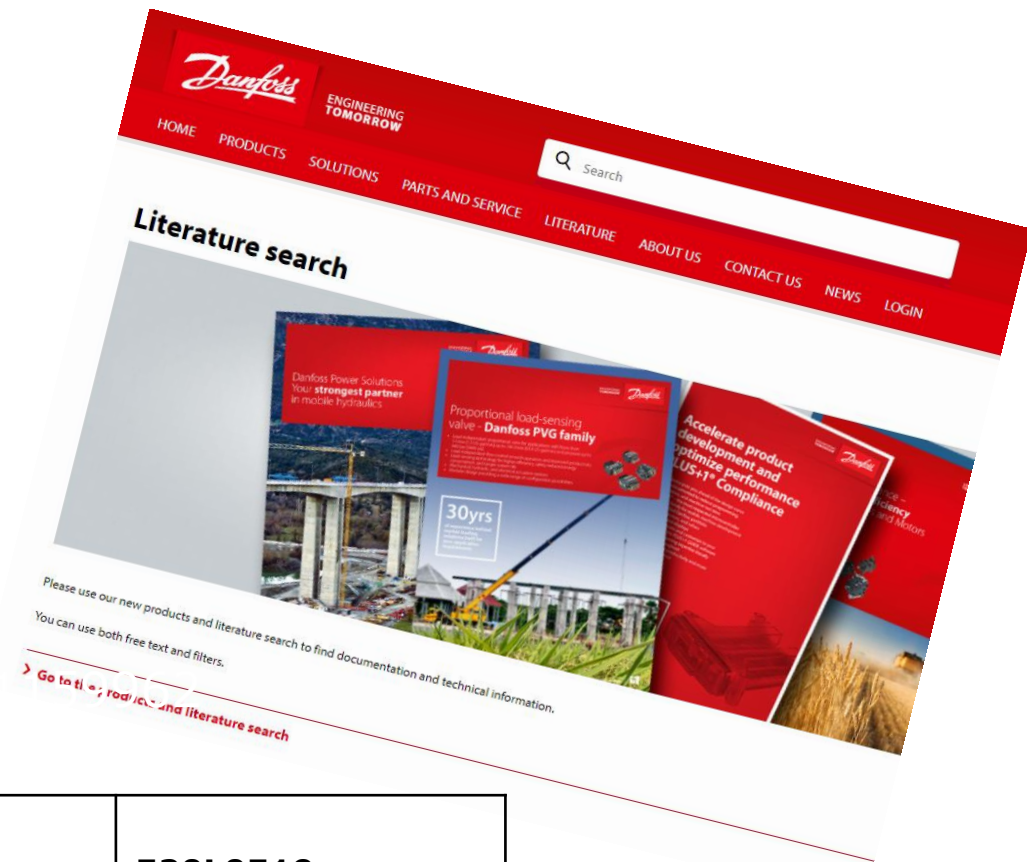


Support Literature Overview

The following documents are
available via the Company
Homepage:

Visit

<http://powersolutions.danfoss.com>



<p>Technical Information</p> <p>Series 45 Axial Piston Open Circuit Pumps Tech. Information</p> <p>Series 45 Data Sheet</p>	<p>520L0519</p> <p>11076184</p>
<p>Service Manuals</p> <p>Series 45 Frame E Service Manual</p> <p>Series 45 Frame F Service Manual</p> <p>Series 45 Frame G Service Manual</p> <p>Series 45 Frame H Service Manual</p> <p>Series 45 Frame J Service Manual</p> <p>Series 45 Frame K and L Service Manual</p>	<p>520L0606</p> <p>11005158</p> <p>520L0605</p> <p>520L0607</p> <p>520L0532</p> <p>520L0611</p>

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MAKING MODERN LIVING POSSIBLE

OTÁZKY ???