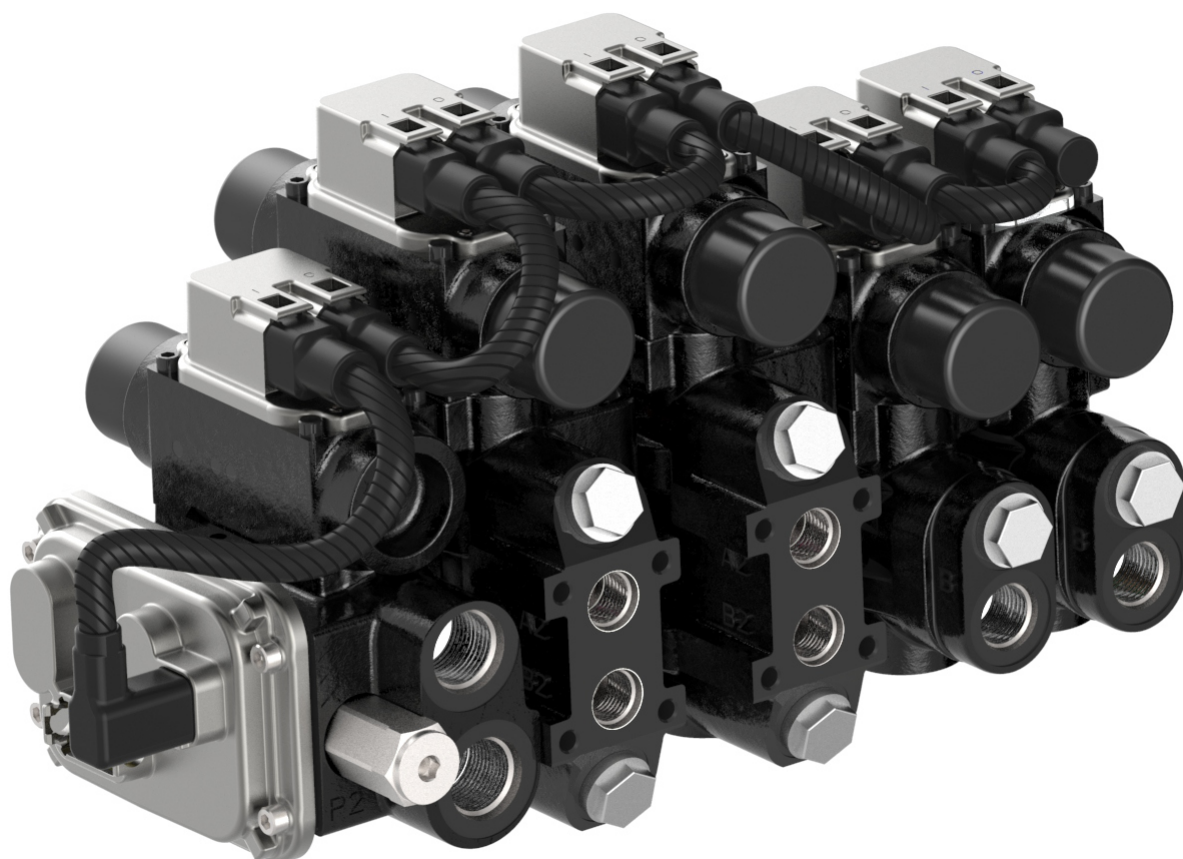




Danfoss

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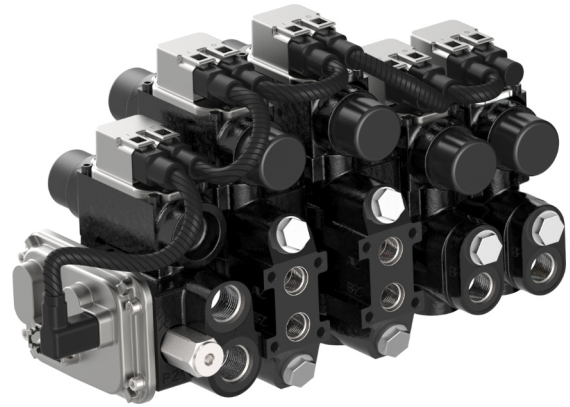
Danfoss CMA90

Advanced sectional mobile valve

The CMA is an advanced CAN-Enabled electro-hydraulic sectional mobile valve with two types of sections – CMA and CMT. Both CMA and CMT sections are modular in design and can be combined with an inlet section to form a CMA system, otherwise known as a CMA valve assembly. When paired together, CMA and CMT sections can optimize applications requiring high performing work functions as well as standard work functions all in the same compact CAN controlled CMA valve bank.

CMA sections use integrated pressure and position sensors for independent metering control allowing greater flexibility to control both pressure and flow on both sides of a cylinder. Where conventional mobile valves often compromise on precision or response, the CMA sections deliver both by using on board sensing of meter-in and meter-out work ports. Coupling the system sensing with on board electronics and advanced software control algorithms, the CMA sections are compensated for external factors such as pressure, temperature and flow. The CMA offers sub-micron hysteresis through closed loop control over the spool position for repeatable performance.

CMT sections use integrated pressure and position sensors for precise flow control. Where conventional mobile valves can only control 1 work function per section, a single CMT section can control 2 work functions independently. Two independent 3 position 4-way spools control two double acting services. This means each spool can control a double acting cylinder or motor.



Typical applications

- Concrete boom trucks
- Utility trucks
- Forwarders
- Agriculture tractors
- Drill rigs
- Snow groomers

CMA90 Advanced sectional mobile valve

CMA90

Features and benefits

- Pressure compensated meter- in and meter-out control
- Precise close loop control
- Sub-micron hysteresis
- High valve responsiveness
- Flow sharing – pre and post compensation capabilities
- Flexibility in configuration with easily changed parameters
- Command factory-calibrated flow from either work port
- Easy to use CAN communication with the valve
- Reduced load on the vehicle CAN bus
- Advanced diagnostics for improved reliability and productivity
 - Hose burst detection
 - Limp mode
 - Inlet, tank, load sense, and work port pressures, spool position, consumed flow and oil temperature
- Platform can support future software development for future product development
- Reliable performance across a broad temperature range

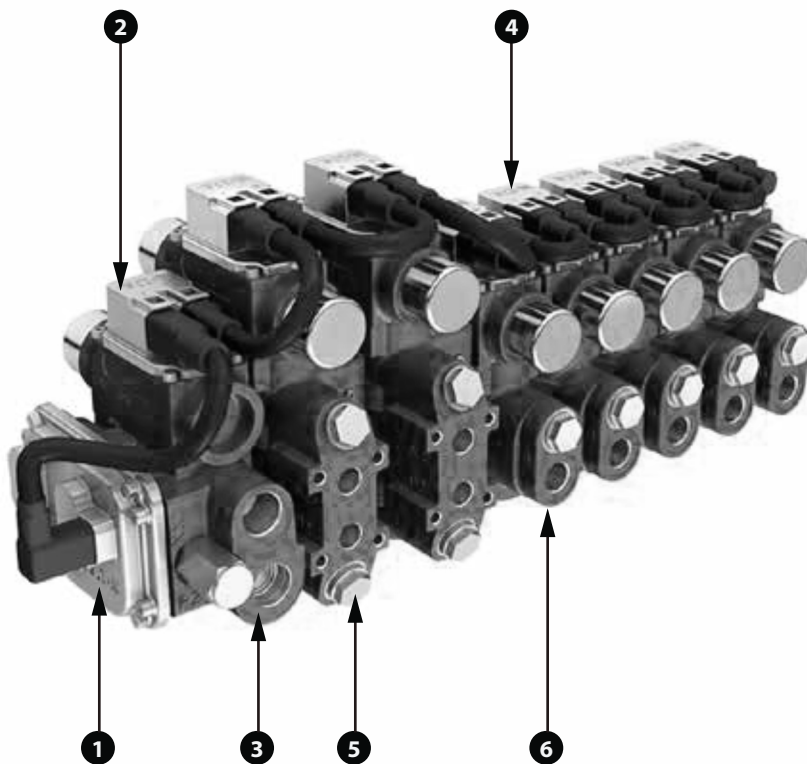
Additional features and benefits with CMA work section

- Independent metering control
- Advanced force and flow, control modes
- Intellifloat and boom stability control capabilities
- Command factory-calibrated pressure from either work port
- Reduction in metering losses / energy management

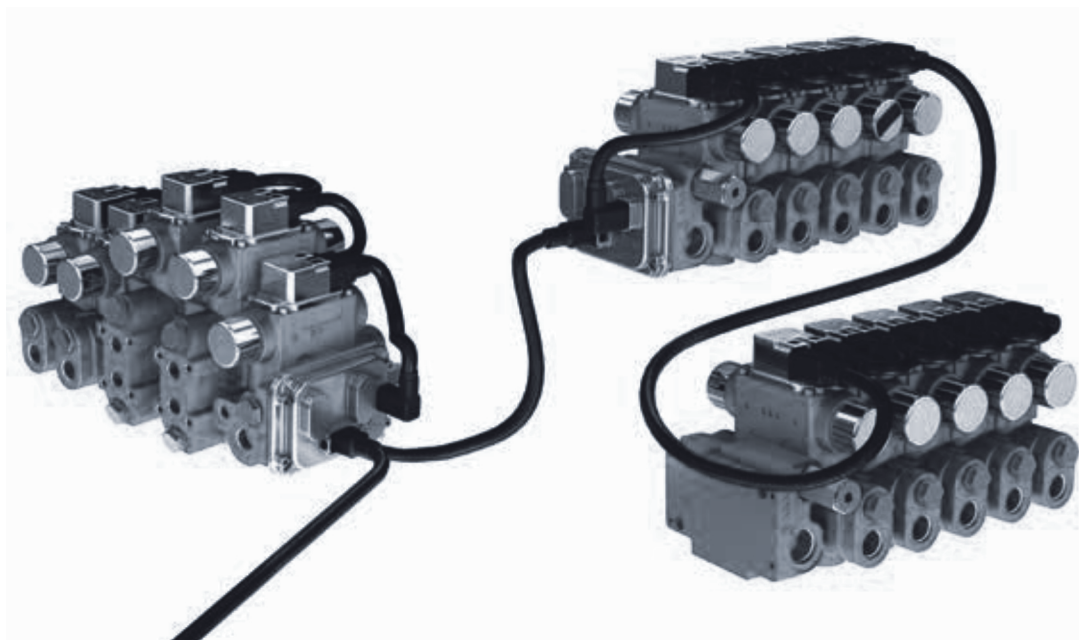
CMA90 Advanced sectional mobile valve

CMA90 Valve assembly

1. Valve System Module (VSM)
2. Conditioning Valve (CV)
3. Inlet
4. Pilot Valve (PV)
5. CMT work section
6. CMA work section



CMA90 distributed architecture



1. 4 section CMA90 valve bank with VSM
2. 5 section CMA90 valve bank with VSE and extension inlet
3. 5 section CMA90 valve bank with extension inlet

Specifications and performance: CMA90

Pressures

Inlet and work port (rated)	380 bar (5511 psi)
Inlet and work port (maximum)	440 bar (6382 psi)
Tank (maximum)*	30 bar (435 psi)

Flow

CMA work port (max with high flow spools, measured with internal pressure sensors)	120 lpm (32 gpm) @ 16 bar ΔP
CMT work port	90 lpm (24 gpm) @ 16 bar ΔP
Inlet (max with two sections fully open)	200 lpm (53 gpm) @ 25 bar P-T

Leakage**

Max leakage without work port valves	30 cc/min @100 bar @ 21 cSt
Max leakage with work port valves	40 cc/min @100 bar @ 21 cSt

Construction

Physical	Up to 8 sections per block
Network	Up to 15 sections per VSM

Port Types

SAE	P1	SAE-10
	P2 & T	SAE-12
	LS	SAE-4
	A & B	SAE-8 or SAE-10
BSP	P1	G 1/2
	P2 & T	G3/4
	LS	G 1/4
	A & B	G 1/2

Inlet section options

Variable displacement (Load sensing)
Fixed displacement

Work section options

Work port valves	Anti-cavitation Port relief & Anti-cavitation Port relief
------------------	---

Compensation type

CMA Work Sections	Digital	On meter-in and meter-out
CMT Work Sections	Mechanical	On meter-in

Actuation

Primary	CAN
Emergency	Mechanical override

Control modes

CMA and CMT Work Sections	Flow
CMA Work Sections	Pressure (for CMZ only)
CMA and CMT Work Sections	Spool position
CMA and CMT Work Sections	Float

Temperatures

Ambient (operating)	-40°C to 105°C
Standard oil (operating)*****	-40°C to 85°C
Extended oil (operating)	-20°C to 105°C
Storage	-40°C to 105°C

Filtration

ISO 4406	18/16/13
Pressure reducing valve	75 micron
Pilot valve	100 micron

Electromagnetic protection

EMC Directive 2014/30/EC***	
Earth moving	ISO 13766: 2006
Construction	EN 13390: 2010
Agriculture	ISO 14982: 2009

Electrical environmental****

Ingress protection	IP67
Thermal cycling	-40°C to 105°C for 1000 cycles
Mechanical shock	50G ½ sine wave, 11 ms pulse

Random vibration

Method	MIL STD 202G, Method 214-1
Limits	Test condition A
Duration	8 hrs/axis
# Of Axes	3 separately
Profile	Reference appendix

Oil viscosity

Recommended viscosity	10 to 85 cSt
Absolute maximum viscosity	2250 cSt
Absolute minimum viscosity	7 cSt

Electrical

Input voltage	9 - 32VDC
Power consumption range	Reference appendix
CAN Interface	J1939 2.0B, CANopen

Electrical interface connectors

Deutsch (VSM)	DT06-12SB-P012
Deutsch (VSE)	DT06-12SA-P012

Dynamic performance

Loop time for internal CAN	3 ms
Typical step response	24 ms @ 15 cSt
Typical frequency response	17.5 Hz @ 15 cSt
*W ith manual override, tank is limited to 10 bar (145 psi) maximum.	
**Data taken from work port to tank and supply.	

***Electronics are designed to power down and recover automatically under various power conditions (i.e., Load Dump, Ignition Cranking, Disconnection of Inductive Loads) CE testing with J1939 at 250 kb/s.

****Additional Electrical Environmental tests were performed Contact Danfoss for additional details.

***** Max. differential between CMA valves and system temperature is 50°F (28°C).

CMA90 Advanced sectional mobile valves

CMA work section

Principles of operation

The work section is comprised of two independent spools that act as a pair working to control double acting services, or alternatively as single spools controlling a single acting service (2 single acting services can be controlled from any work section).

Demands to each work section are transmitted over a CAN bus and power is provided to each work section via a single daisy chain cable arrangement. Each work section has a single pilot valve comprised of on-board electronics, embedded sensors, and two independent 3 position 4 way pilot spools driven by a low power embedded micro controller.

The independent pilot spools control the mainstage spools. Closed loop control of each work section is achieved locally by leveraging the on-board electronics and sensors.

Each mainstage spool has its own position sensor enabling closed loop position control of the mainstage spool.

Further, a pressure sensor is located in each work port, pressure line, load sense line and tank line.

With the upstream and downstream pressure information known at any time, flow delivered to the service can be controlled by moving the spools to create the appropriate orifice area for the desired flow rate.

Figure 1: CMA90 system with load-sensing inlet & a single CMA work section

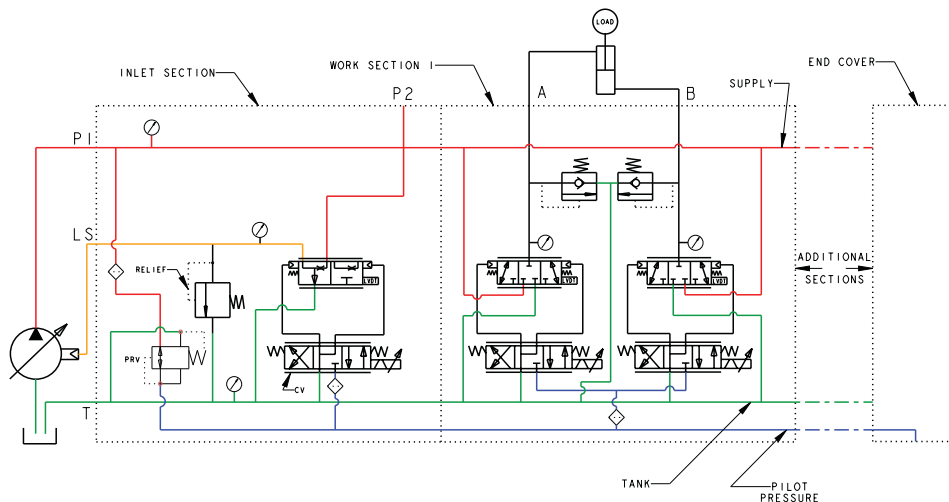
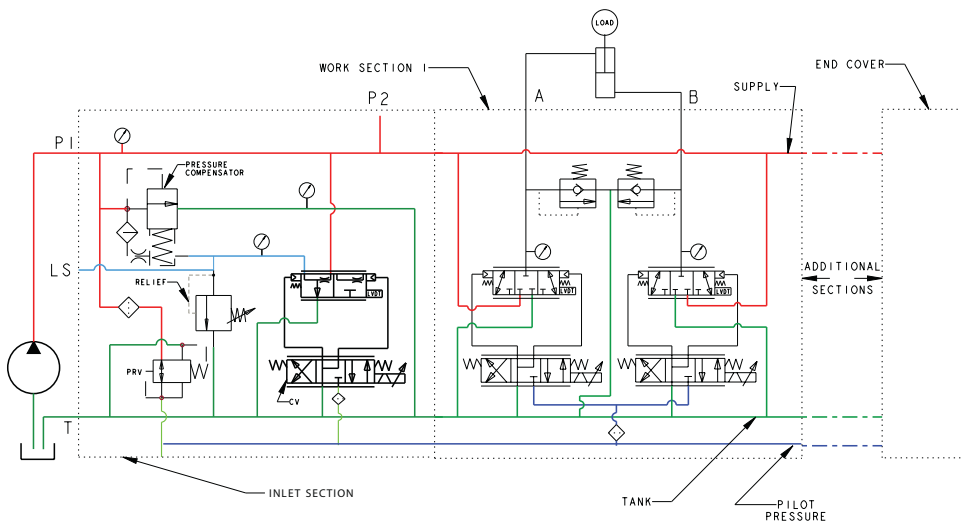
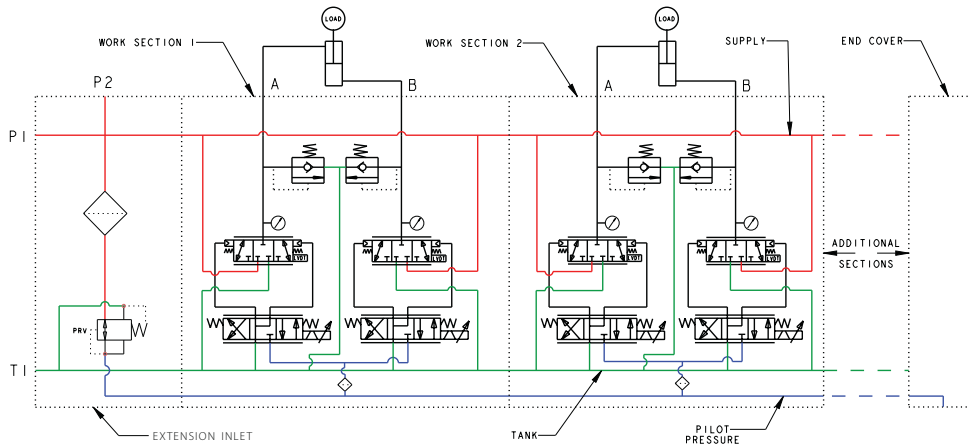


Figure 2: CMA90 system with fixed displacement inlet & a single CMA work section



CMA90 CMA

Figure 3: CMA90 system with extension inlet & CMA work section



CMA90 Advanced sectional mobile valves

CMT work section

Principles of operation

The work section is comprised of two independent 3 position 4 way spools that act to control two double acting services. Each spool can control a double acting cylinder or bi-directional motor.

Demands to each work section are transmitted over a CAN bus and power is provided to each work section via a single daisy chain cable arrangement. Each work section has a single pilot valve comprised of on-board electronics, embedded sensors, and two independent 3 position 4 way pilot spools driven by a low power embedded micro controller.

The independent pilot spools control the mainstage spools. Closed loop control of each work section is done locally by leveraging the on-board electronics and sensors.

Each mainstage spool has its own position sensor enabling closed loop position control of the mainstage spool. Further, a pressure sensor is located in each service measuring meter-in pressures, pressure line, load sense line and tank line.

The CMT work section is pre-compensated which means the compensator spool is located before the main metering spool. Pressure differential acting on the compensator spool is picked from either side of the main metering orifice. The compensator spool for each service receives a load sense signal from the respective service. The pressure differential across the main metering orifice is maintained by the compensator, resulting in a constant flow rate through the valve that is independent of load pressure.

Figure 1: CMA90 system with load-sensing inlet & CMT work sections

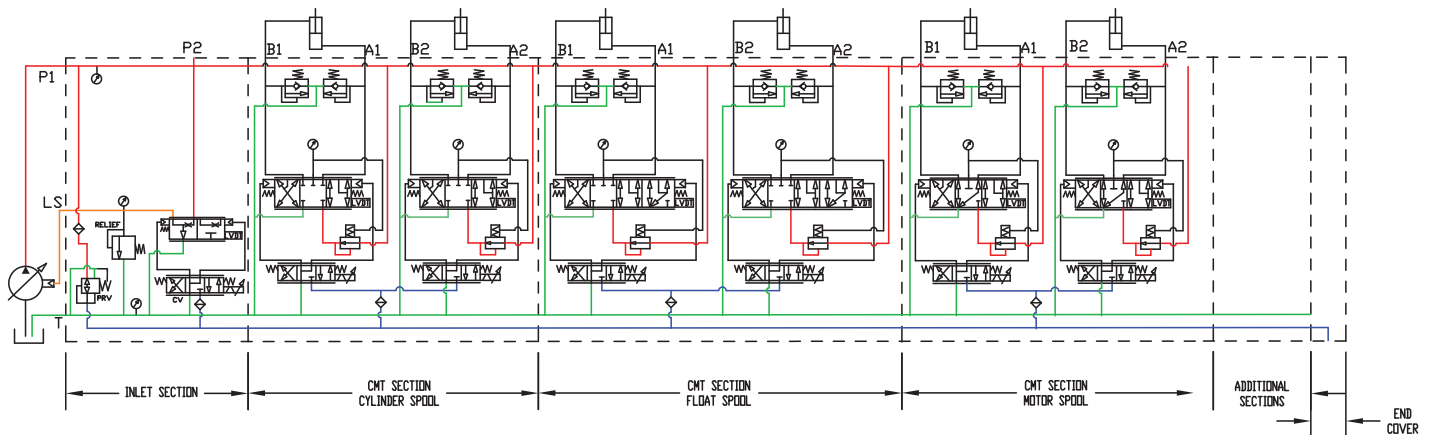
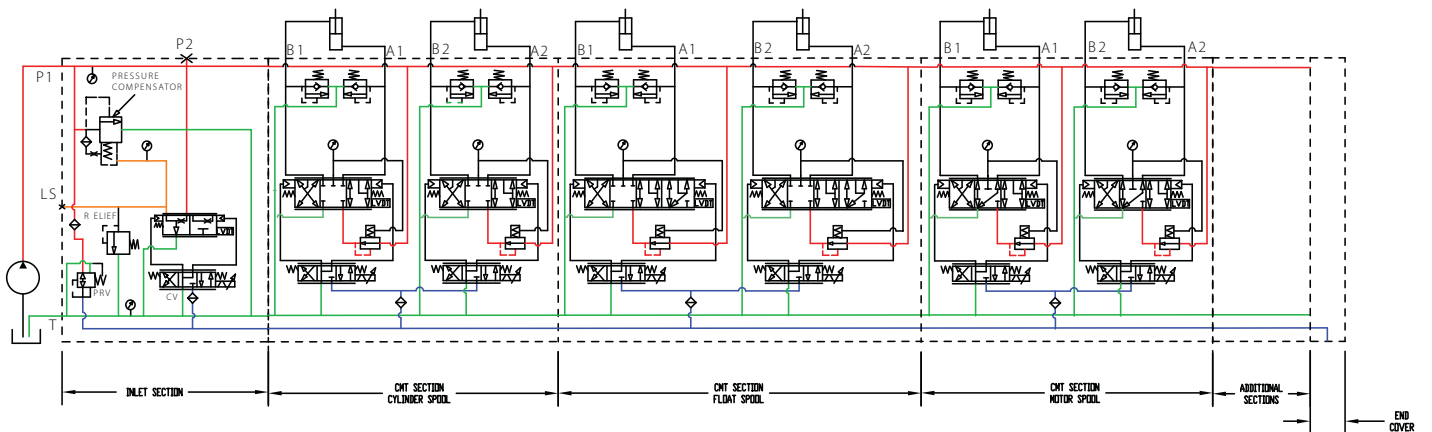


Figure 2: CMA90 system with fixed displacement inlet & CMT work sections

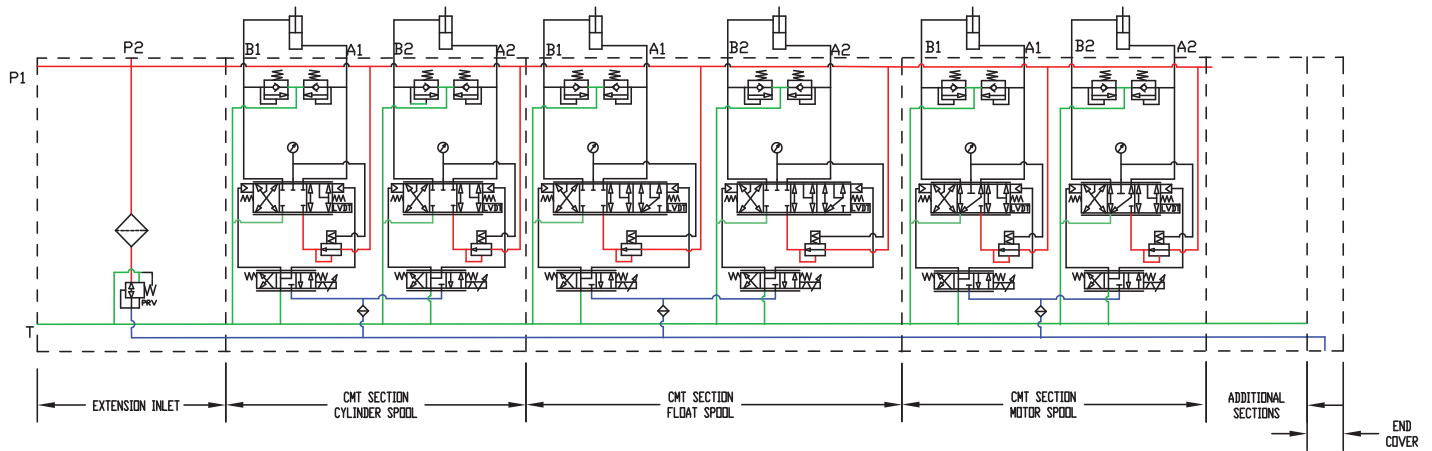


CMA90 Advanced sectional mobile valves

CMT work section

CMA90
CMT

Figure 3: CMA90 system with extension inlet & CMT work sections

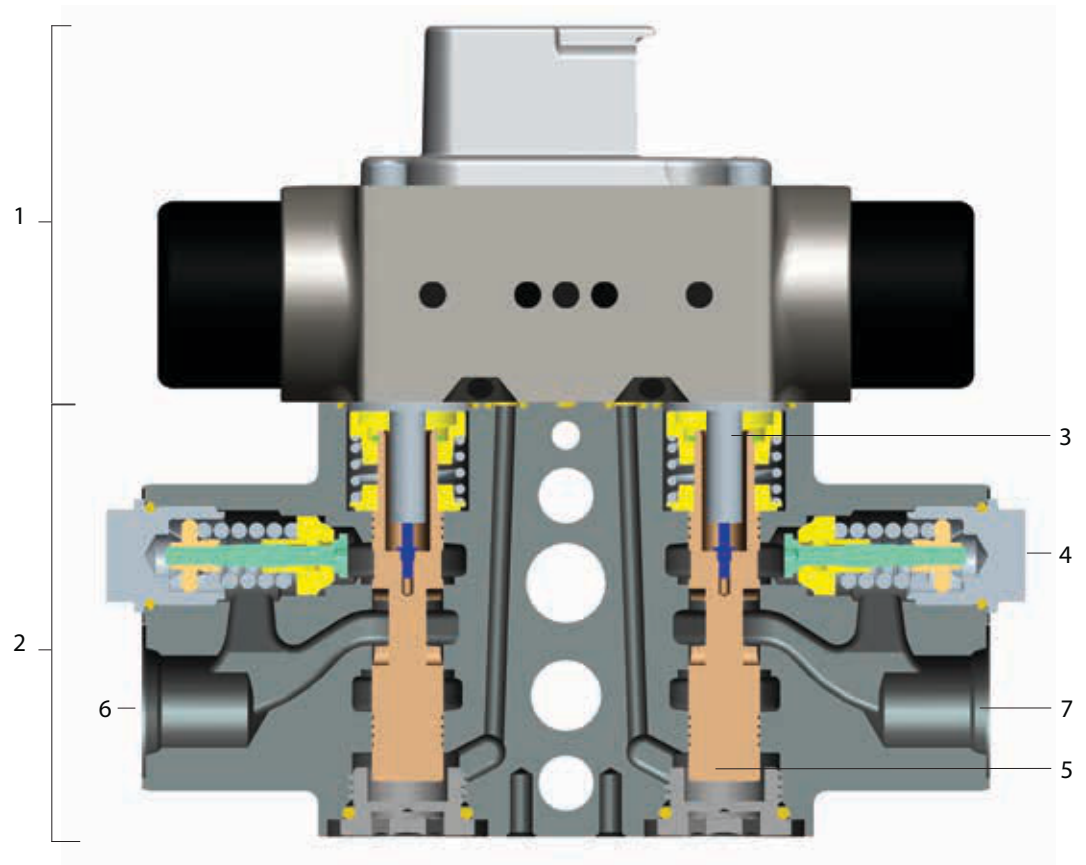


CMA90 Advanced sectional mobile valves

CMA work section cross section

Valve cross section:

1. Pilot Valve
2. Main Stage
3. Linear Position Sensor
4. Port Reliefs / Anti-Cavs
5. Main Metering Spools
6. Work Port A
7. Work Port B



CMA90 Advanced sectional mobile valves

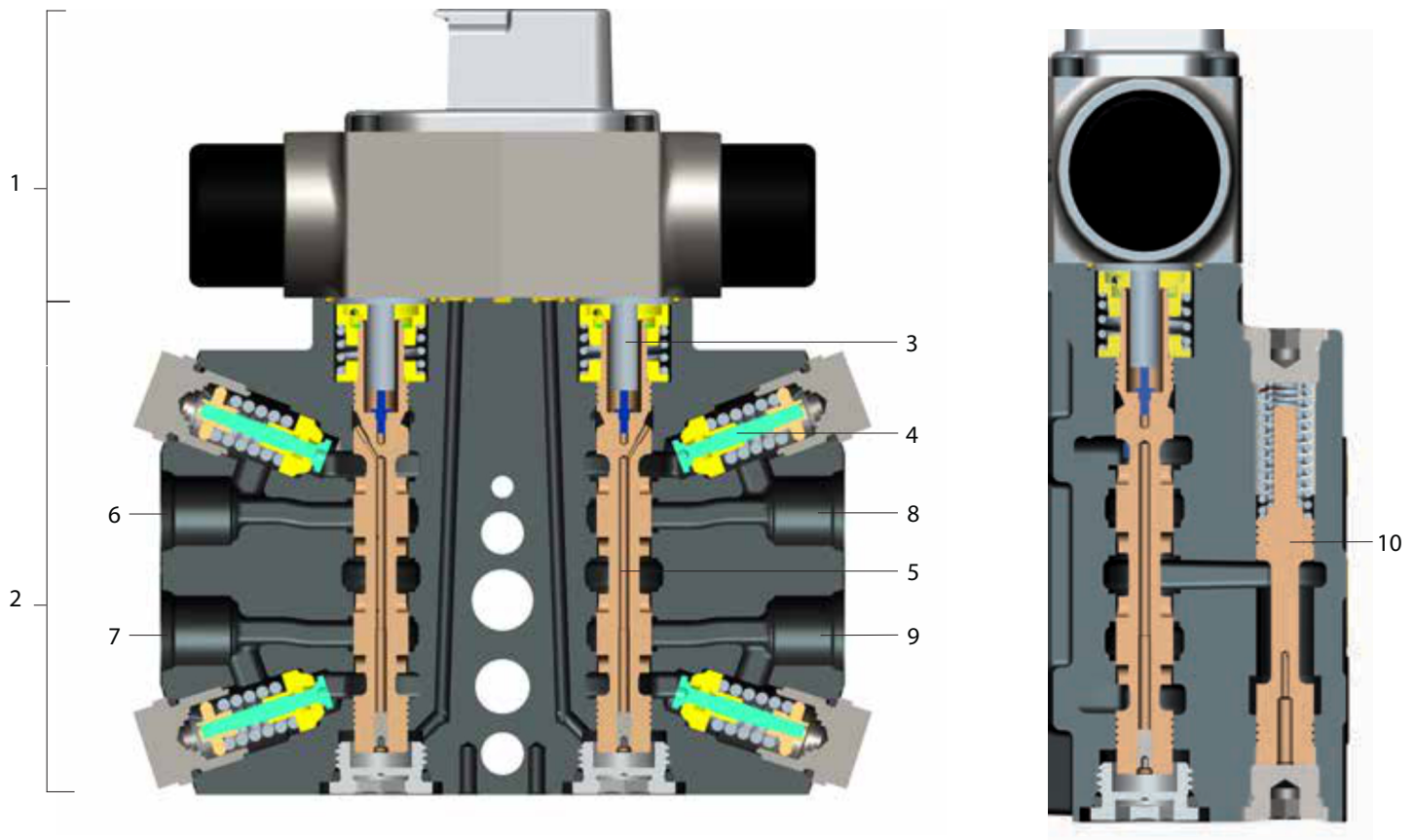
CMT work section cross section

CMA90

CMT

Valve cross section:

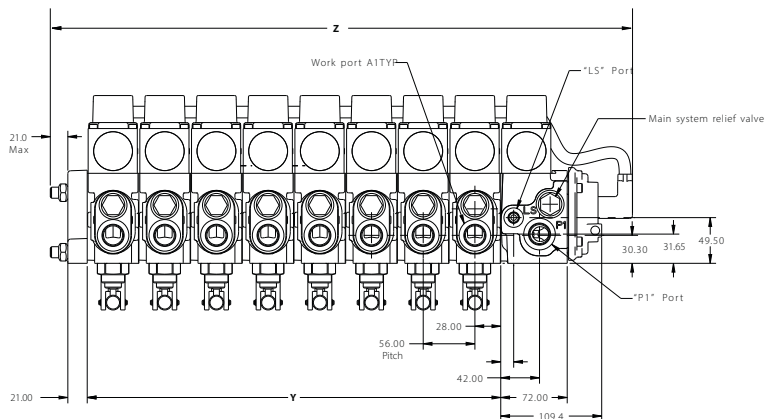
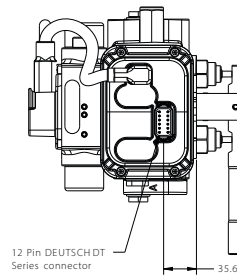
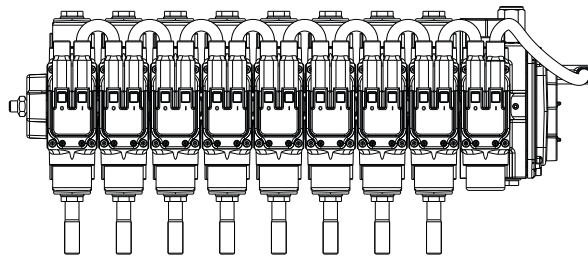
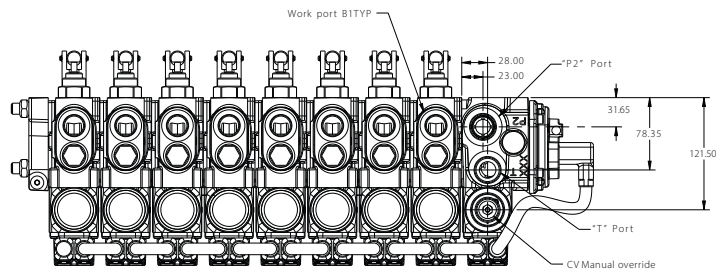
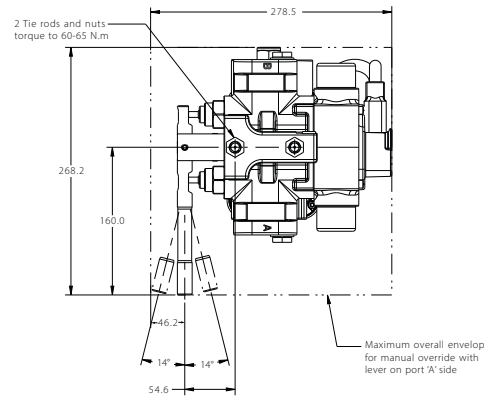
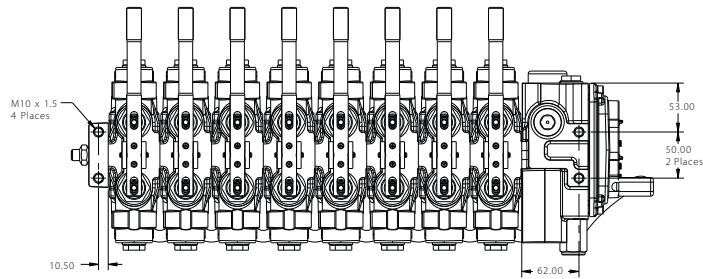
1. Pilot Valve
2. Main Stage
3. Linear Position Sensor
4. Port Reliefs / Anti-Cavitation valve
5. Main Metering Spools
6. Work Port A1
7. Work Port B1
8. Work port A2
9. Work port B2
10. Pre-Compensator spool



CMA90 Advanced sectional mobile valve

Installation views: 8 CMA work sections with manual override with inlet block

Units: mm

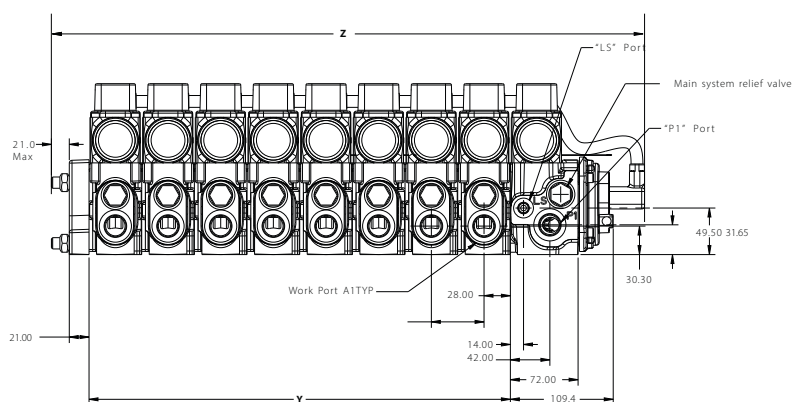
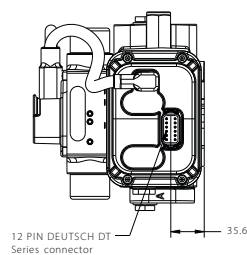
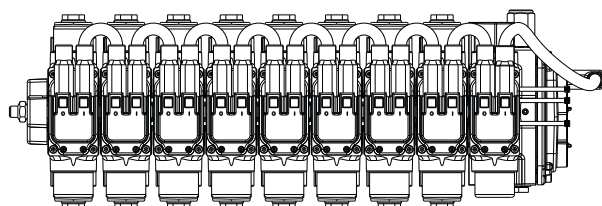
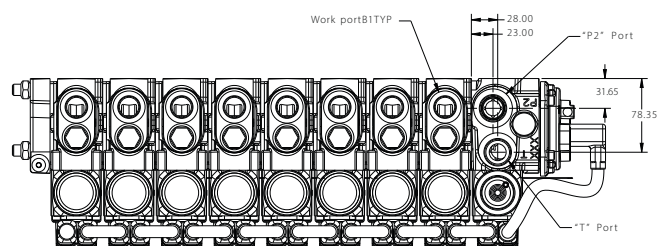
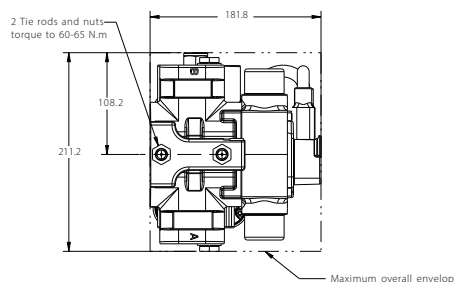


Number of sections

Dimension	/1	/2	/3	/4	/5	/6	/7	/8
Y (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	241.0	297.0	353.0	409.0	465.0	521.0	577.0	633.0
Weights (kg)	16.4	23.6	30.9	38.1	45.4	52.6	59.9	67.1

Installation views: 8 CMA work sections without manual override with inlet block

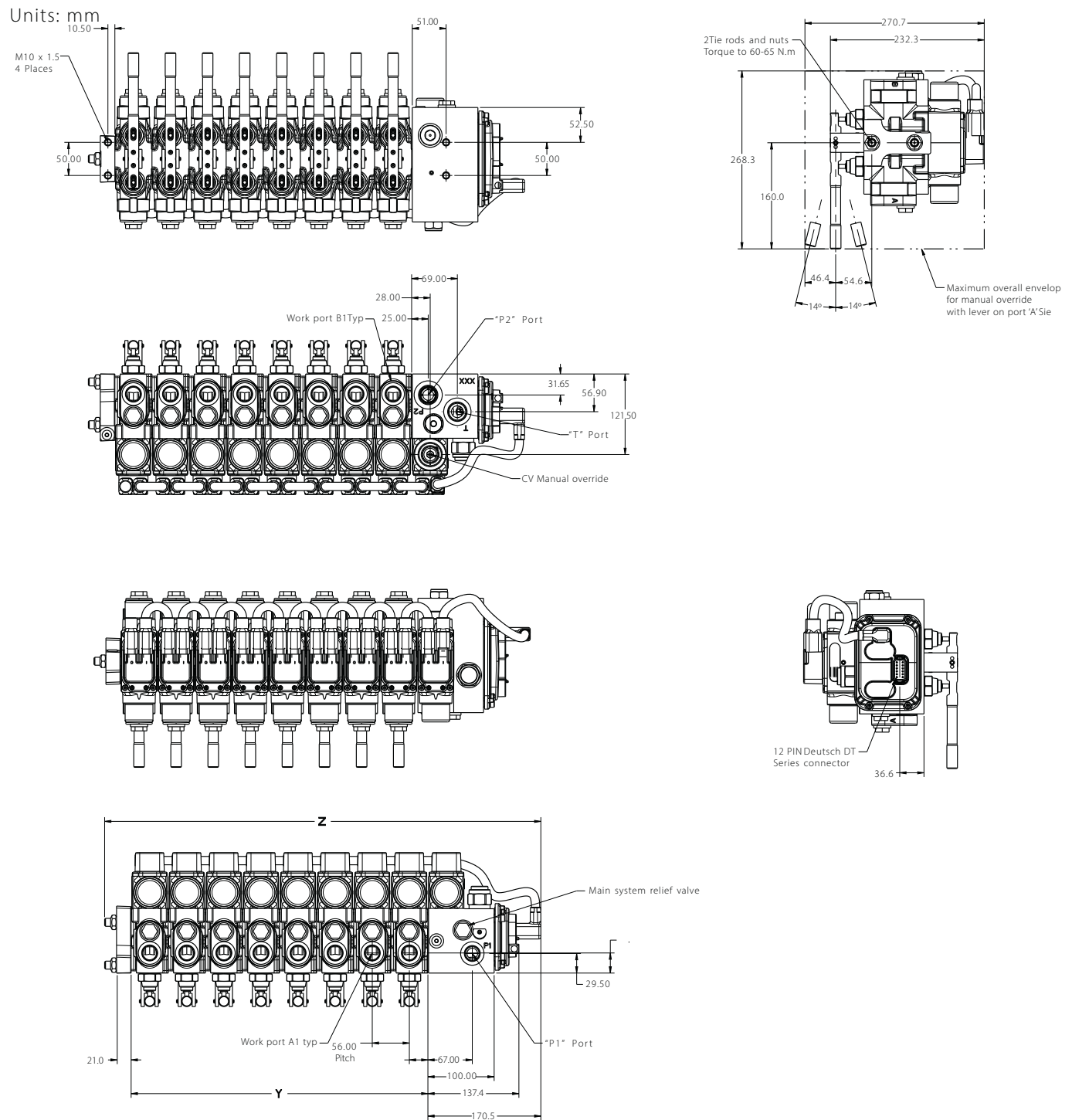
Technical drawing of the front view of the engine assembly. The drawing shows a horizontal arrangement of eight cylinders with a central cooling fan. Dimensions include a total width of 62.00, a distance of 10.50 from the left edge to the first cylinder, and a distance of 53.00 from the top of the fan to the top of the cylinders. There are also two M10 x 1.5 screws on the left side, spaced 50.00 apart.



	Number of sections							
Dimension	/1	/2	/3	/4	/5	/6	/7	/8
Y (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	241.0	297.0	353.0	409.0	465.0	521.0	577.0	633.0
Weights (kg)	15.7	22.3	28.9	35.5	42.1	48.7	55.3	61.9

CMA90 Advanced sectional mobile valve

Installation views: 8 CMA work sections with manual override with FD inlet block



Number of sections

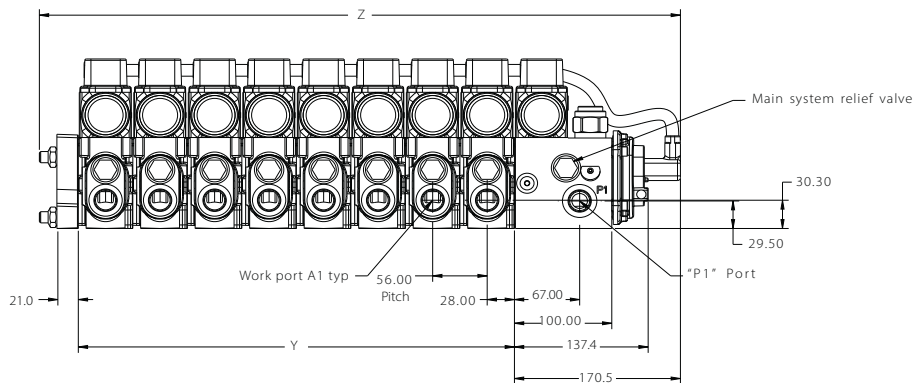
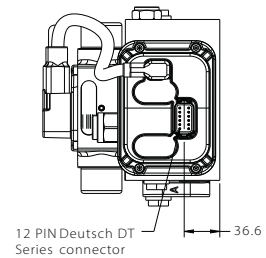
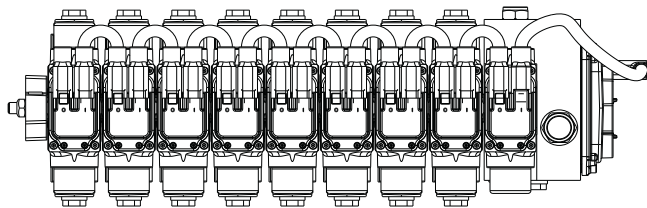
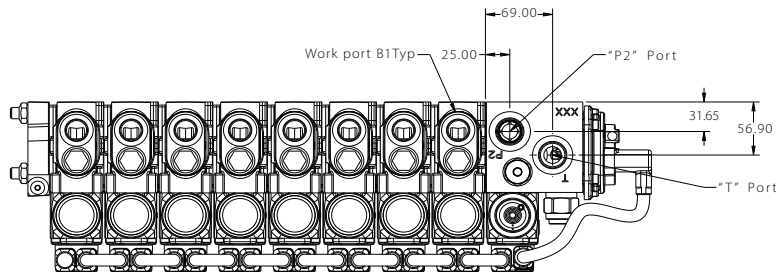
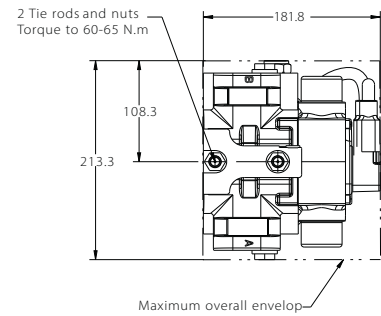
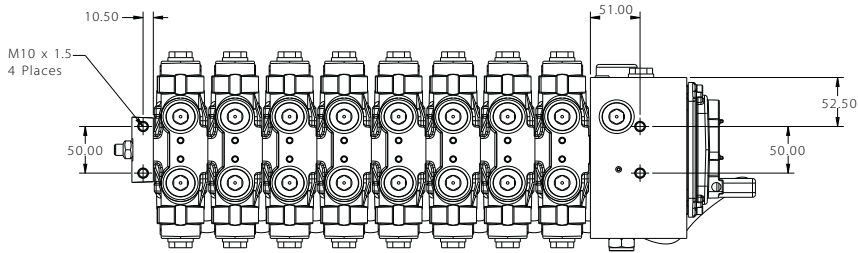
Dimension	/1	/2	/3	/4	/5	/6	/7	/8
Y (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	267.5	323.5	379.5	435.5	491.5	547.5	603.5	659.5
Weights (kg)	21.6	28.8	36.1	43.3	50.6	57.8	65.1	72.3

CMA90 Advanced sectional mobile valve

Installation views: 8 CMA work sections without manual override with FD inlet block

CMA90
CMA

Units: mm

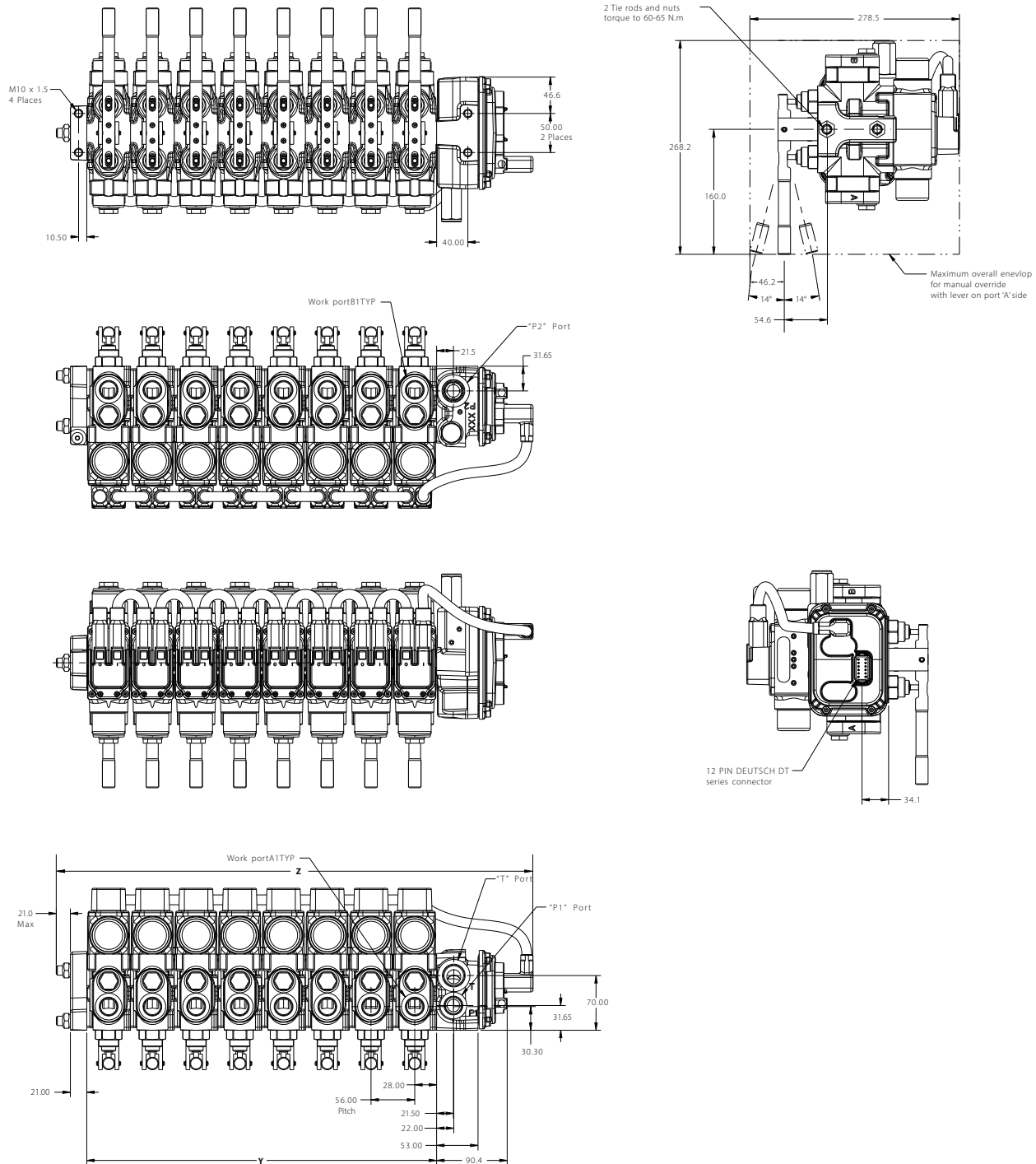


Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
Y (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	267.5	323.5	379.5	435.5	491.5	547.5	603.5	659.5
Weights (kg)	20.9	27.5	34.1	40.7	47.3	53.9	60.5	67.1

CMA90 Advanced section mobile valve

Installation views: 8 CMA work sections with manual override with extension inlet block

Units: mm



Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
Y (mm)	56.0	112.0	168.0	224.0	280.0	336.0	390.0	448.0
Z (mm)	222.0	278.0	334.0	390.0	446.0	502.0	556.0	614.0
Weights (kg)	12.4	19.6	26.9	34.1	41.4	48.6	55.9	63.1

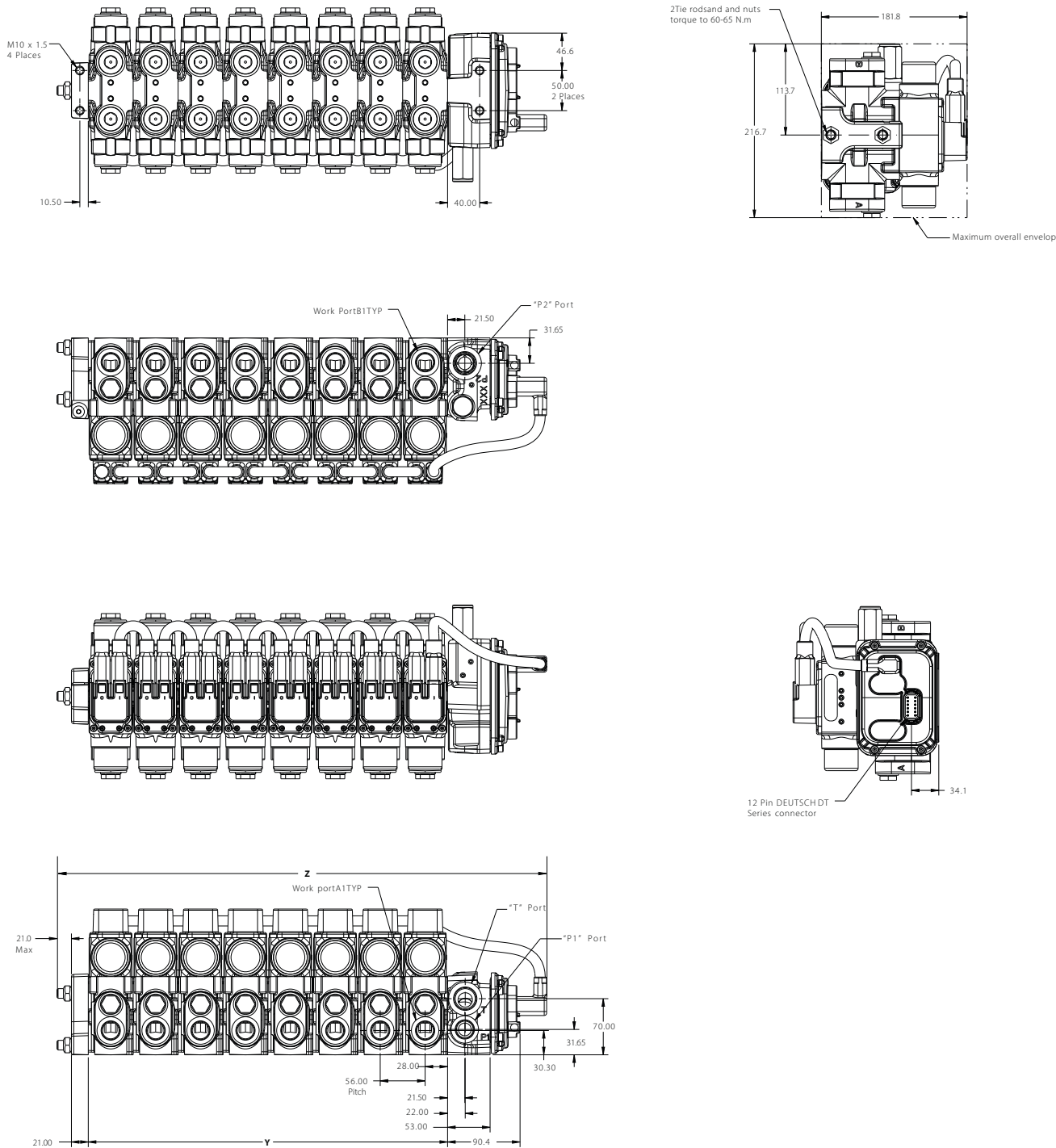
CMA90 Advanced section mobile valve

Installation views: 8 CMA work sections without manual override with extension inlet block

CMA90

CMA

Units: mm

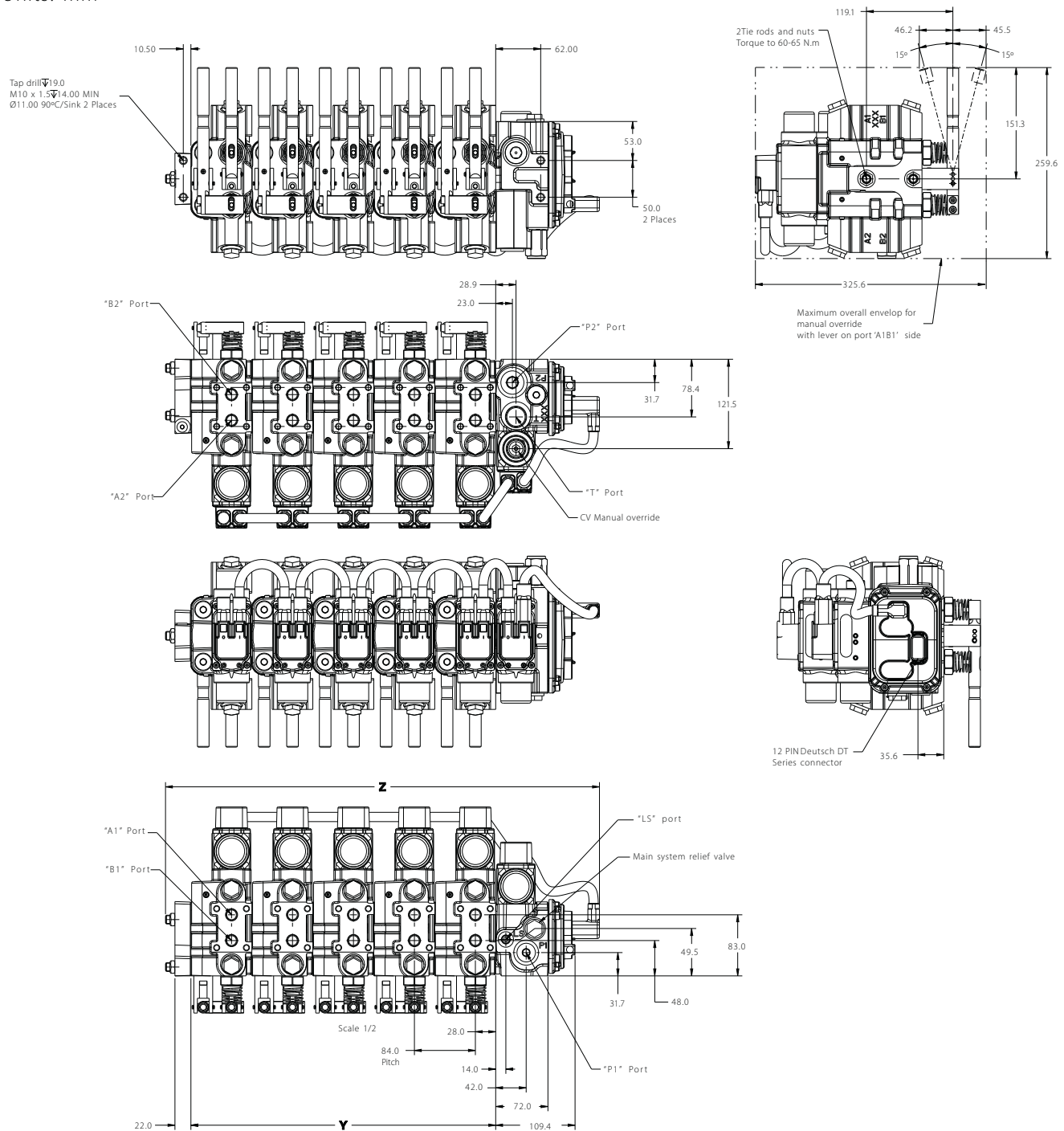


Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
Y (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	222.0	278.0	334.0	390.0	446.0	502.0	556.0	614.0
Weights (kg)	11.7	18.3	24.9	31.5	38.1	44.7	51.3	58.5

CMA90 Advanced sectional mobile valve

Installation views: 5 CMT work sections with manual override with inlet block

Units: mm



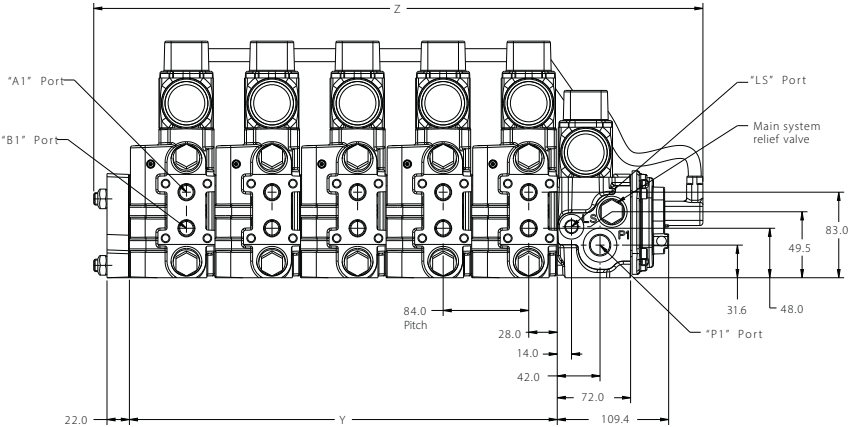
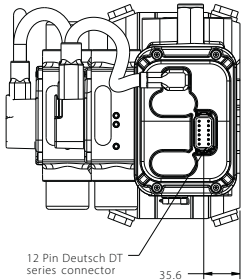
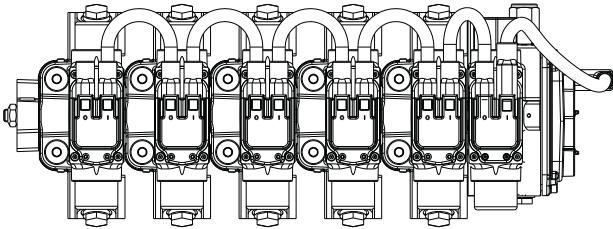
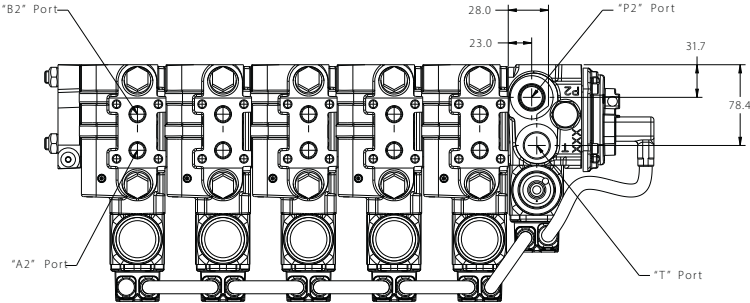
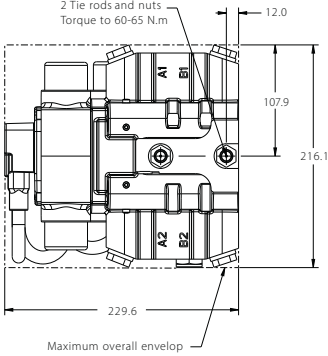
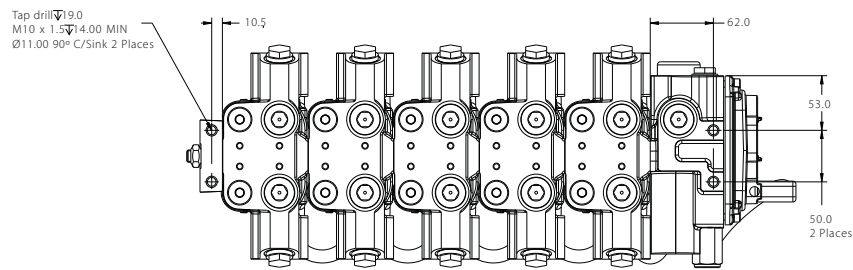
Dimension	Number of sections				
	/1	/2	/3	/4	/5
Y (mm)	84.0	168.0	252.0	336.0	420.0
Z (mm)	269.0	353.0	437.0	521.0	605.0
Weight (kg)	26.5	41.1	55.7	70.3	84.9

CMA90 Advanced sectional mobile valve

Installation views: 5 CMT work sections without manual override with inlet block

CMA90
CMT

Units: mm

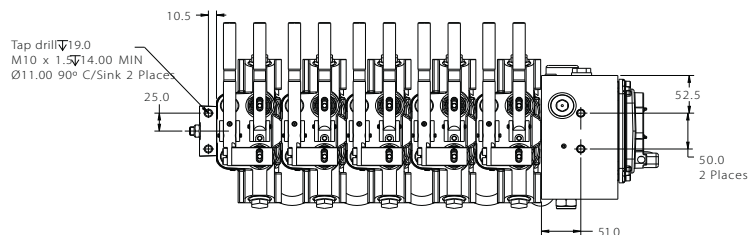
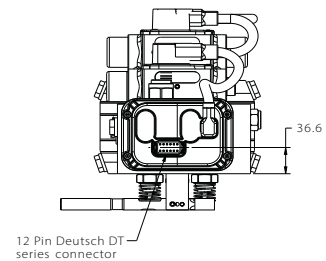
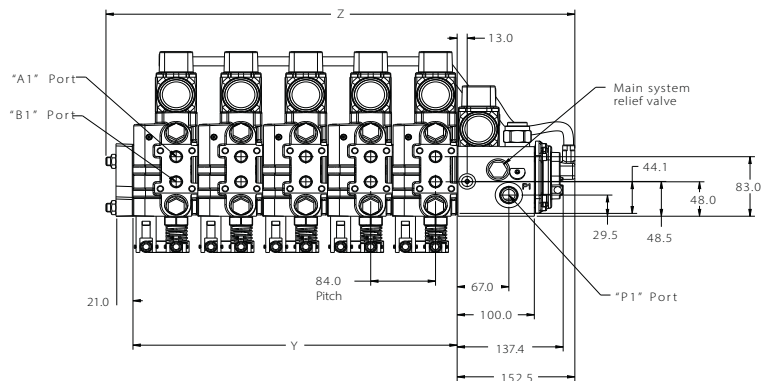
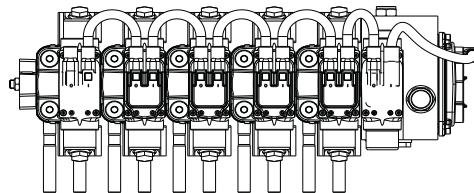
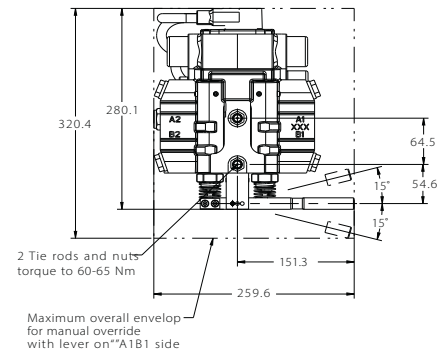
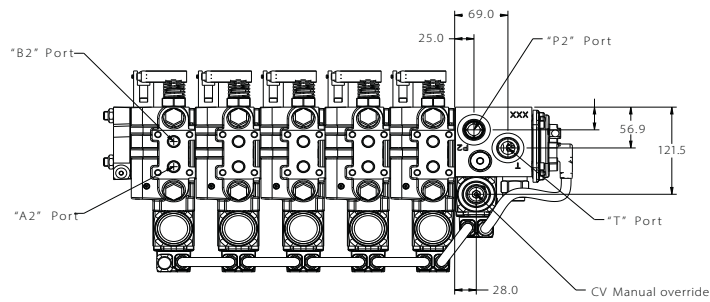


Dimension	Number of sections				
	/1	/2	/3	/4	/5
Y (mm)	84.0	168.0	252.0	336.0	420.0
Z (mm)	269.0	353.0	437.0	521.0	605.0
Weight (kg)	26.5	38.0	49.5	61.0	72.5

CMA90 Advanced sectional mobile valve

Installation views: 5 CMT work sections with manual override with FD inlet block

Units: mm

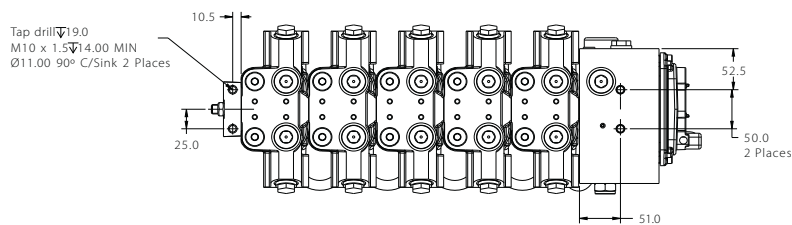
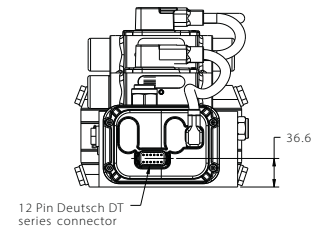
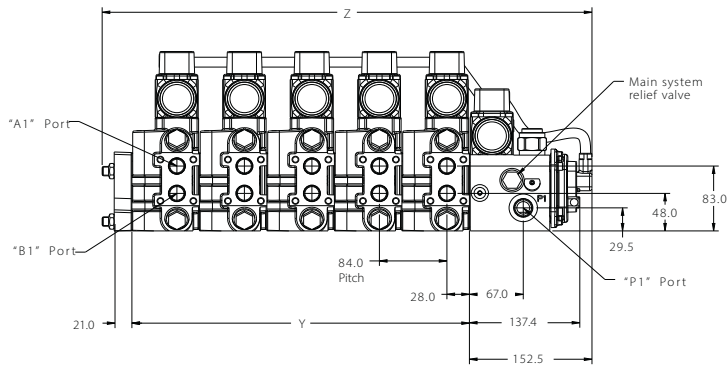
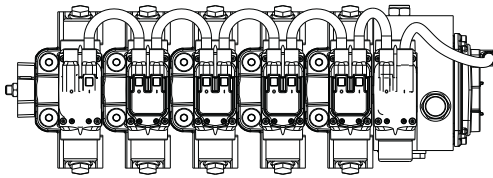
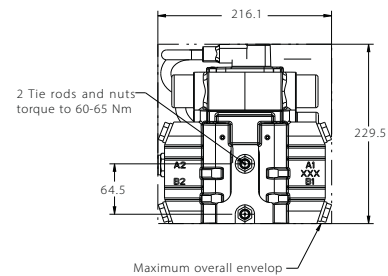
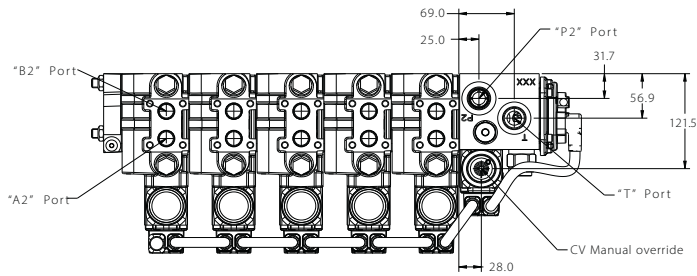


Dimension	Number of sections				
	/1	/2	/3	/4	/5
Y (mm)	84.0	168.0	252.0	336.0	420.0
Z (mm)	263.0	384.0	428.0	518.0	598.0
Weight (kg)	31.7	46.3	60.9	75.5	90.1

CMA90 Advanced sectional mobile valve

Installation views: 5 CMT work sections without manual override with FD inlet block

Units: mm

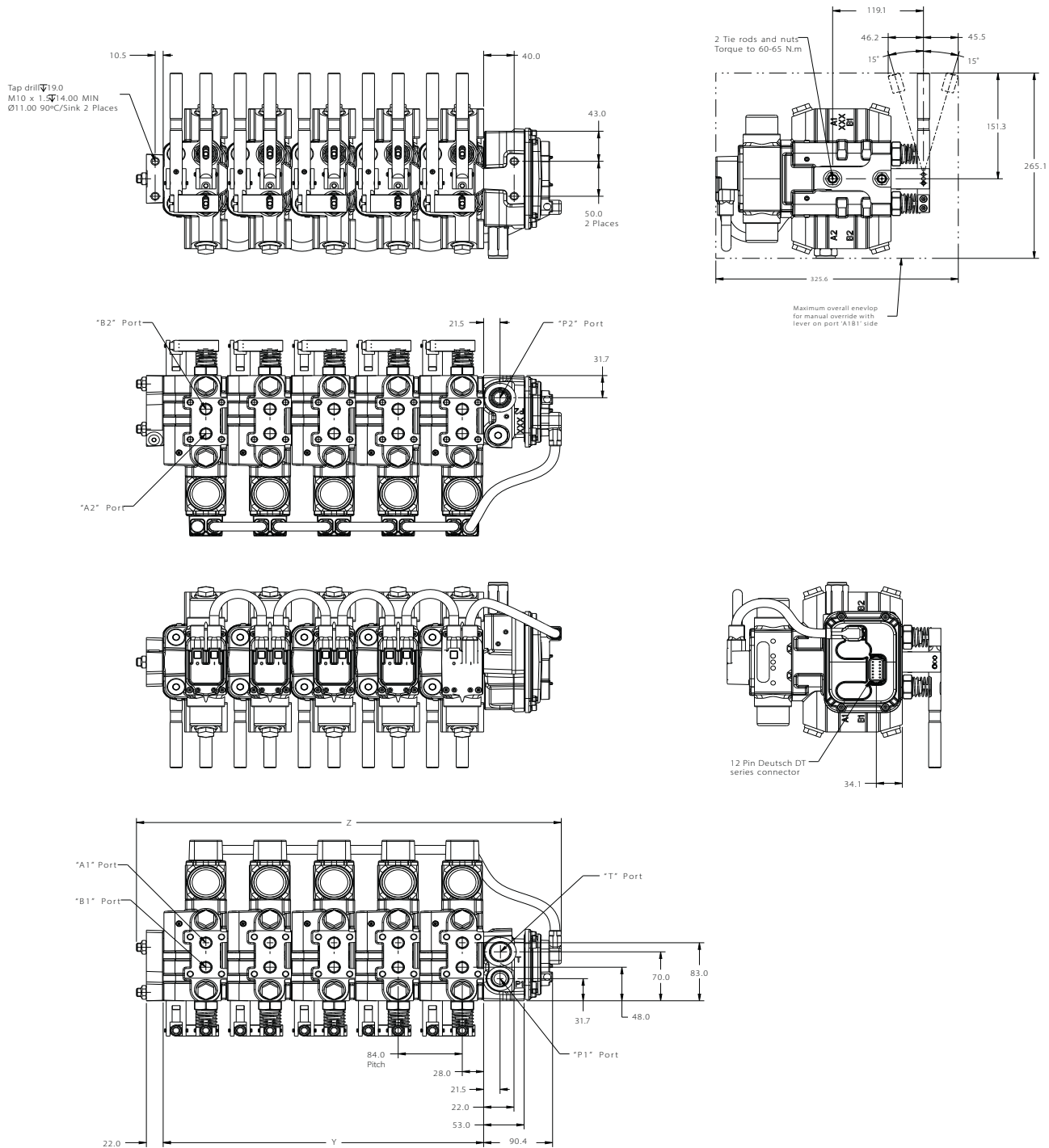


Dimension	Number of sections				
	/1	/2	/3	/4	/5
Y (mm)	84.0	168.0	252.0	336.0	420.0
Z (mm)	263.0	348.0	428.0	518.0	598.0
Weight (kg)	31.7	43.2	54.7	66.2	77.7

CMA90 Advanced sectional mobile valve

Installation views: 5 CMT work sections with manual override with extension inlet block

Units: mm



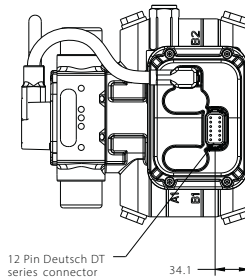
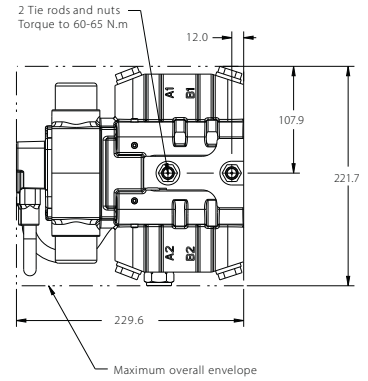
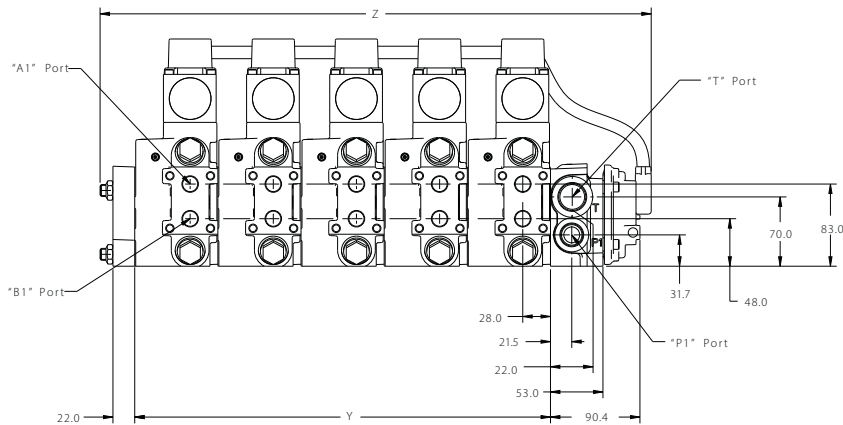
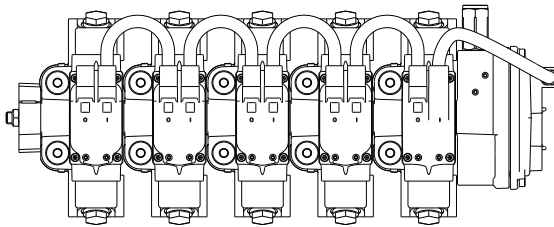
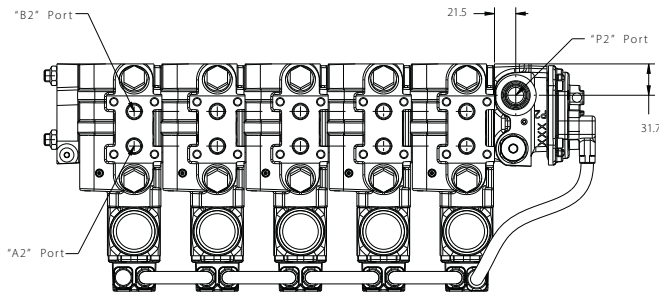
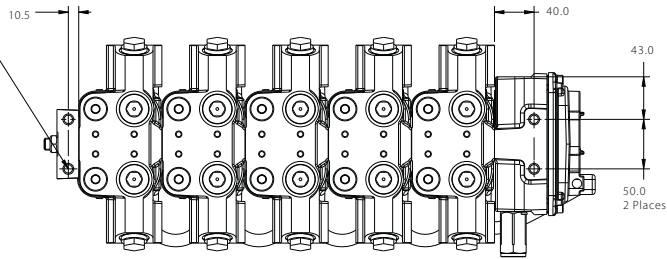
Dimension	Number of sections				
	/1	/2	/3	/4	/5
Y (mm)	84.0	168.0	252.0	336.0	420.0
Z (mm)	250.0	334.0	418.0	502.0	586.0
Weight (kg)	21.9	36.6	51.3	66.0	80.6

CMA90 Advanced sectional mobile valve

Installation views: 5 CMT work sections without manual override with extension inlet block

Units: mm

Tap drill ∇ 19.0
M10 x 1.5 ∇ 14.00 MIN
 $\varnothing$ 11.00 90° C/Sink 2 Places

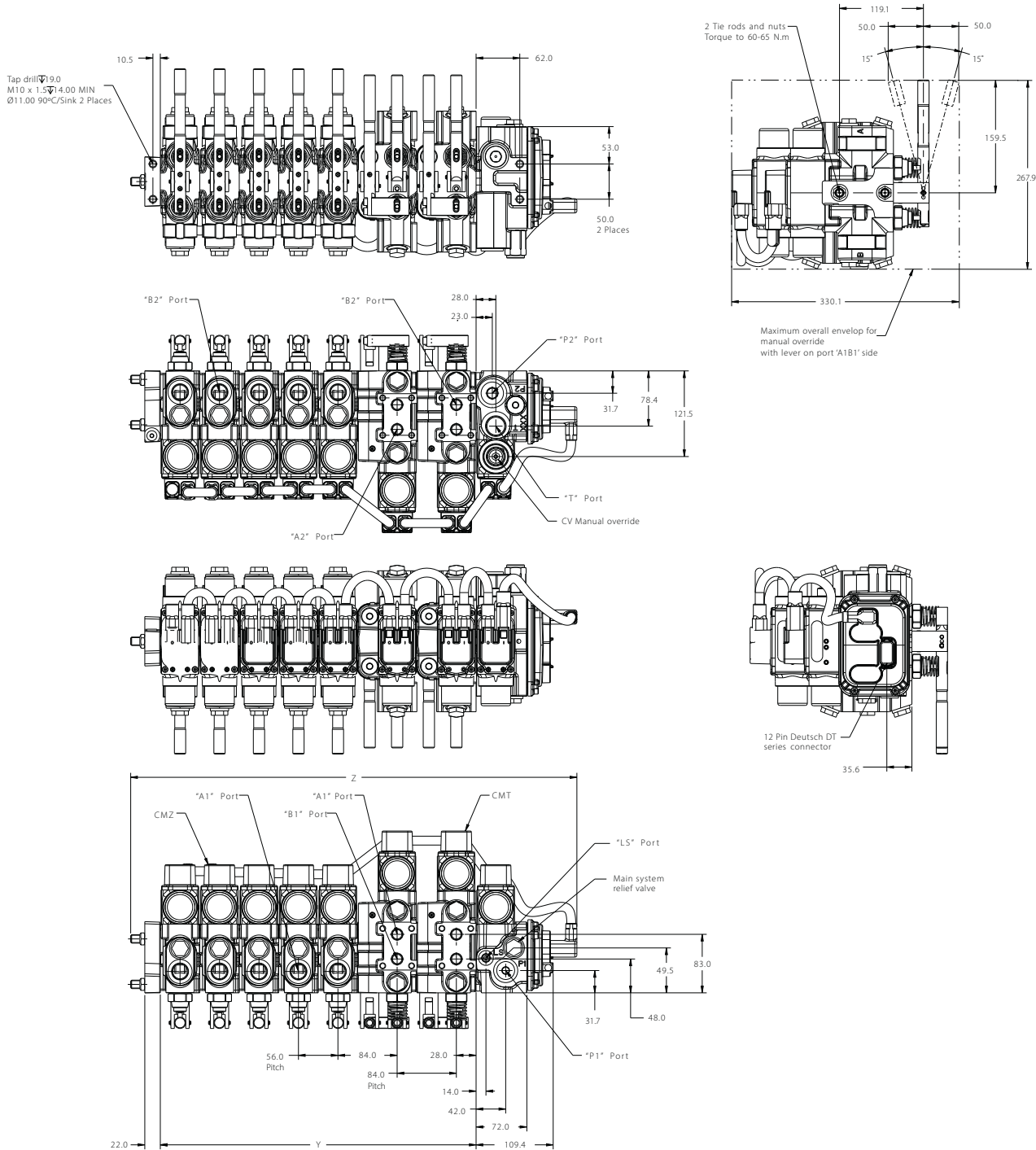


Dimension	Number of sections				
	/1	/2	/3	/4	/5
Y (mm)	84.0	168.0	252.0	336.0	420.0
Z (mm)	250.0	334.0	418.0	502.0	586.0
Weight (kg)	21.9	34.5	46.0	58.5	70.0

CMA90 Advanced sectional mobile Valve

Installation views: 7 CMA + CMT work sections with manual override with inlet block

Units: mm



Number of sections

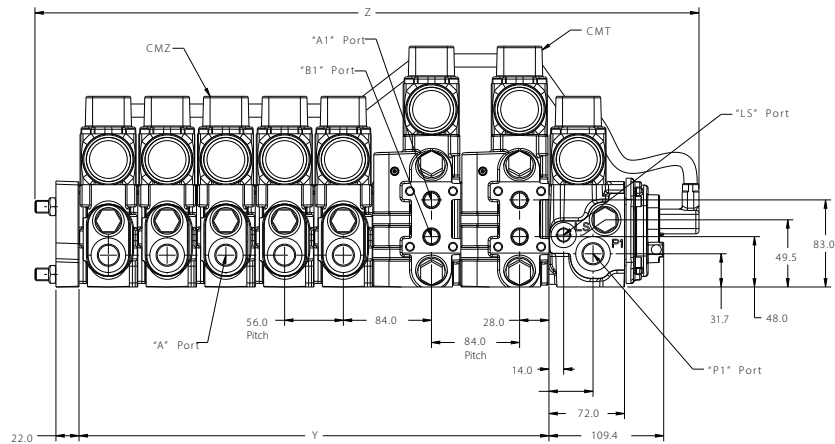
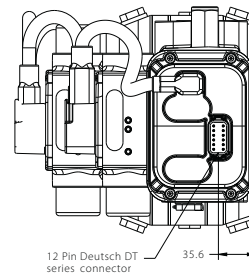
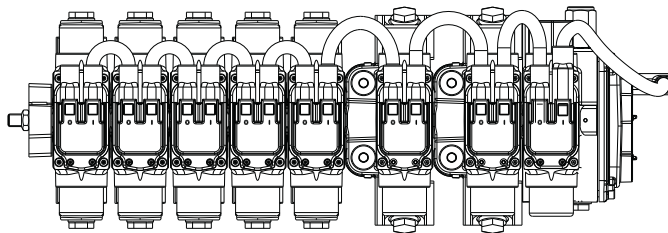
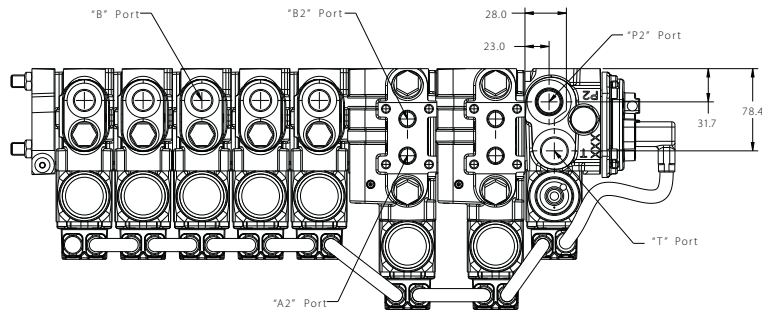
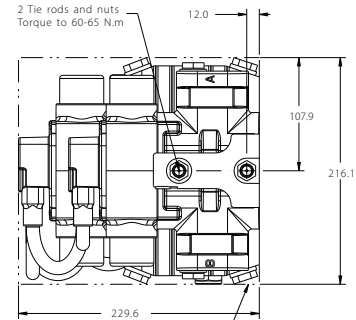
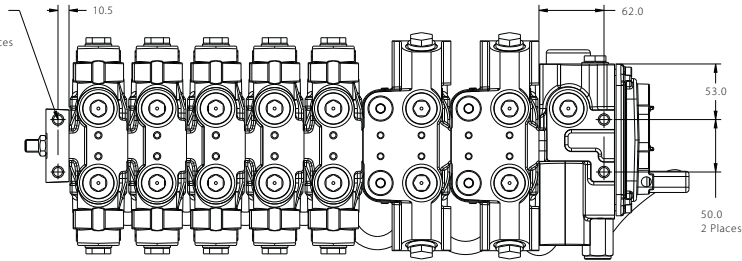
CMT	/1						/2					/3			/4	
	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
CMZ	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
Y (mm)	140	196	252	308	364	420	224	280	336	392	448	308	364	420	392	448
Z (mm)	325	381	437	493	549	605	409	465	521	577	633	493	549	605	577	633
Weight (kg)	34.9	43.2	51.5	59.8	68.1	76.4	55.4	62.2	69.0	75.8	82.6	64.0	72.4	80.8	78.8	87.1

CMA90 Advanced sectional mobile Valve

Installation views: 7 CMA + CMT work sections without manual override with inlet block

Units: mm

Tap drill 19.0
M10 x 1.5 14.00 MIN
Ø11.00 90°/Sink 2 Places



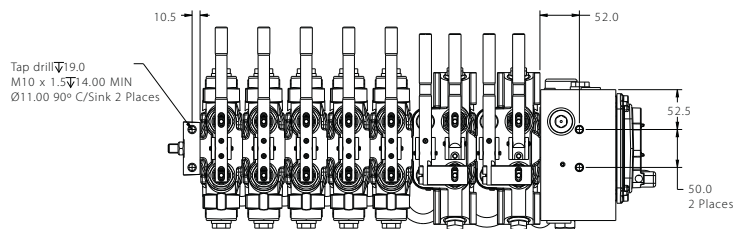
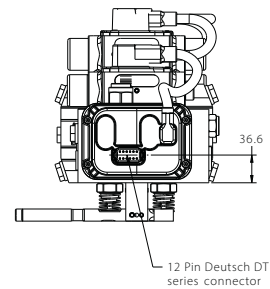
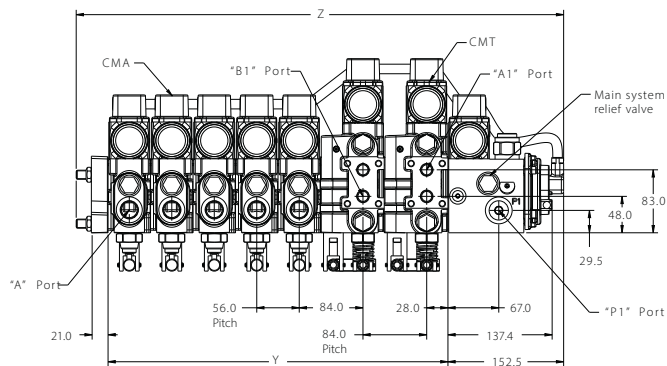
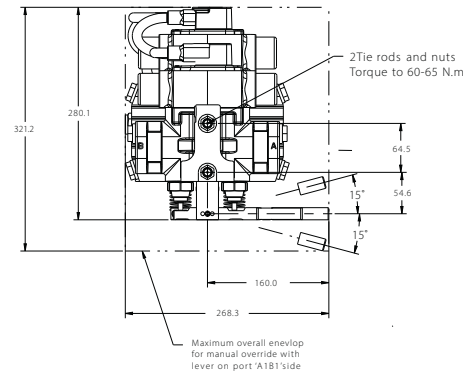
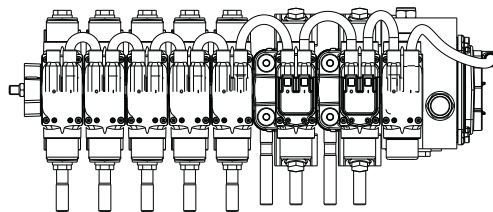
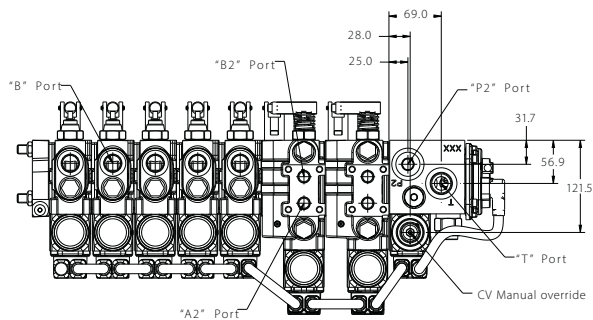
Number of sections

CMT	/1						/2					/3			/4	
CMZ	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
Y (mm)	140	196	252	308	364	420	224	280	336	392	448	308	364	420	392	448
Z (mm)	325	381	437	493	549	605	409	465	521	577	633	493	549	605	577	633
Weight (kg)	33.5	40.5	47.5	54.5	61.5	68.5	45.0	52.0	59.0	66.0	73.0	56.5	63.5	70.5	68.0	75.0

CMA90 Advanced sectional mobile Valve

Installation views: 7 CMA + CMT work sections with manual override with FD inlet block

Units: mm



Number of sections

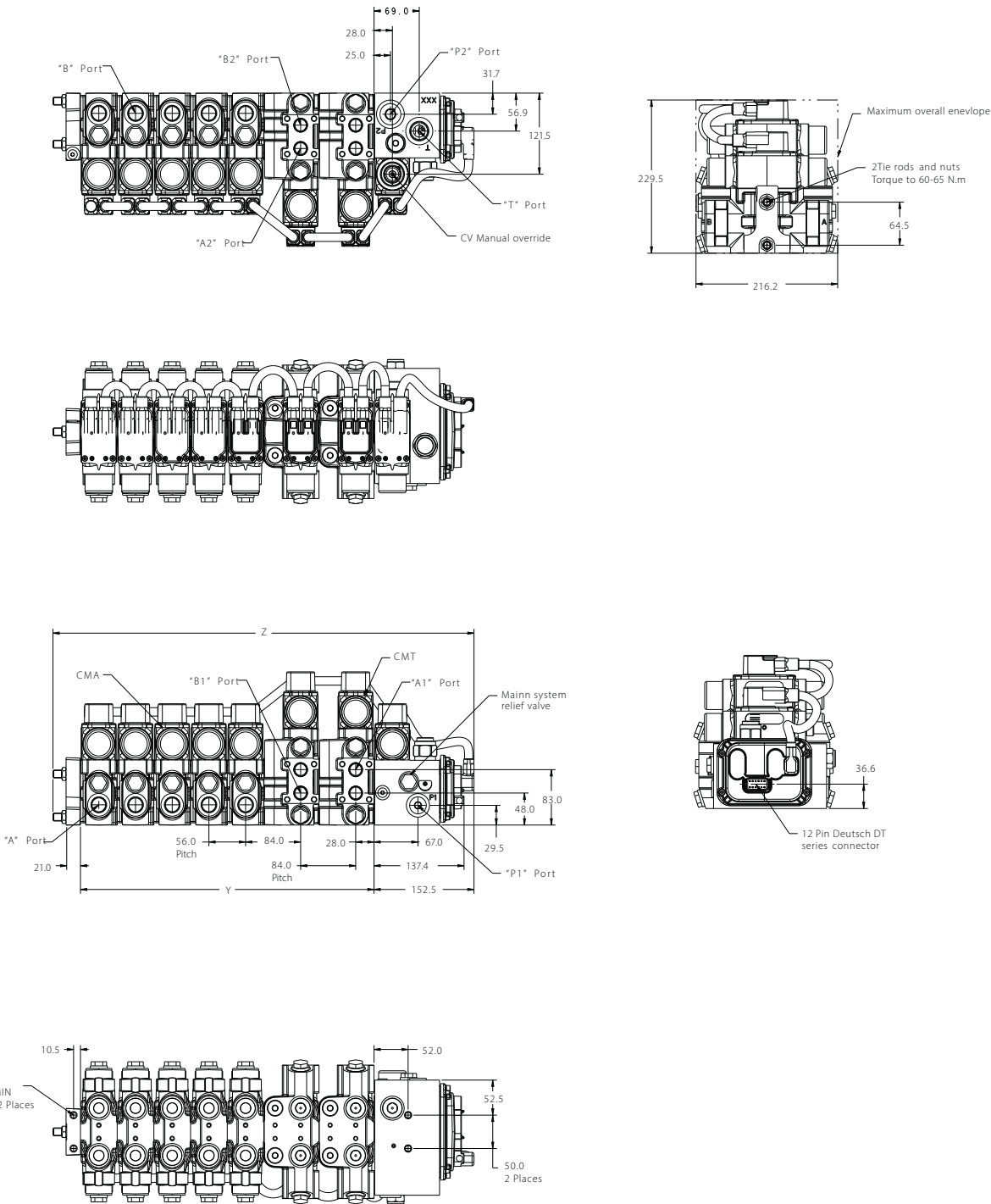
CMT	/1						/2					/3			/4	
CMZ	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
Y (mm)	140	196	252	308	364	420	224	280	336	392	448	308	364	420	392	448
Z (mm)	361.1	419.1	471.1	529.1	586.1	641.1	446.1	506.1	561.1	616.1	676.1	529.1	586.1	641.1	616.1	676.1
Weight (kg)	40.1	48.4	56.7	65.0	73.3	81.6	60.6	67.4	74.2	81.0	87.8	69.2	77.6	86.0	84.0	92.3

CMA90 Advanced sectional mobile Valve

Installation views: 7 CMA + CMT work sections without manual override with FD inlet block

CMA90

Units: mm



Number of sections

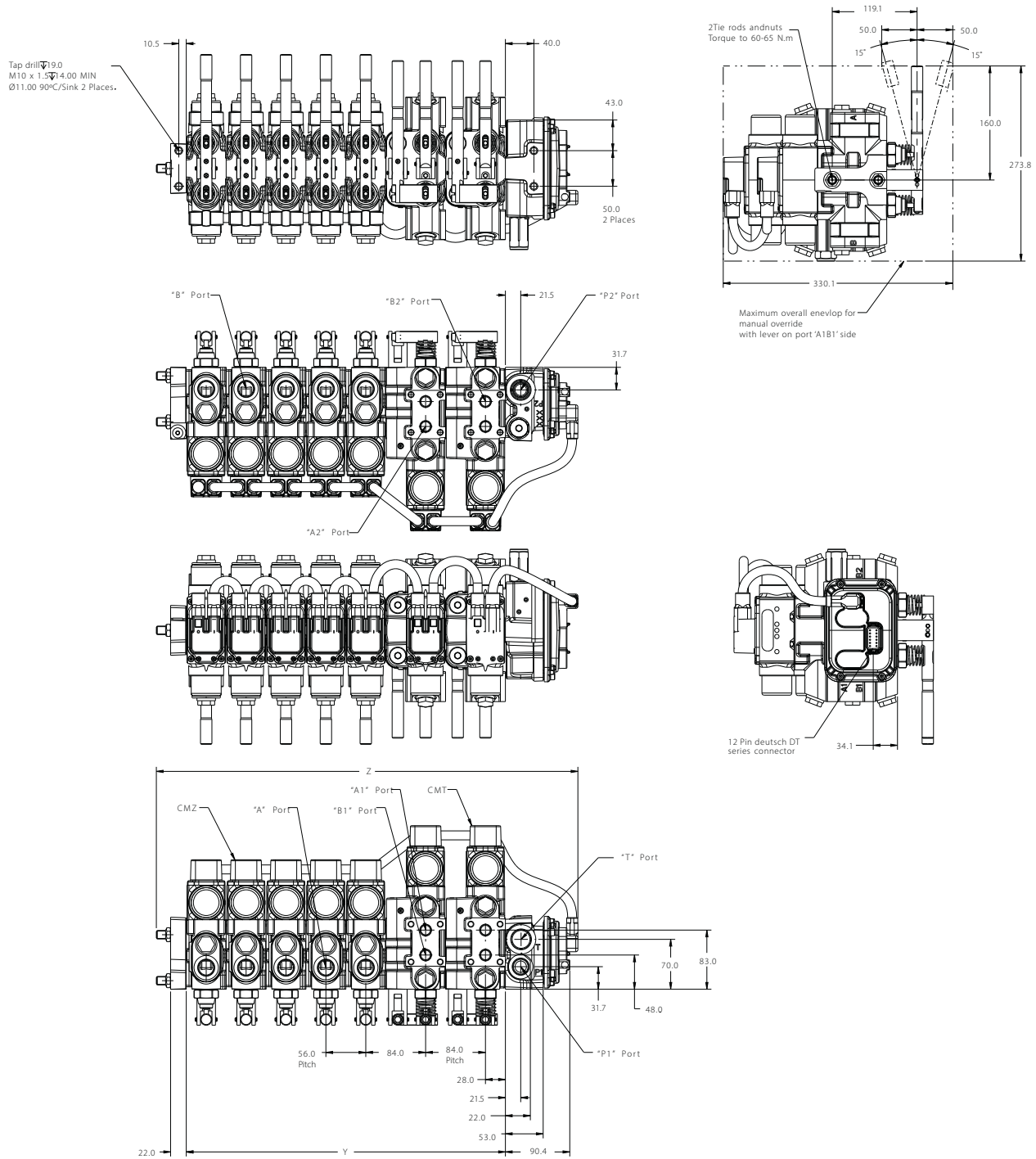
CMT	/1						/2					/3			/4	
CMZ	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
Y (mm)	140	196	252	308	364	420	224	280	336	392	448	308	364	420	392	448
Z (mm)	361.1	419.1	471.1	529.1	586.1	641.1	446.1	506.1	561.1	616.1	676.1	529.1	586.1	641.1	616.1	676.1
Weight (kg)	38.7	45.7	52.7	59.7	66.7	73.7	50.2	57.2	64.2	71.2	78.2	61.7	68.7	75.7	73.2	80.2

CMA90 Advanced sectional mobile Valve

Installation views: 7 CMA + CMT work sections with manual override with extension inlet block

CMA90

Units: mm



Number of sections

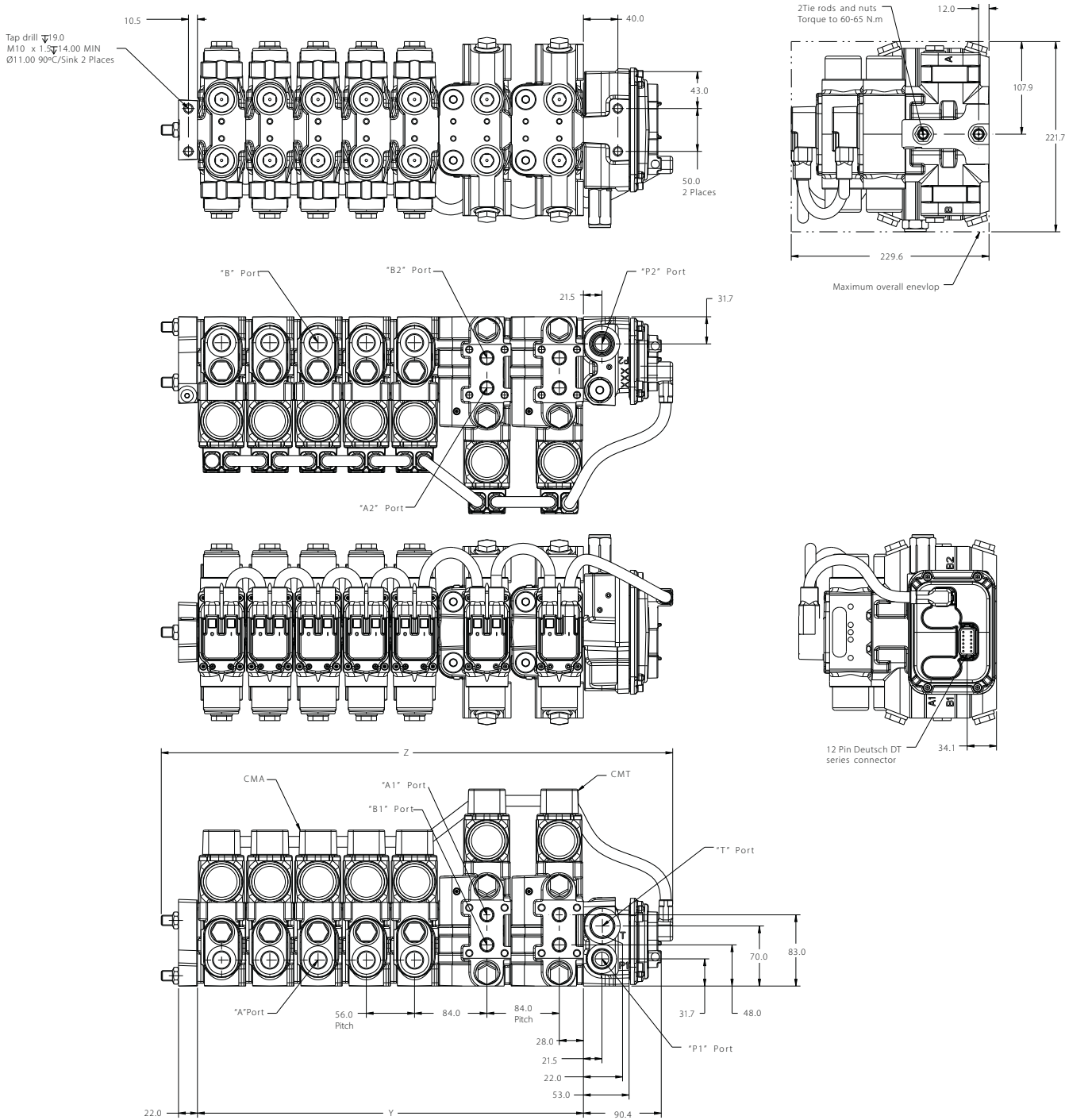
CMT	/1						/2					/3			/4	
	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
Y (mm)	140	196	252	308	364	420	224	280	336	392	448	308	364	420	392	448
Z (mm)	306	362	418	474	530	586	390	446	502	558	614	474	530	586	558	614
Weight (kg)	30.0	38.3	46.6	54.9	63.2	71.6	42.4	51.7	61.0	70.3	79.6	58.7	68.0	77.3	74.4	82.3

CMA90 Advanced sectional mobile Valve

Installation views: 7 CMA + CMT work sections without manual override with extension inlet block

CMA90

Units: mm



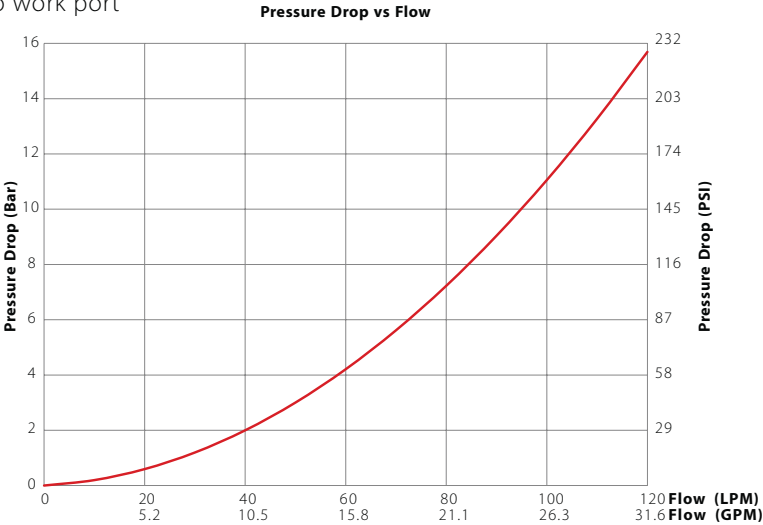
Number of sections																
CMT	/1						/2					/3			/4	
CMZ	/1	/2	/3	/4	/5	/6	/1	/2	/3	/4	/5	/1	/2	/3	/1	/2
Y (mm)	140	196	252	308	364	420	224	280	336	392	448	308	364	420	392	448
Z (mm)	306	362	418	474	530	586	390	446	502	558	614	474	530	586	558	614
Weight (kg)	28.8	38.0	45.0	52.0	59.0	66.0	42.5	49.5	56.5	63.5	70.5	54.0	61.0	68.0	65.5	72.5

CMA90 Advanced sectional mobile valves

Typical curves CMA work section

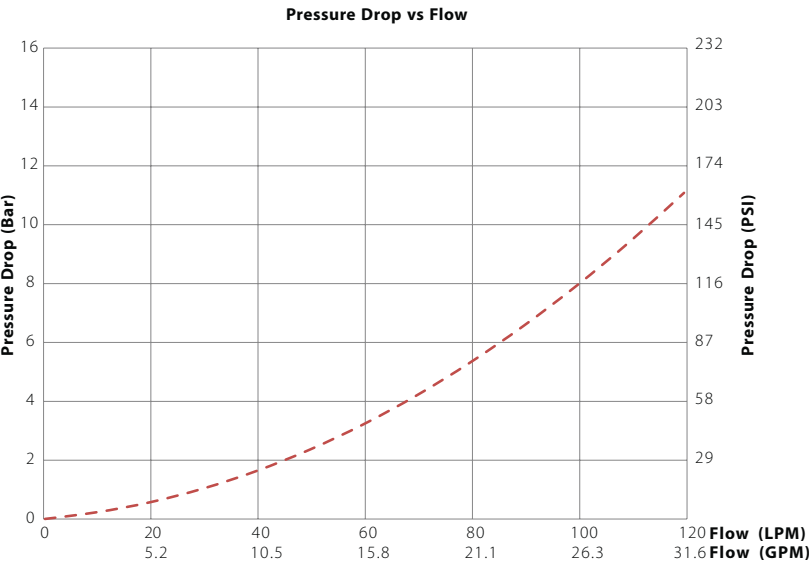
Work section - pressure drop

Measured with external pressure sensors, inlet to work port

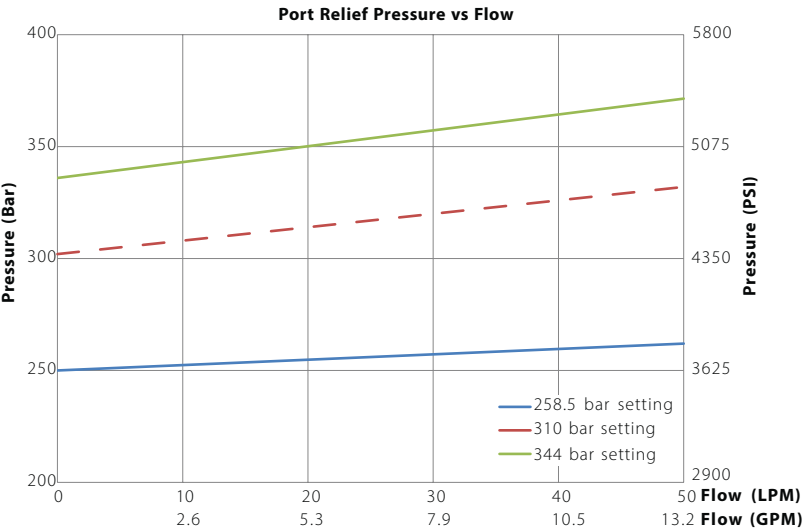


Work section - pressure drop

Measured with external pressure sensors, work port to tank



Work section - work port relief valve

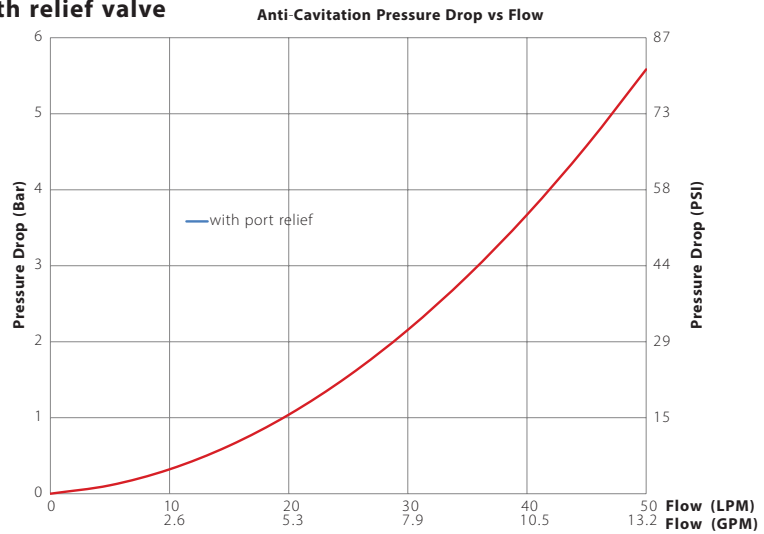


CMA90 Advanced sectional mobile valves

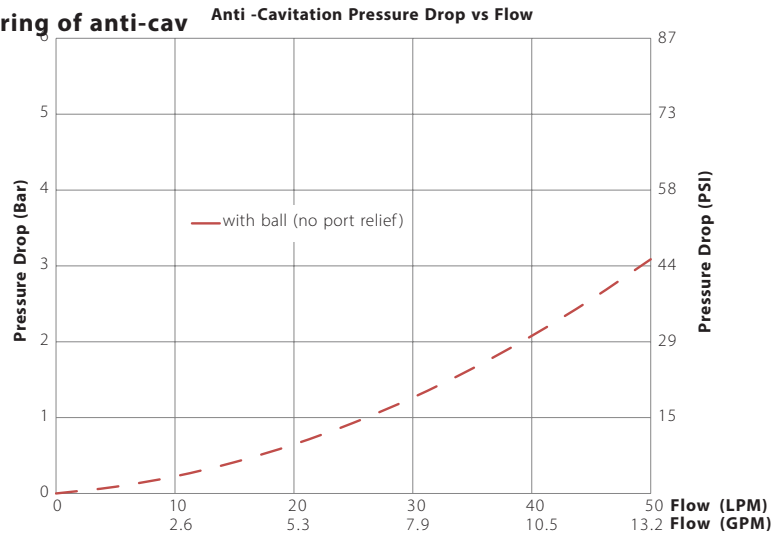
Typical curves CMA work section

CMA90
CMA

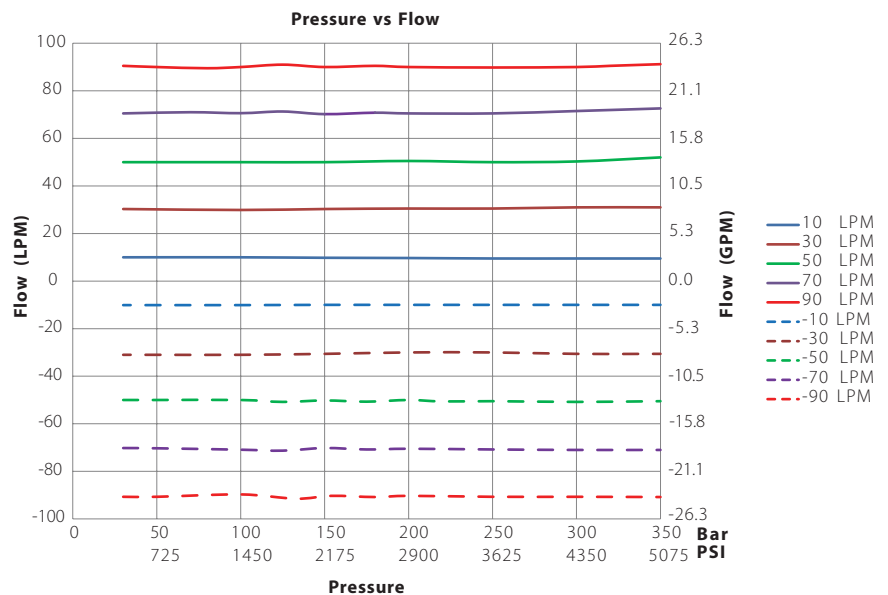
Work section - pressure drop across anti-cav with relief valve



Work section - pressure drop across ball and spring of anti-cav



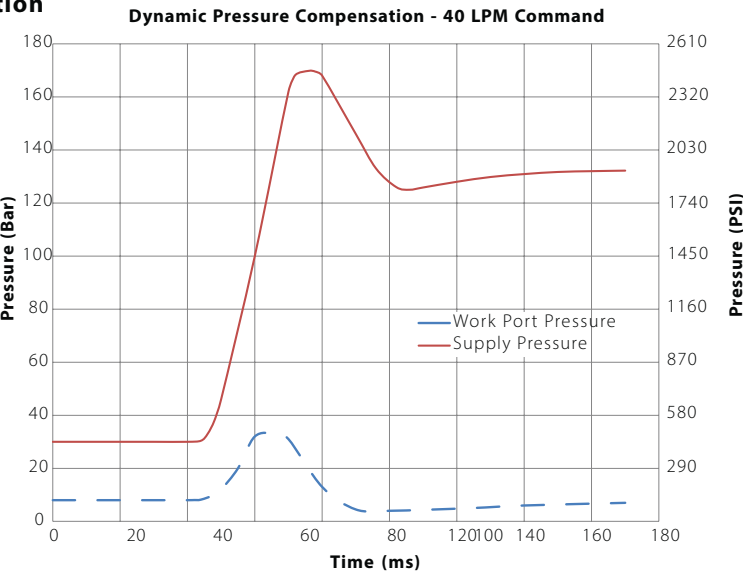
Work section - pressure compensation



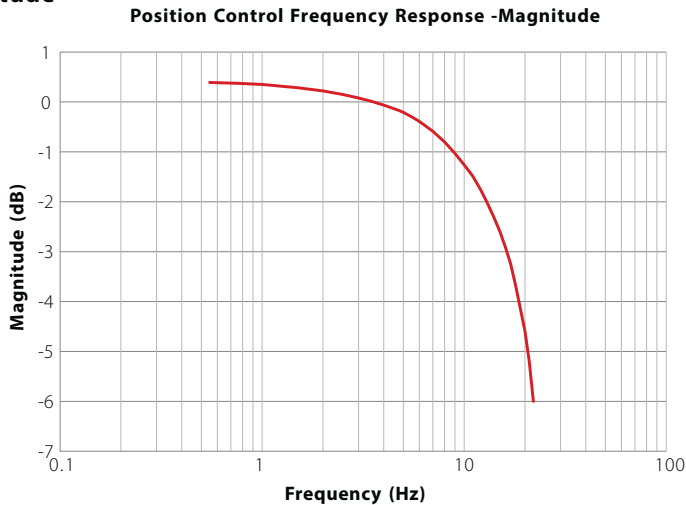
CMA90 Advanced sectional mobile valves

Typical curves CMA work section

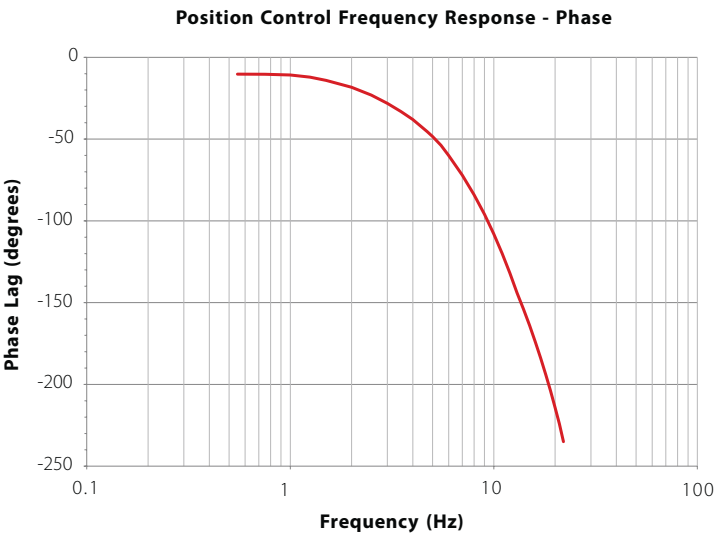
Work section - dynamic pressure compensation



Position control frequency response - Magnitude



Position control frequency response - Phase

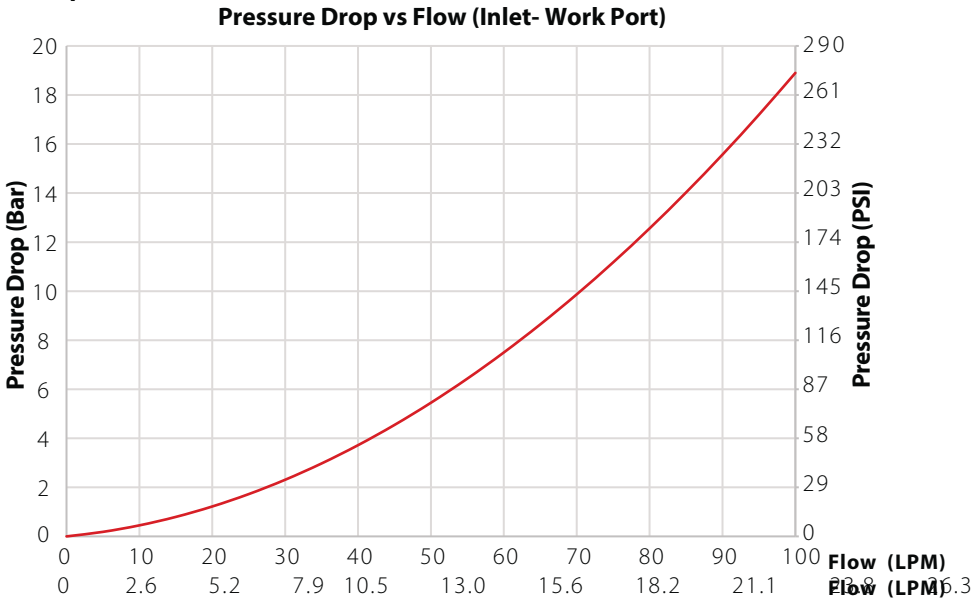


CMA90 Advanced sectional mobile valve

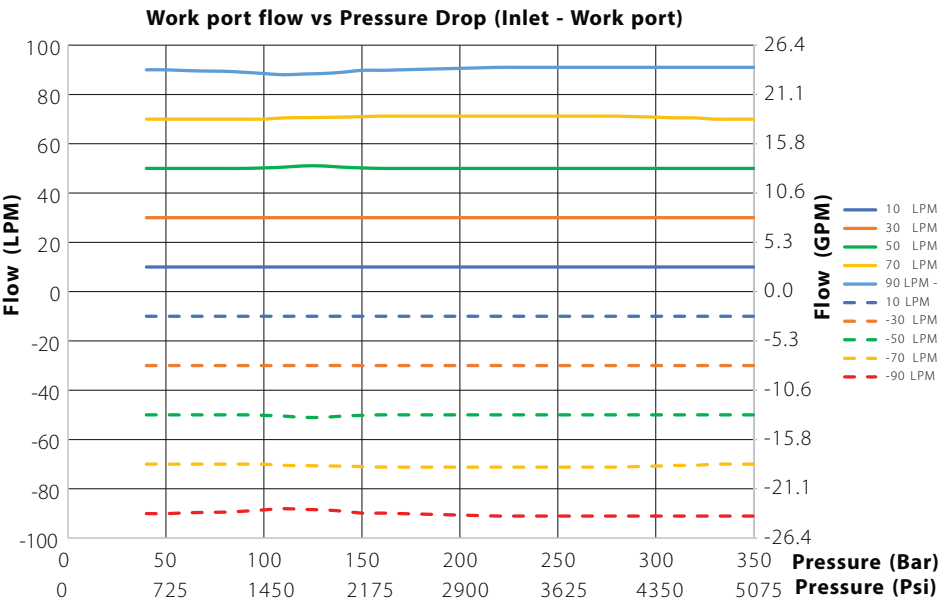
Typical curves CMT work section

CMA90
CMT

Work section - pressure drop Inlet to work port



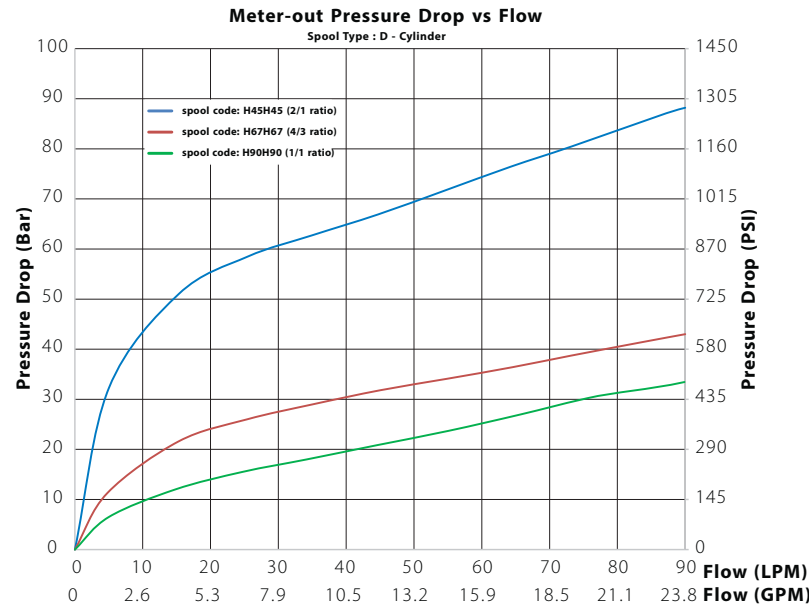
Work section - pressure compensation



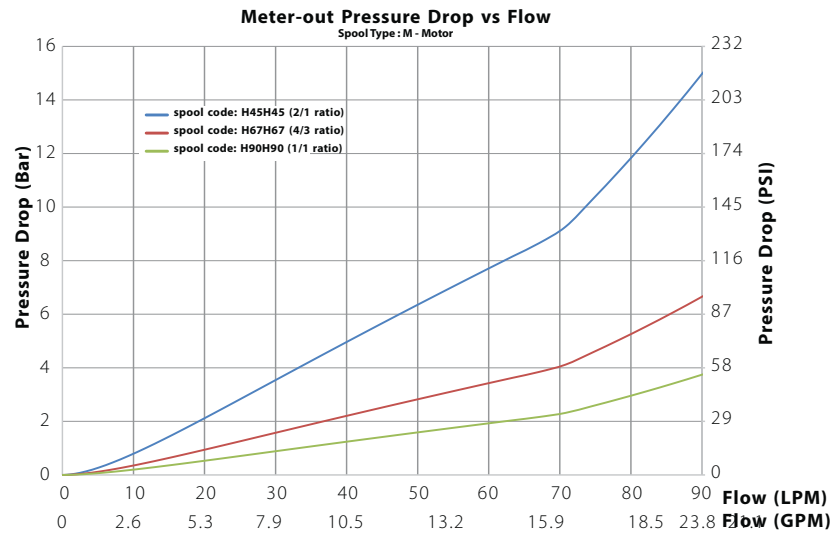
CMA90 Advanced sectional mobile Valve

Typical curves CMT work section

Work section - pressure drop (Cylinder spool) Work port to tank port



Work section - pressure drop (Motor spool) Work port to tank port

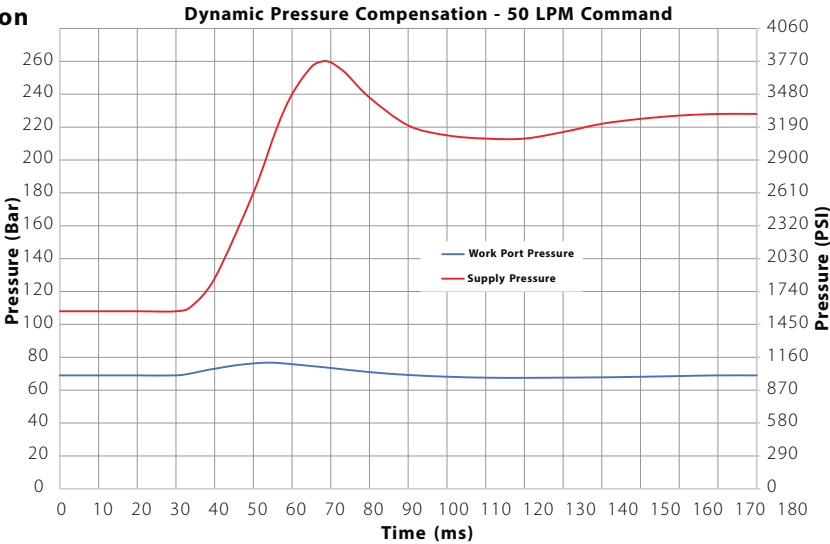


CMA90 Advanced sectional mobile Valve

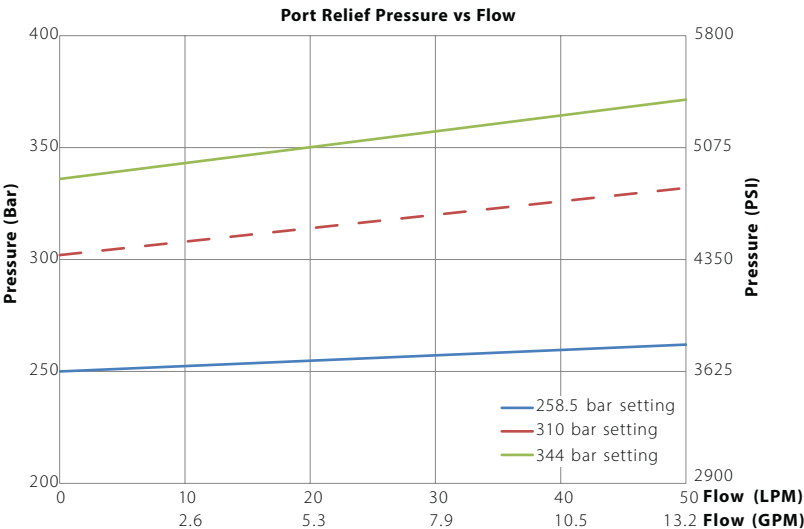
Typical curves CMT work section

CMA90
CMT

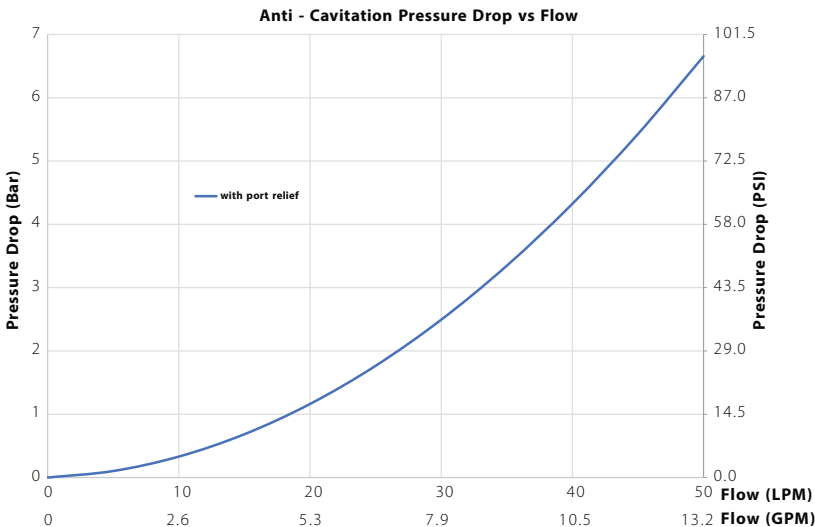
Work section - dynamic pressure compensation



Work section - work port relief valve



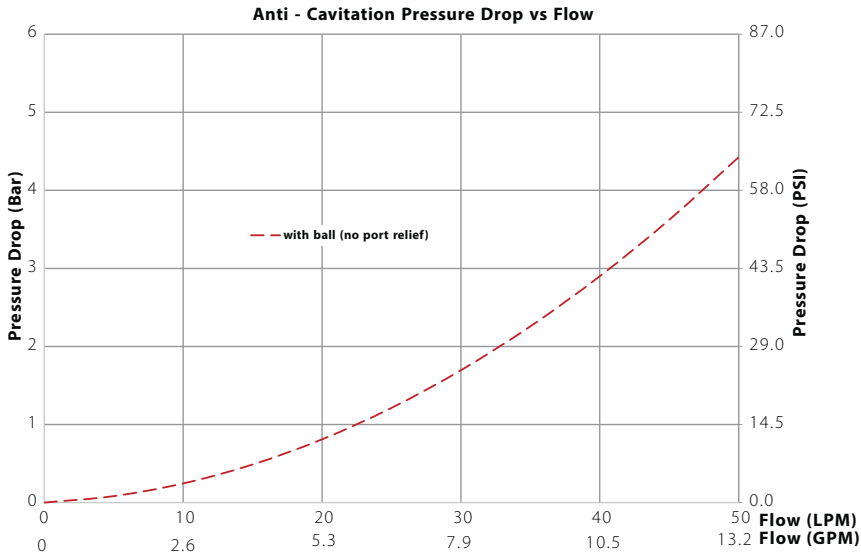
Work section - pressure drop across anti-cav with relief valve



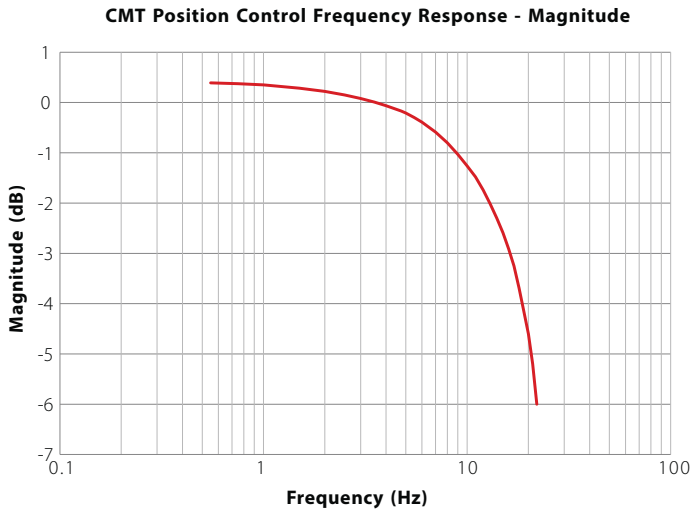
CMA90 Advanced sectional mobile Valve

Typical curves CMT work section

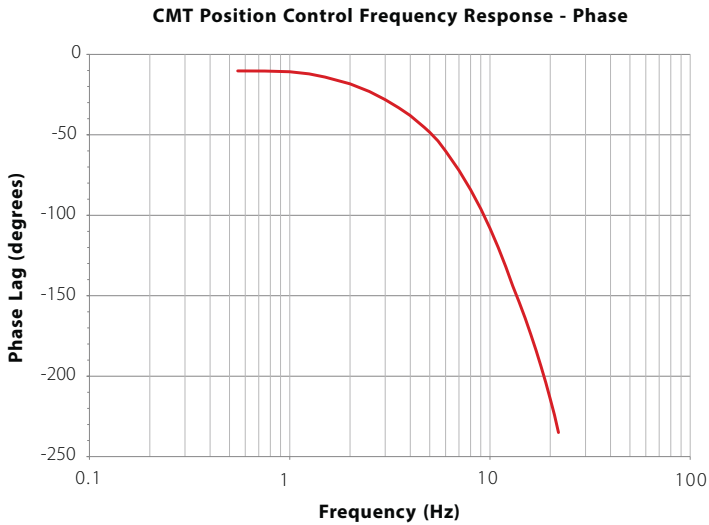
Work section - pressure drop across ball and spring of anti-cav



Position control frequency response - Magnitude



Position control frequency response - Phase



CMA90 Machine integration process

Because of CMA's CAN communication and advanced software features, there are a couple of other additional steps to integrate a CMA valve into your machine. The following steps outline a typical integration process.

1. Specify inlet and sections and purchase valve block assemblies, (Please refer to page 39 for more information in specifying a CMA90 system).
2. Develop software for CAN communication to CMA as well as the machine's application software.
 - a. Communication libraries in CoDeSys 3.5.5 are available for use on Danfoss' HFX Controller or other CoDeSys programmed ECUs.
 - b. If programming in another language, refer CMA's Application Developer's Guide for J1939 or CANOpen for definition of the necessary communication message structure.
3. Design and build wiring harnesses to connect the machine to each CMA system as well as harnesses to connect between CMA valve blocks.
 - a. Cables connecting valves within a block will be provided by Danfoss.
 - b. See wiring schematic and suggested components (Please reference page 85) "CMA Wiring Harness Details" for more information.
4. Procure CAN card (Please reference page 92) "Pro-FX[®] Configure" for more information.
5. Once the CMA valve is received and installed on the machine, setup and tune CMA's software features using Pro-FX[®] Configure.

Specifying a CMA90 system

For each CMA valve block desired, configure 1 inlet section model code and a CMT or CMA work section model code for each work section on the block. When dividing work sections across multiple valve blocks, the below rules must be followed. Note, a CMA system consists of all CMA blocks connected to the same VSM. Multiple blocks are configured together on the inlet model code as defined by the distance the blocks are from each other as outlined on model code position 8 - Interface module. (Refer page 42).



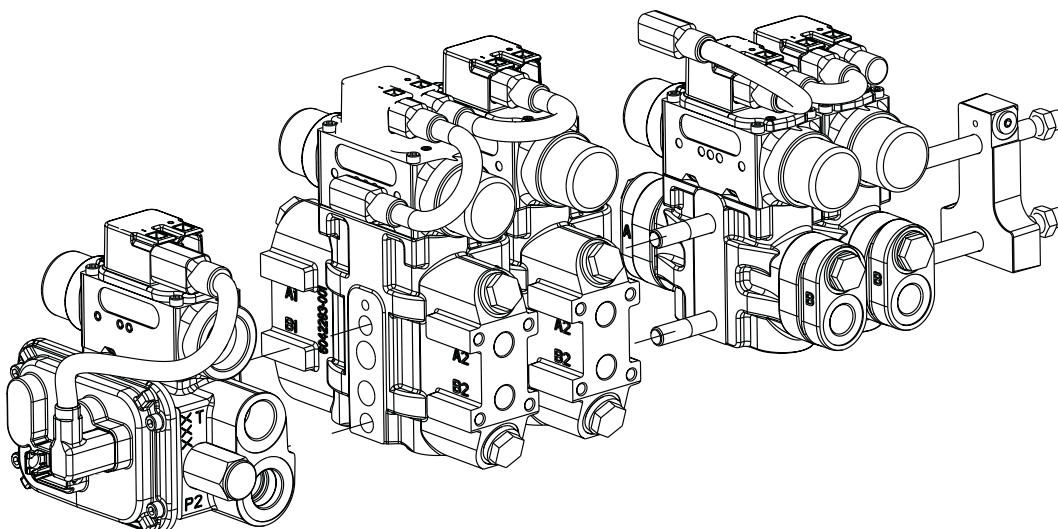
- One and only one VSM and Inlet Pressure Controller are required per system
- Maximum of 5 only CMT work sections per block
- Maximum of 8 only CMA work sections per block
- Maximum of 7 CMA & CMT combined work sections per block (Each CMT is multiplied by factor 1.5 and CMA by 1. The sum of both should be ≤ 8 . Ex: 4 CMT sections can go with maximum 2 CMA sections.)
- Maximum of 15 work sections per system

Section type	Allowed number of combined CMA and CMT work sections in a bank															
CMT	1	1	1	1	1	1	2	2	2	2	2	3	3	3	4	4
CMZ	1	2	3	4	5	6	1	2	3	4	5	1	2	3	1	2

Valve block order example

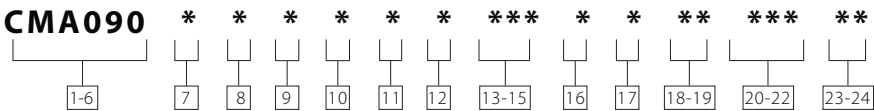
1. Inlet	CM A090 J M S V 3 0 000 K 1 00 XXA 10
2. Section 1	CM T090 H B D H 90 H 90 B 328 B 328 D H 90 H 90 B 328 B 328 0 K 1 00 XXA 10
3. Section 2	CM T090 H B M H 45 H 45 B 414 B 414 M H 90 H 90 B 414 B 414 0 K 1 00 XXA 10
4. Section 3	CMZ090 B MC B 379 MC B 379 0 K 1 00 XXA 10
5. Section 4	CMZ090 B MC B 379 MC B 379 0 K 1 00 XXA 10

Note: 1) Repeat section model code for additional sections. 2) End cover, tie rods, and cables to connect between the valves on the block are provided by default.



Model code: CMA90 Inlet

CMA90



1-6 CMA90 Series

- 7 Communication Protocol**
J J1939
C CAN OPEN
0 None

- 8 Interface Module**
M VSM
E VSE
0 None

- 9 Port Types**
S SAE P1 = 7/8"-14 UNF (SAE-10)
P2 = 1 1/16"-12 UN (SAE-12)
T = 1 1/16"- 12 UN (SAE-12)
LS = 7/16"-20 UNF (SAE-04)
B BSP P1= G 1/2
P2= G 3/4
T = G 3/4
LS= G 1/4

- 10 Inlet Pressure Controller**
V Variable Displacement
F Fixed Displacement
0 none, Used on VSE or extension block

- 11 Active Pressure Port**
1 P1
2 P2
3 P1 & P2

- 12 Manual Override**
0 None
M Manual Override on CV

- 13-15 Main Relief Setting (In bar)**
000, 086, 103, 121, 138, 155, 172, 190, 207, 224, 241, 259, 276, 293, 310, 328, 345, 362, 379, 397, 414, 431*

- 16 Paint Type**
A No Paint
B Blue Primer
K Std. Flat Black

- 17 Seals**
1 Default (NBR)
H HNBR
V Viton

- 18-19 Special Features**
00 None

- 20-22 Software Version**
000 No Software (Used only with VSE)
XXA Standard

- 23-24 Design Code**
10 Design Code

Note: An electronic pressure limit can be set on the valve via software to any value in increments of 0.01 bar using available configuration software suite. This applies to both inlet and work port settings.

* Contact Danfoss for 431 bar relief setting

CMA90 Inlet – Communication protocol

Model code position 7

CMA is a CAN controlled valve that can communicate with either J1939 or CAN open networks.

- J** - The J1939 version of the valve is seen as one node on the user CAN network and operates at 250 kb/sec as specified by J1939. The valve is addressed using a single 29 bit extended identifier.
- C** - The CANOpen version of the valve utilizes an 11 bit identifier with configurable baud rates of 125, 250, and 500 kb/sec. The valve system will be one node on the CAN open network.
- 0** - If the inlet section is an extension block with or without VSE, Communication protocol needs not to be selected as the block is a slave with no VSM.

CMA90 Inlet – Interface module

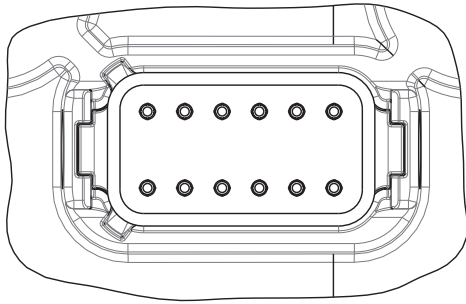
Model code position 8

CMA90

M - VSM (Valve System Module)

This is the interface module for the valve – it acts as a CAN gateway, a DC to DC power supply, and a supervisory controller for the system.

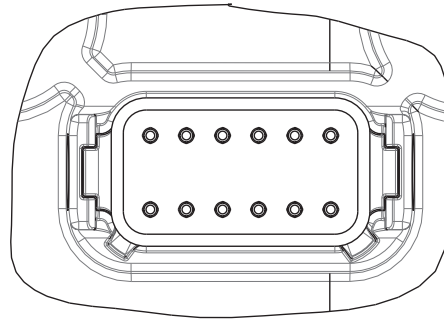
Every CMA system must have one and only one VSM.



VSM 12 pin connector "B" Keying

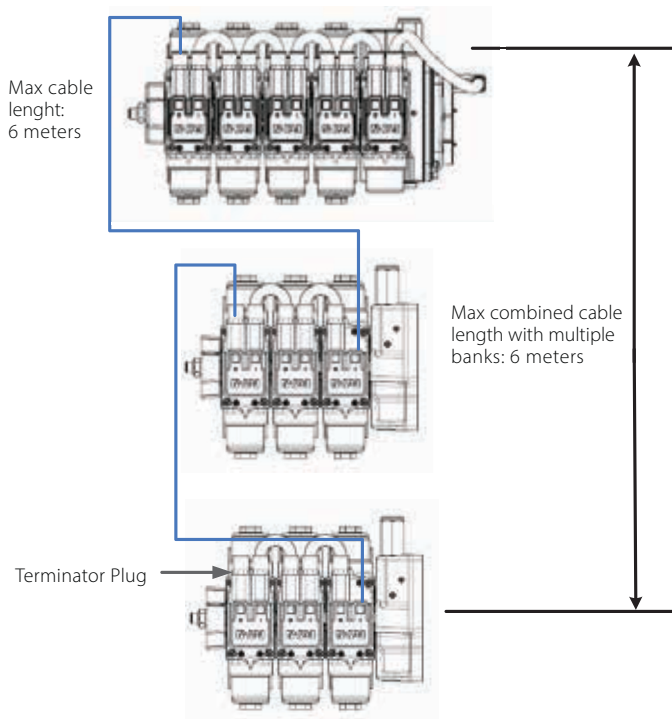
E - VSE (Valve System Extender)

This is used on blocks where the distance between it and the VSM or a VSE is greater than 6 meters (19.6 feet). Maximum distance between a VSE and its VSM is 30 meters (98.4 feet)

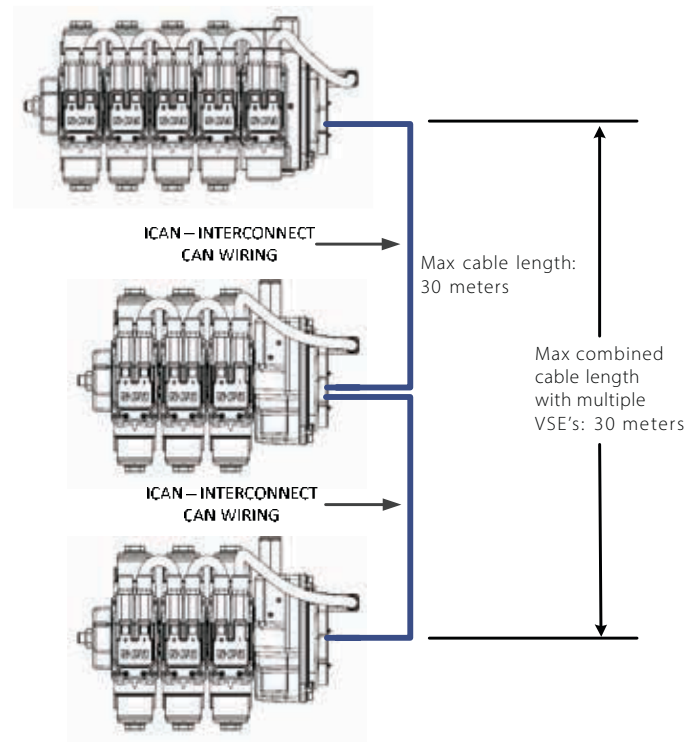


VSE 12 pin connector "A" Keying

System layout without VSE's



System layout with VSE's



0 - None

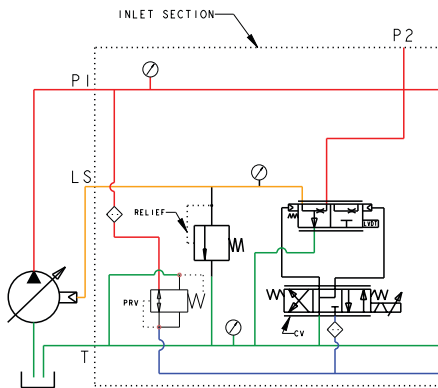
This is selected for blocks where the distance between it and the VSM or a VSE is less than 6 meters (19.6 feet). This block would be connected with an extension cable to the last PV on the closest block.

CMA90 Inlet – Inlet pressure controller

Model code position 10

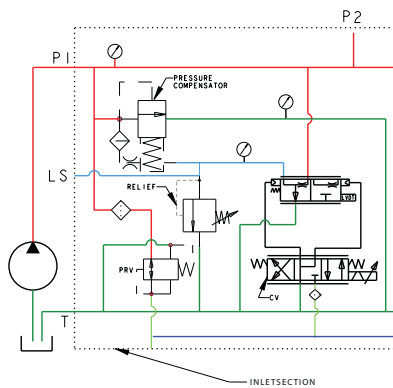
V – Variable displacement

A variable displacement inlet has a load sense port for connecting to a variable displacement pump. Each CMA system needs one and only one Inlet Pressure Controller.



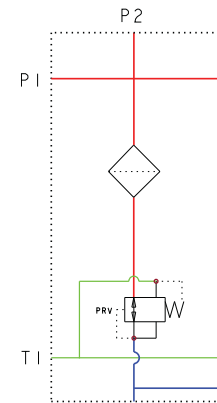
F – Fixed displacement

A Fixed displacement inlet has a DPS to unload flow to keep system pressure to that demanded by the work sections. Each CMA system needs one and only one Inlet Pressure Controller.



0 – None

If this is for an extension block, with or without a VSE, no Inlet Pressure Controller is needed. An extension inlet will be installed on the block that has supply and tank ports but no load sense port.

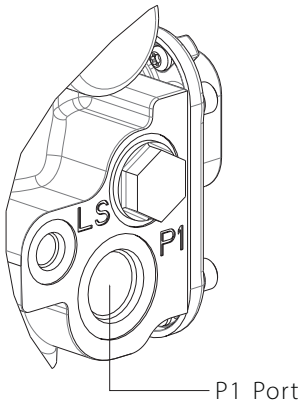


CMA90 Inlet – Active pressure port

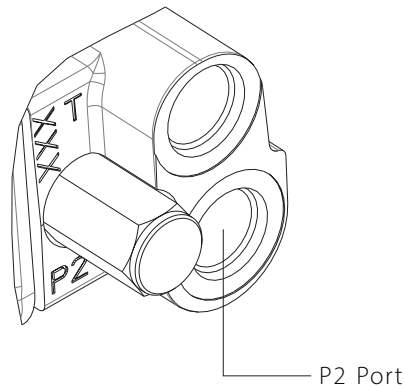
Model code position 11

Multiple pressure ports can be machined to provide easier hose routing to additional CMA valve blocks. Specify which Inlet pressure port location is required.

1 – P1



2 – P2



3 – P1 & P2

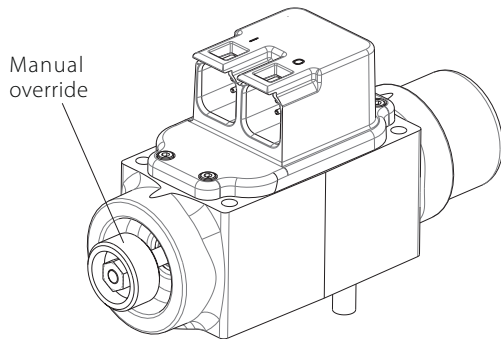
CMA90 Inlet – Manual override

Model code position 12

CMA90

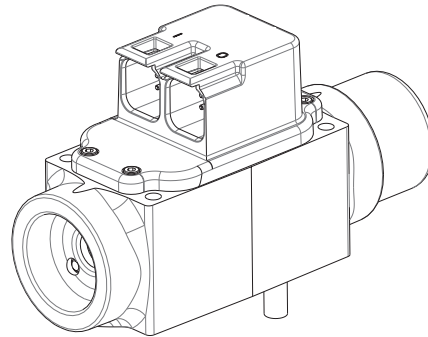
M – Manual Override on CV

A manual override is installed on the CV, or Conditioning Valve, that can be used to control the supply pressure. This manual override allows a user to force supply pressure to its maximum if electrical power is lost. This would be necessary if a manual override needed to be actuated to raise a service without electrical power. Electrical Power is necessary for the Work Sections to be able to communicate their Load Sense demands to the Inlet over CAN.



0 – None

No manual override is installed



CMA90 Inlet – Software versions

Model code position 20-22

The Software Version position is broken up into two sections, the first 2 characters designating the major software version, and the last character designates the software options desired

Software major version

The first two characters in Software Version should indicate the major version of software desired.

If a specific major version is desired, the major version desired is indicated, for example, 03 for software with a major version 3. For CMA, all versions of software that have the same major version are compatible, for example, version 3.8 and version 3.9. The software version of CMA valves already purchased can be found using Pro-FX® Configure.

If the latest major version of software available is desired, these characters should be XX.

The valve will always be shipped with the most up-to-date minor software version available for the designated major version.

CMA90 Inlet – Software versions (continued)

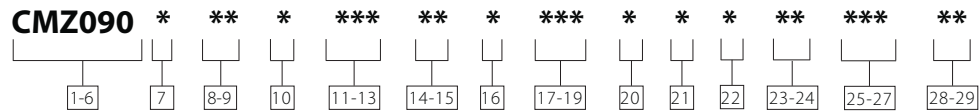
Model code position 22

CMA90

A - Standard software control features

Software	Description
Autoload sense	A mode that controls the pump to provide pressure to be above the highest detected load in the system
Pressure control	A mode that allows the user to command a desired pump pressure
Smart data	The valve can transmit data such as: supply pressure, load sense pressure, tank pressure, spool position, and oil temperature
Ratio Flow Share	An anti-saturation method that reduces the flow to all services by the same percentage when the pump is saturated. Similar to "post-compensated" hydraulic valves. Individual services can be exempted from flow share, giving them priority
Uniform Flow Share	An anti-saturation method that reduces the flow to all services by the same amount of flow when the pump is saturated. Similar to "post-compensated" hydraulic valves. Individual services can be exempted from flow share, giving them priority
Cascade Flow Share	An anti-saturation method that reduces the flow to services in a specified order of priority

Model code – CMA Work section



1-6 Product Series

CMZ090 - Advanced mobile valve series

7 Body Port Thread Sizes

A 3/4" 16 UNF (SAE-8)
B 7/8" 14 UNF (SAE-10)
D G 1/2"

8-9 Spool Type at Position A

MC 90 lpm, biased to center
MT 90 lpm, biased to tank
MP 90 lpm, biased to pressure
LC 25 lpm, biased to center
LT 25 lpm, biased to tank
LP 25 lpm, biased to pressure

10 Valve Option at A

0 None
B Anti-cavitation valve with relief valve
C Anti-cavitation valve
S Relief valve

11-13 Relief Setting at Position A

RV Setting in Bar
000, 086, 103, 121, 138, 155, 172, 190, 207, 224, 241, 259, 276, 293, 310, 328, 345, 362, 379, 397, 414, 431*

14-15 Spool Type at Position B

MC 90 lpm, biased to center
MT 90 lpm, biased to tank
MP 90 lpm, biased to pressure
LC 25 lpm, biased to center
LT 25 lpm, biased to tank
LP 25 lpm, biased to pressure

16 Valve Option at B

0 None
B Anti-cavitation valve with relief valve
C Anti-cavitation valve
S Relief valve

17-19 Relief Setting at Position B

RV Setting in Bar
000, 086, 103, 121, 138, 155, 172, 190, 207, 224, 241, 259, 276, 293, 310, 328, 345, 362, 379, 397, 414, 431*

20 Manual Override Type

0 None
A Lever-handle toward port A
B Lever-handle toward port B

21 Paint Type

A No Paint
B Blue primer
K Std. Flat Black

22 Seal

1 Default (NBR)
H HNBR
V Viton

23-24 Special Features

00 None

25-27 Software Version

XXA Standard
XXU Advanced control
XXB Boom stability control
XXT A, U and B packages

28-29 Design Code

10 Design Code

Note: An electronic pressure limit can be set on the valve in software to any value in increments of 0.01 bar using available configuration software suite. This applies to both inlet and work port settings.

Note: If an option without a relief is selected for port A or B, no relief valve setting should be selected in corresponding Relief Setting position (i.e., select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

* Contact Danfoss for 431 bar relief setting

[illegible]

Note: If an option without a relief is selected for port A or B, no relief valve setting should be selected in corresponding relief setting position (i.e., select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

*If an option F-Float spool is selected, available max flow for (P-A) is limited to 45 lpm only.

** Contact Danfoss for 431 bar relief setting

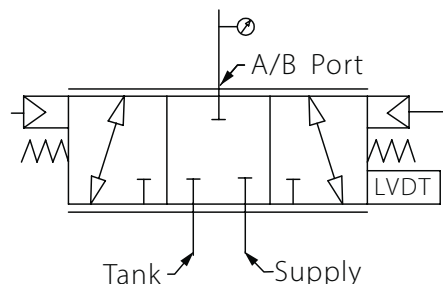
Work section options -CMA

Spool type at position A and position B

Schematic of spool types for
model code position 8 - 9 and 14 - 15

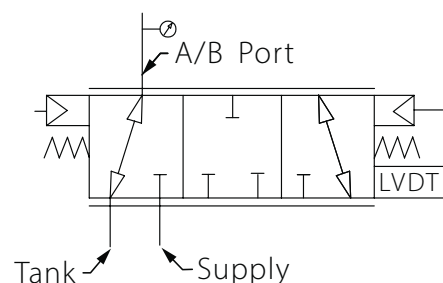
MC/LC - Biased to center

In biased to center, the spring will move the spool to the center position when there is no power to the coils or no pilot pressure. In the center position, the flow to both pressure and tank is blocked



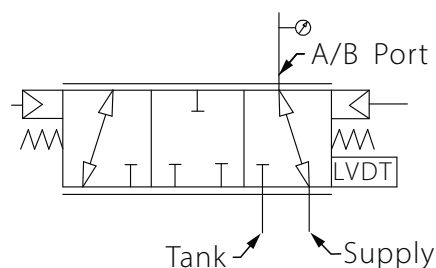
MT/LT - Biased to tank

With a tank-biased spool, the spring will push the spool to fully open the Work Port (A or B) to the Tank rail when the valve receives an Idle command or when there is no electrical power



MP/LP - Biased to pressure

With a Pressure-biased spool, the spring will push the spool to fully open the Work Port (A or B) to the Pump rail when the valve receives an Idle command or when there is no electrical power



Choosing the mechanical bias condition

For most applications it's recommended to use a center-biased spool (MC/LC). Otherwise, a Tank-biased (MT/LT) or Pressure-biased (MP/LP) can be used depending on the behavior desired when the valve is at idle or electrical power is lost.

Note: Since control behavior of each spool can be commanded from the vehicle's controller, any combination of spools can act like a cylinder spool arrangement, motor spool arrangement, etc. Thus, many different spool options are not necessary for CMA like for a traditional Mobile Valve.

Work sections option – CMT

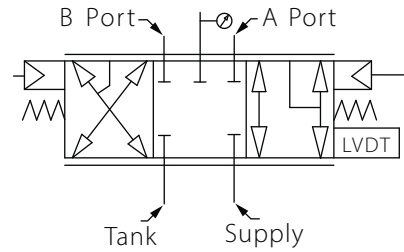
Spool types at service 1 and service 2

Model code position 9 and 24

CMA90
CMT

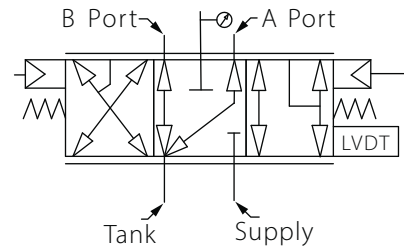
D - Cylinder spool

In the center position, all ports are blocked.



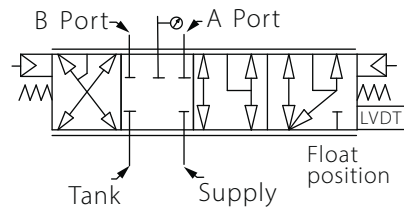
M - Motor spool

In the center position, flow from both work ports A/B is routed to tank port.



F - Float spool

In the float position, flow from both work ports A/B is routed to tank port.



Work section options -

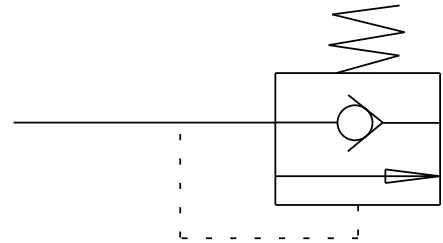
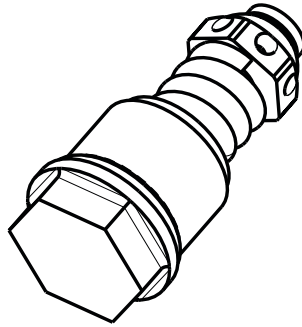
Ports A & B Functions and settings for CMA work section

Model code position 10 and 16

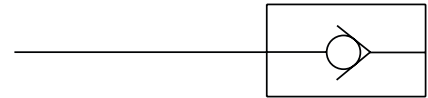
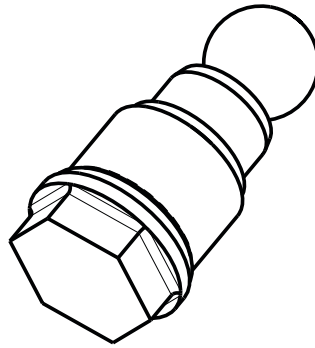
Ports A1B1 & A2B2 Functions and settings for CMT work section

Model code position 16, 20, 31 and 35

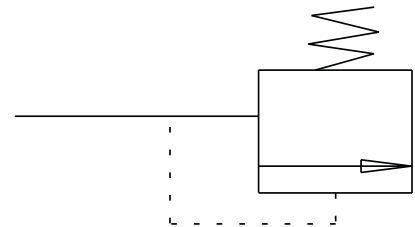
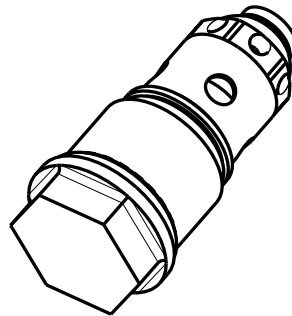
B - Anti-cavitation valve with relief valve



C - Anti-cavitation valve



S - Relief valve



0 - None No port for auxiliary valves is machined.

Note: If an option without a relief is selected for port A or B, no relief valve setting should be selected in the corresponding Relief Setting position (i.e. select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

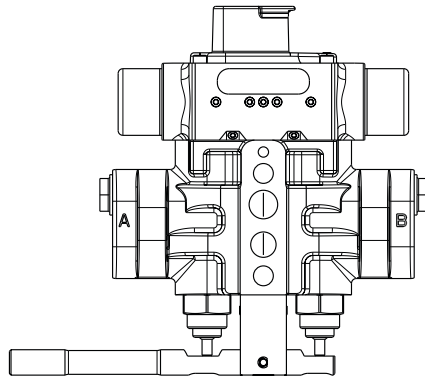
Work section options - CMA manual override types

Model code position 20

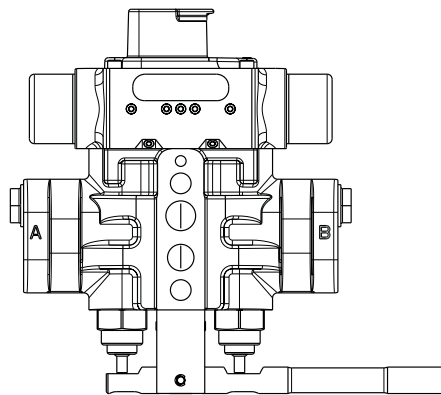
CMA90

CMA

A - Lever-handle toward port A



B - Lever-handle toward port B



0 - None

Note: Manual override is for emergency use only. If a Work Section's manual override is actuated alone, the pump will not respond to the load in the cylinder and the load can only be lowered. In order to raise a load, if electrical power is lost but hydraulic power remains, a manual override on the inlet must have been selected in its model code to be able to force the supply pressure to be increased to its maximum. A manual override does not have fine metering control, therefore personnel should be clear from the service prior to its actuation.

Work sections option – CMT manual override types

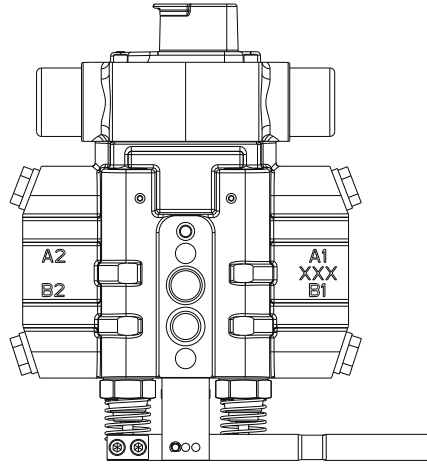
Model code position 39

CMA90

CMT

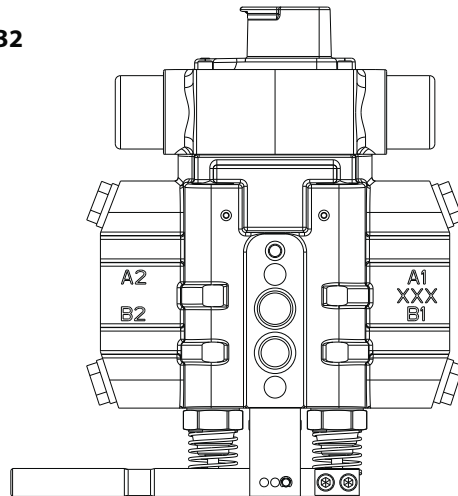
A -

Lever-handle towards ports A1B1



B -

Lever-handle towards ports A2B2



0 - None

Note: Manual override is for emergency use only. If a Work Section's manual override is actuated alone, the pump will not respond to the load in the cylinder and the load can only be lowered. In order to raise a load, if electrical power is lost but hydraulic power remains, a manual override on the inlet must have been selected in its model code to be able to force the supply pressure to be increased to its maximum. A manual override does not have fine metering control, therefore personnel should be clear from the service prior to its actuation.

Work section options – Software versions for CMA and CMT

CMA Model code position 25 - 27 CMT Model code position 44 - 46

The Software Version position is broken up into two sections, the first 2 characters designating the major software version, and the last character designates the software options desired.

Software major version

The first two characters in Software Version should indicate the major version of software desired.

If a specific major version is desired, the major version desired is indicated, for example, 05 for software with a major version 5.

For CMA, all versions of software that have the same major version are compatible, for example, version 5.8 and version 5.9. The software version of CMA valves already purchased can be found using Pro-FX Configure®.

CMT sections are only compatible with major versions 5 and above. In turn, if there is a single CMT section in the CMA system the whole system must have major version 5 software or above.

If the latest major version of software available is desired, these characters should be XX.

The valve will always be shipped with the most up-to-date minor software version available for the designated major version.

Work sections option – CMA Software versions (continued)

Model code position 27

CMA90

CMA

A - Standard software control features

Software	Description
Pressure compensated flow control	Flow from the valve will remain constant regardless of the supply and load pressures. This applies to both meter-in AND meter-out flows
Flow compensated pressure control	A mode that maintains the pressure on a workport regardless of the flow into or out of the workport
Intellifloat	A mode that lowers a service to the ground at a controlled rate then fully opens the spool(s) to tank when it detects the service is on the ground.
Intelligent twin spool flow control (IFC)	Versatile flow controller which maintains the desired flow independent of transitions between passive and overrunning loads
Load damping	A feature in flow control which reduces service oscillation induced by moving large structures, such as a boom
Electronic load sense	Broadcast the pump pressure demand on the CAN bus
Electronic port relief	A feature that opens the valve from neutral to tank when the port pressure exceeds the maximum pressure
Electronic pressure limit	A feature that limits port pressure to the specified maximum pressure while the service is being commanded to move.
Single spool flow control	Controls the flow into or out of a single workport
Single spool position control	A mode that commands the position of the spool, causing it to behave as a proportional orifice
Smart data	The valve can transmit data such as: work port pressures, spool positions, work port flows, and oil temperature
Limp mode	If a sensor fails, the valve will continue to work with reduced performance until the machine can be serviced

U – Advanced control

Includes standard package and following features

Software	Description
Torque control	Advanced force or torque control for double-acting cylinders or motors
Slew control	A twin-spool controller that reduces oscillations and the hard stop often associated with inertial loads
Hose burst detection	Prevents major oil spill events by monitoring flow consumption on each service and closing the spools for that circuit if a major leak is detected

B – Boom stability control

Includes standard package and following features

Software	Description
Boom Stability Control (BSC)	A controller designed to actively dampen oscillations in flexible services that tend to vibrate

T – A, U and B packages

Includes Standard, Advanced control and Boom stability control packages

Work sections option – CMT Software versions

Model code position 46

CMA90

CMT

A - Standard software control features

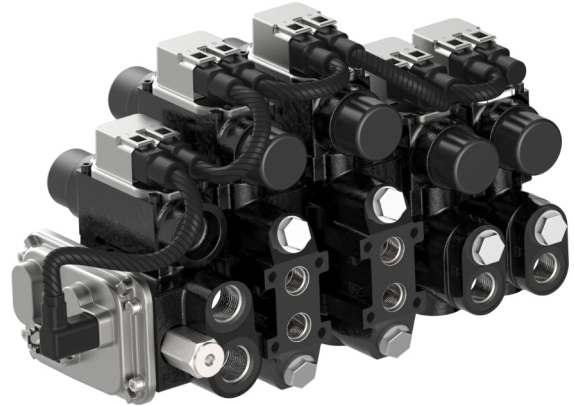
Software	Description
Pressure compensated flow control	Flow from the valve will remain constant regardless of the supply and load pressures. This applies to only the meter-in flow
Float	A valve position that connects both workports to tank
Load damping	A feature in flow control that reduces load-induced oscillations
Electronic load sense	Broadcast the pump pressure demand on the CAN bus
Electronic pressure limit	A feature that limits port pressure to the specified maximum pressure while the service is being commanded to move
Smart data	The valve can transmit data such as: work port pressures, spool positions, work port flows, and oil temperature
Limp mode	If a sensor fails, the valve will continue to work with reduced performance until the machine can be serviced

Danfoss CMA200

Advanced sectional mobile valve

The CMA200 is an advanced CAN-Enabled electro-hydraulic sectional mobile valve with independent metering that utilizes pressure and position sensors, on board electronics, and advanced software control algorithms. Where conventional mobile valves often compromise on precision or response, the CMA200 delivers both. The CMA200 offers high performance with sub micron hysteresis, closed loop control over the spool position, and repeatable performance.

CMA200 offers customers the next generation in advanced mobile valves with unlimited possibilities to differentiate your machine capabilities.



Features and benefits

- Precise control maintained for all load conditions
- Reduction in metering losses / energy management
- High valve responsiveness
- Flow sharing – pre and post compensation capabilities
- Flexibility in configuration with easily changed parameters
- Command factory-calibrated flow or pressure from either work port
- Easier communication with the valve
- Reduced load on the Vehicle CAN bus
- Advanced diagnostics for improved reliability and productivity
 - Hose Burst Detection
 - Limp mode
 - Diagnostics on the inlet, tank, load sense, work port pressures, spool position, consumed flow, and oil temperature.

- Platform can support future software development for future product development.
- Reliable performance across a broad temperature range

Typical applications

- Concrete boom trucks
- Utility trucks
- Forwarders
- Agriculture tractors
- Drill rigs
- Snow groomers

Specifications and performance: CMA200

Pressures

Inlet and work port (rated)	380 bar (5511 psi)
Inlet and work port (maximum)	440 bar (6382 psi)
Tank (maximum)*	30 bar (435 psi)

Flow

Work port (max with high flow spools, measured with internal pressure sensors)	200 lpm (53 gpm) @ 16 bar ΔP
Inlet (max with two sections fully open)	400 lpm (106 gpm) @ 35 bar P-T

Leakage**

Max leakage without work port valves	30 cc/min @100 bar @ 21 cSt
Max leakage with work port valves	40 cc/min @100 bar @ 21 cSt

Construction

Physical	Up to 8 sections per block
Network	Up to 15 sections per VSM

Port types

SAE	P1 & P2	SAE-12
	T	SAE-16
	LS	SAE-4
	A & B	SAE-8 or SAE-10 or SAE-12
BSP	P1 & P2	G 3/4
	T	G 1
	LS	G 1/4
	A & B	G 1/2 or G 3/4

Inlet section options

Variable displacement (Load sensing)
Fixed displacement

Work section options

Low flow spools	100 lpm (26 gpm)
High flow spools	200 lpm (53 gpm)
Work port valves	Anti-cavitation
	Port relief & Anti-cavitation
	Port relief

Compensation type

Digital	On meter-in and meter-out
---------	---------------------------

Actuation

Primary	CAN
Emergency	Mechanical override

Control modes

Flow
Pressure
Spool position
Float

Temperatures

Ambient (operating)	-40°C to 105°C
Standard oil (operating)*****	-40°C to 85°C
Extended oil (operating)	-20°C to 105°C
Storage	-40°C to 105°C

Filtration

ISO 4406	18/16/13
Pressure reducing valve	75 micron
Pilot valve	100 micron

Electromagnetic protection

EMC Directive 2014/30/EC***	
Earth moving	ISO 13766: 2006
Construction	EN 13390: 2010
Agriculture	ISO 14982: 2009

Electrical environmental****

Ingress protection	IP67
Thermal cycling	-40°C to 105°C for 1000 cycles
Mechanical shock	50G ½ sine wave, 11 ms pulse

Random vibration

Method	MIL STD 202G, Method 214-1
Limits	Test condition A
Duration	8 hrs/axis
# Of Axes	3 separately
Profile	Reference appendix

Oil viscosity

Recommended viscosity	10 to 85 cSt
Absolute maximum viscosity	2250 cSt
Absolute minimum viscosity	7 cSt

Electrical

Input voltage	9 - 32VDC
Power consumption range	Reference appendix
CAN Interface	J1939 2.0B, CANopen

Electrical interface connectors

Deutsch (VSM)	DT06-12SB-P012
Deutsch (VSE)	DT06-12SA-P012

Dynamic performance

Loop time for internal CAN	3 ms
Typical step response	24 ms @ 15 cSt
Typical frequency response	17.5 Hz @ 15 cSt
*With manual override, tank is limited to 10 bar (145 psi) maximum.	

**Data taken from work port to tank and supply.

***Electronics are designed to power down and recover automatically under various power conditions (i.e., Load Dump, Ignition Cranking, Disconnection of Inductive Loads) CE testing with J1939 at 250 kb/s.

****Additional Electrical Environmental tests were performed Contact Danfoss for additional details.

***** Max. differential between CMA valves and system temperature is 50°F (28°C).

Principles of operation

The work section is comprised of two independent spools that act as a pair working to control double acting services, or alternatively as single spools controlling a single acting service (2 single axis services can be controlled from any work section). Demands to each work section are transmitted over a CAN Bus and power is provided to each work section via a single daisy chain cable arrangement. Each work section has a single pilot valve comprised of on-board electronics, embedded sensors, and * two independent 3 position 4 way pilot spools driven by a low power embedded micro controller.

The independent pilot spools control the mainstage spools. Closed loop control of each work section is done locally by leveraging the on-board electronics and sensors.

Each mainstage spool has its own position sensor enabling closed loop position control of the mainstage spool.

Further, a pressure sensor is located in each work port, pressure line, load sense line and tank line.

With the up and downstream pressure information known at any time, flow delivered to the service can be controlled by moving the spools to create the appropriate orifice area for the desired flow rate.

Figure 1: CMA200 system with Load-Sensing inlet & a single work-section

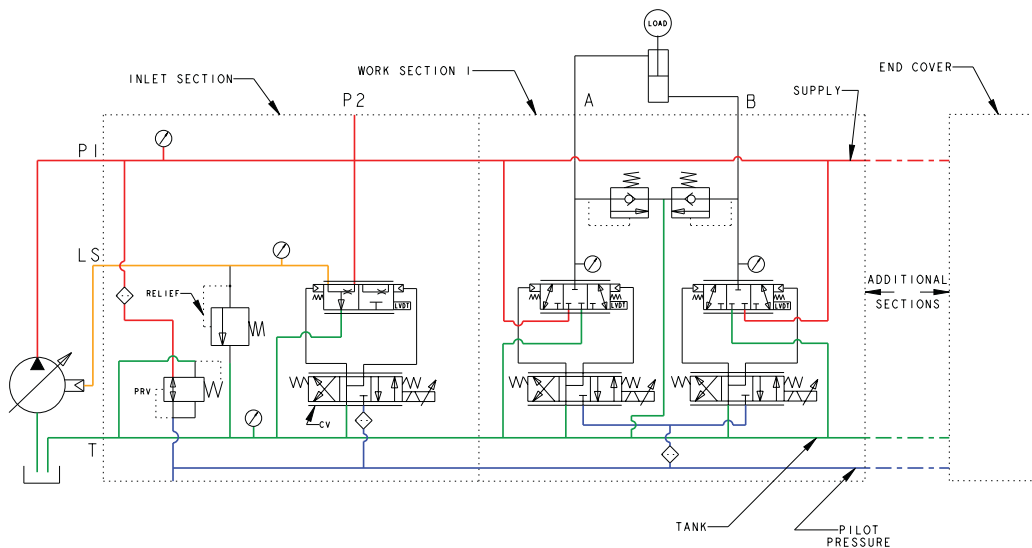
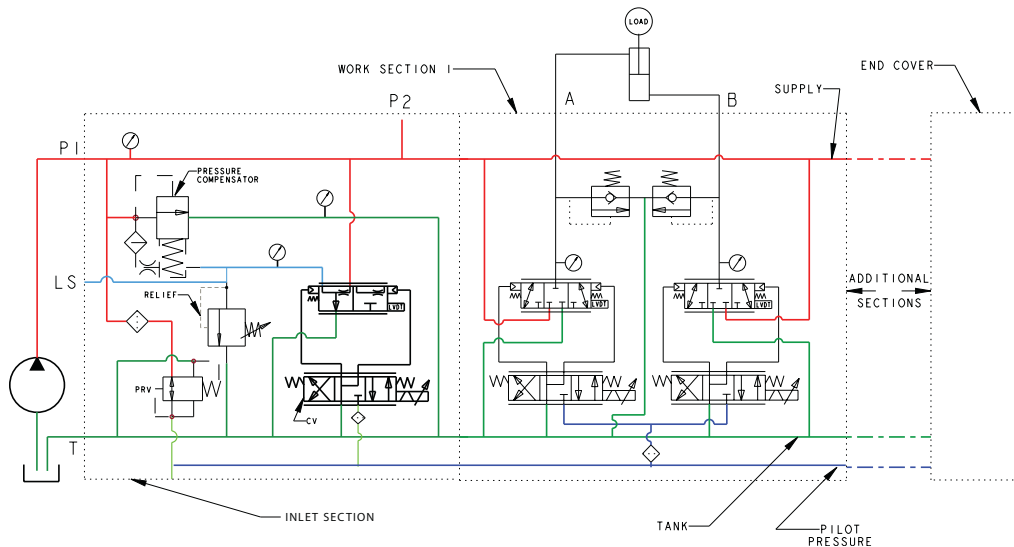


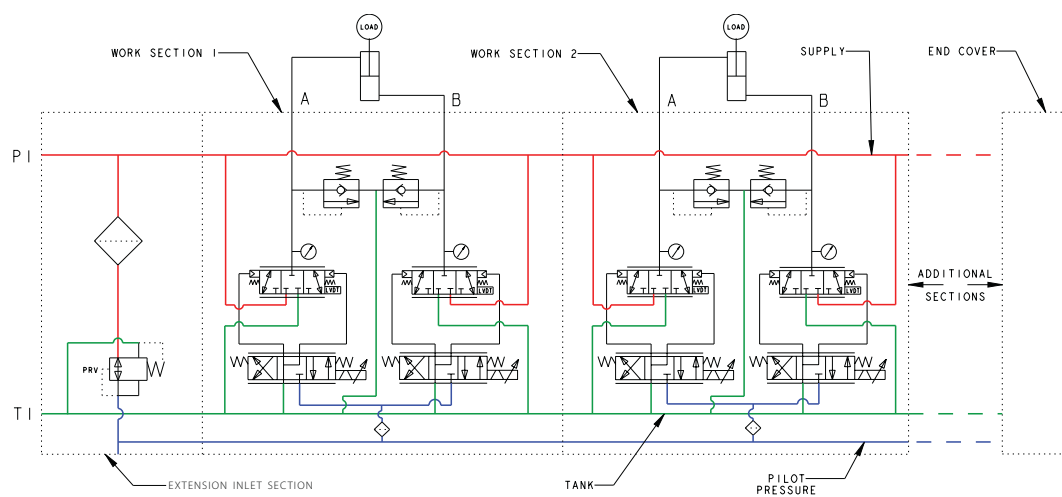
Figure 2: CMA200 system with Fixed Displacement inlet & a single work-section



CMA200 Advanced sectional mobile valves

CMA200

Figure 3: CMA200 system with extension inlet

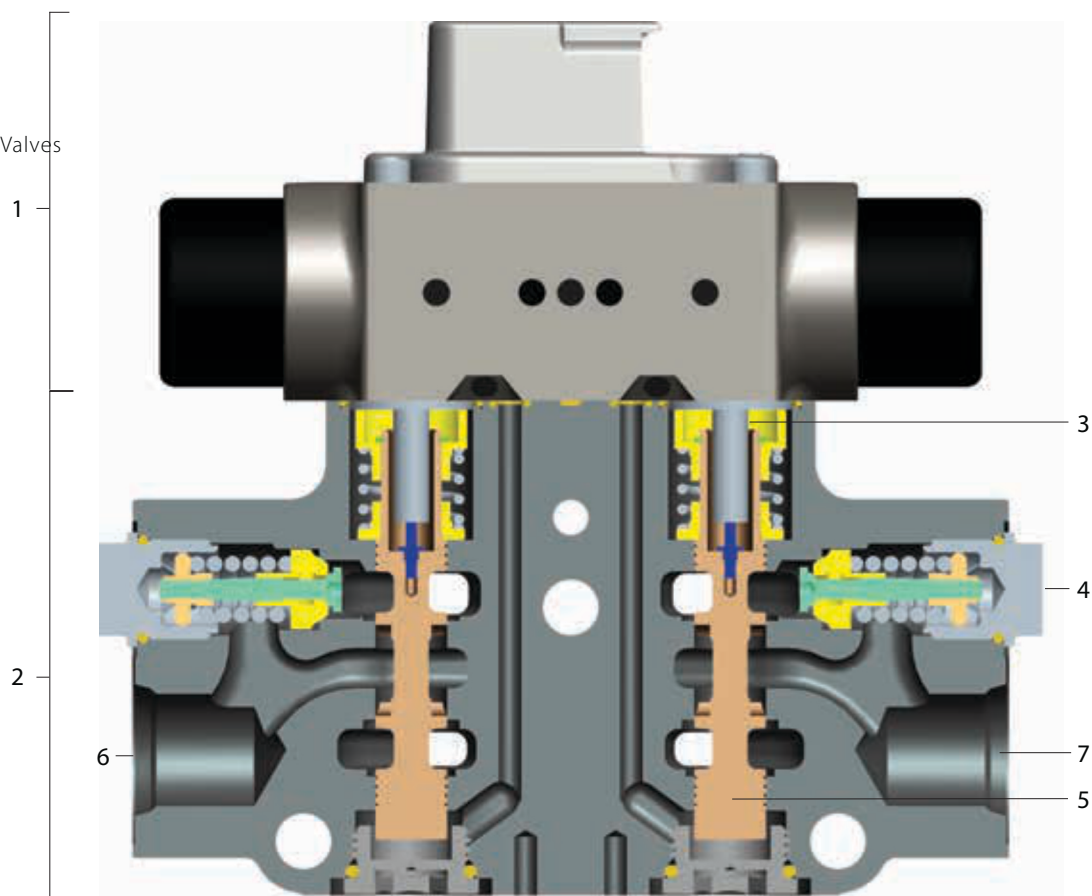


CMA200 Advanced sectional mobile valves

Cross sections

Valve cross section:

1. Pilot Valve
2. Main Stage
3. Linear Position Sensor
4. Port Reliefs / Anti-Cavitation Valves
5. Main Metering Spools
6. Work Port A
7. Work Port B

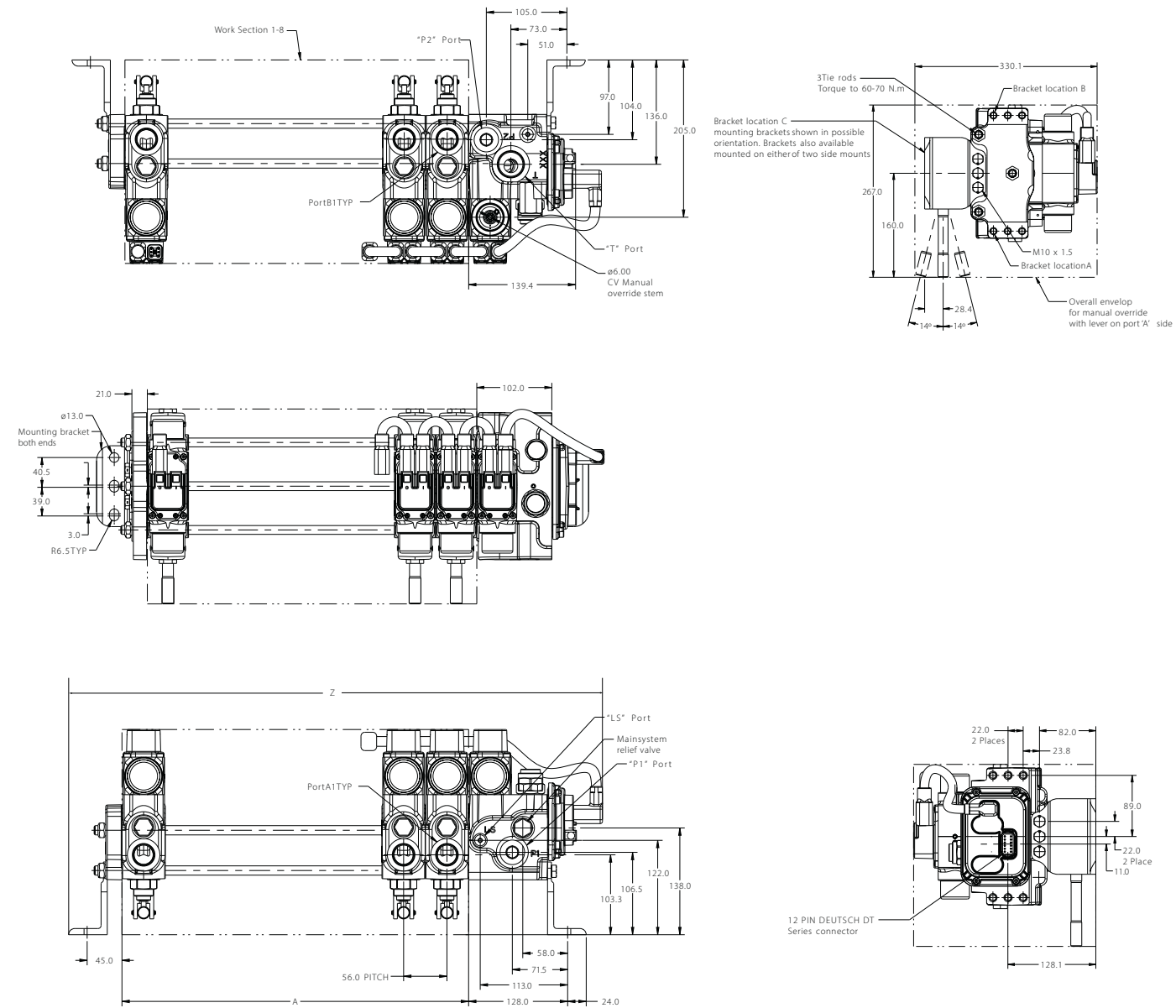


CMA200 Advanced sectional mobile valve

Installation Views: 8 CMA200 sections with manual override with inlet block

CMA200

Units: mm



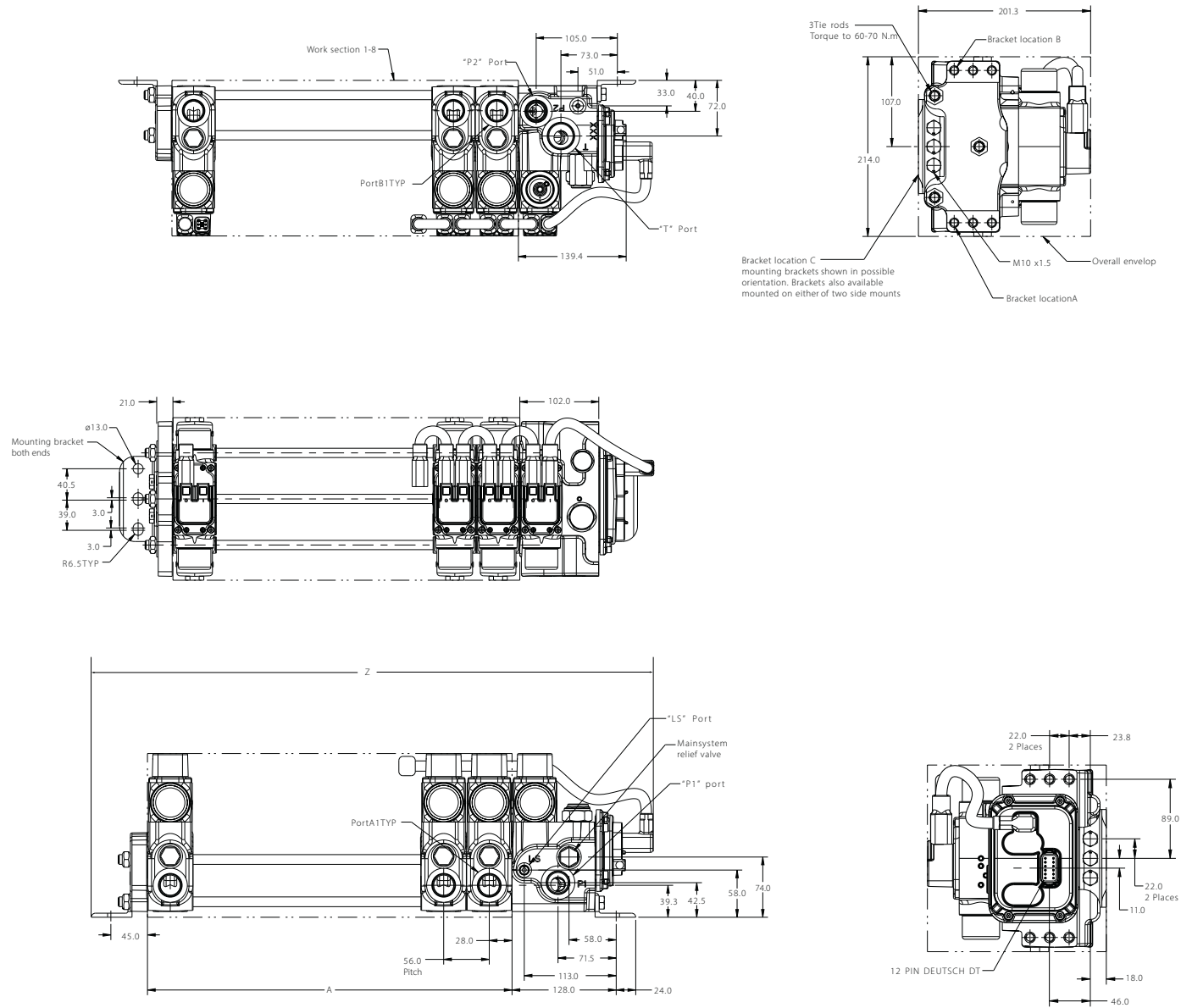
Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	297.0	353.0	409.0	465.0	521.0	577.0	633.0	689.0
Weights (kg)	26.5	34.6	42.8	50.9	59.1	67.3	75.4	83.6

CMA200 Advanced sectional mobile valve

Installation Views: 8 CMA200 sections without manual override with inlet block

CMA200

Units: mm

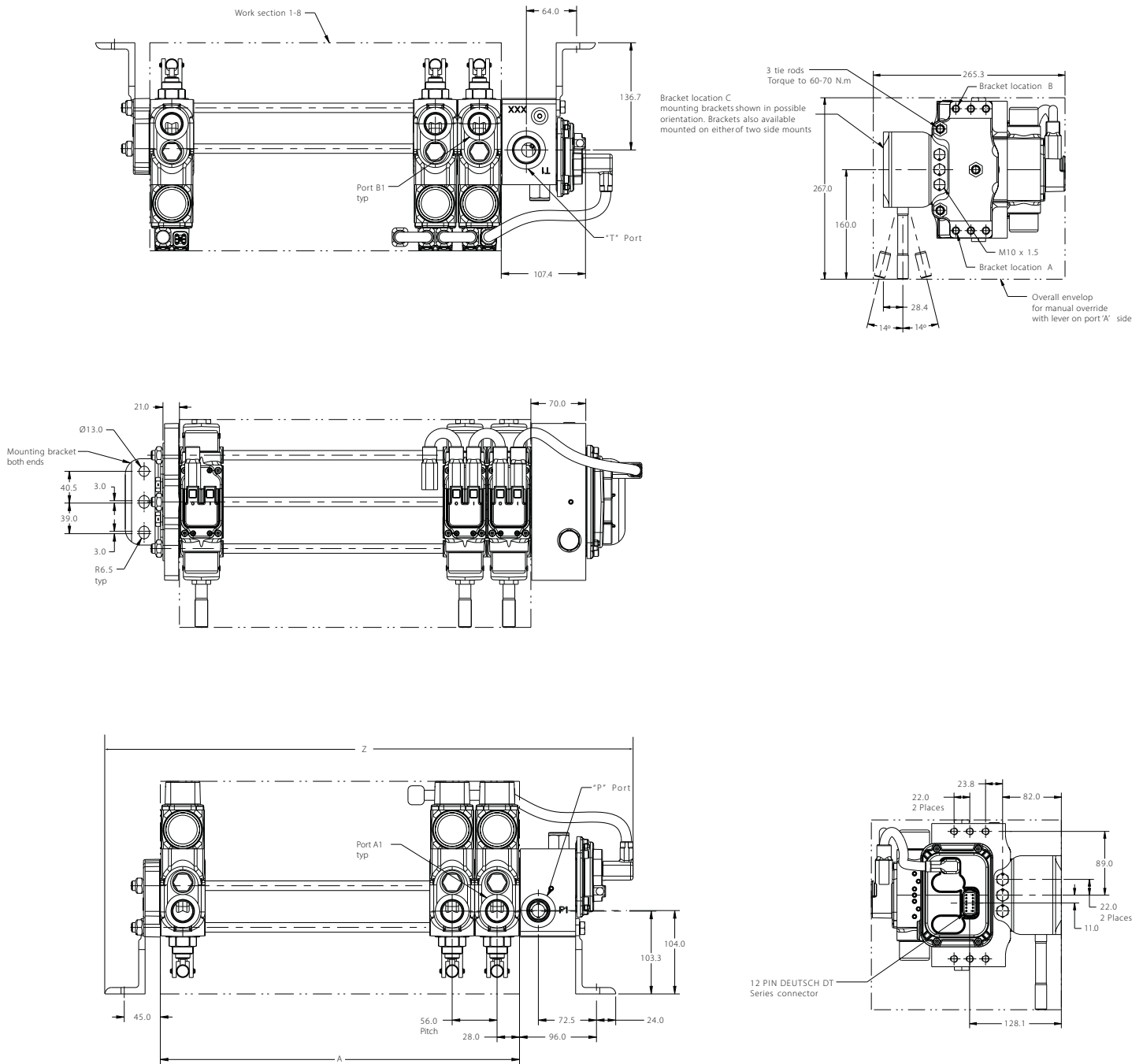


Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	297.0	353.0	409.0	465.0	521.0	577.0	633.0	689.0
Weights (kg)	24.7	32.3	39.8	47.3	54.8	62.3	69.8	77.4

CMA200 Advanced sectional mobile valve

Installation Views: 8 CMA200 sections with manual override with extension inlet block

Units: mm



Number of sections

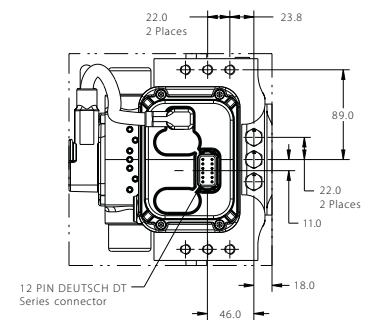
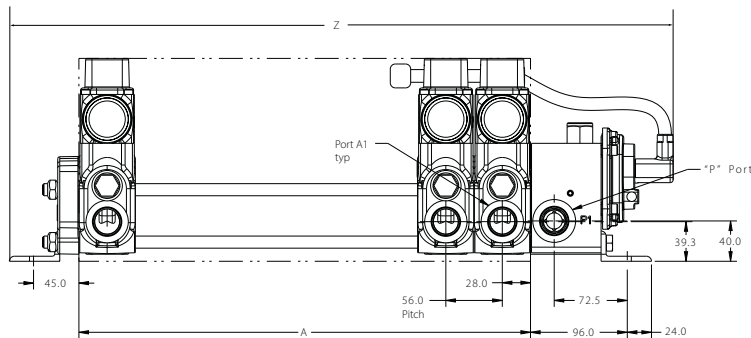
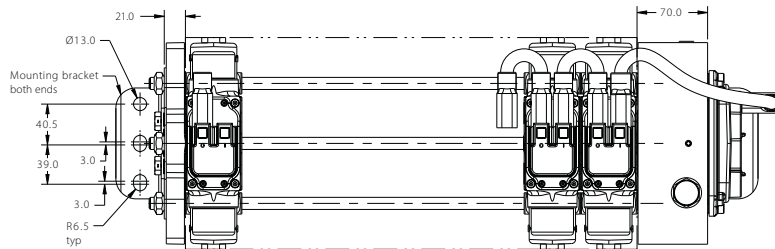
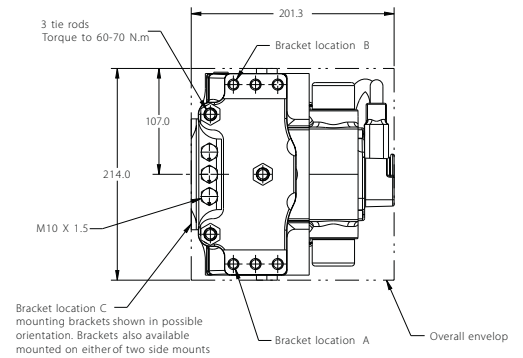
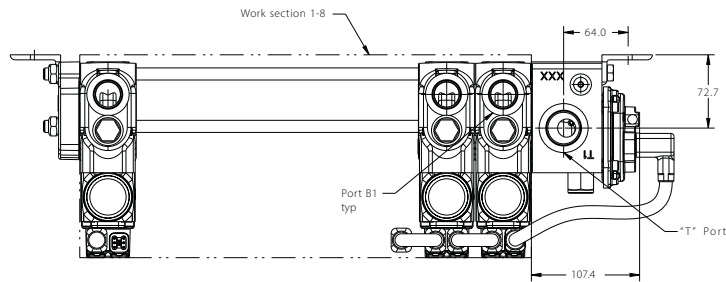
Dimension	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	265.0	321.0	377.0	433.0	489.0	545.0	601.0	657.0
Weights (kg)	24.3	32.4	40.6	48.7	56.9	65.1	73.2	81.4

CMA200 Advanced sectional mobile valve

Installation Views: 8 CMA200 sections without manual override with extension inlet block

Units: mm

CMA200



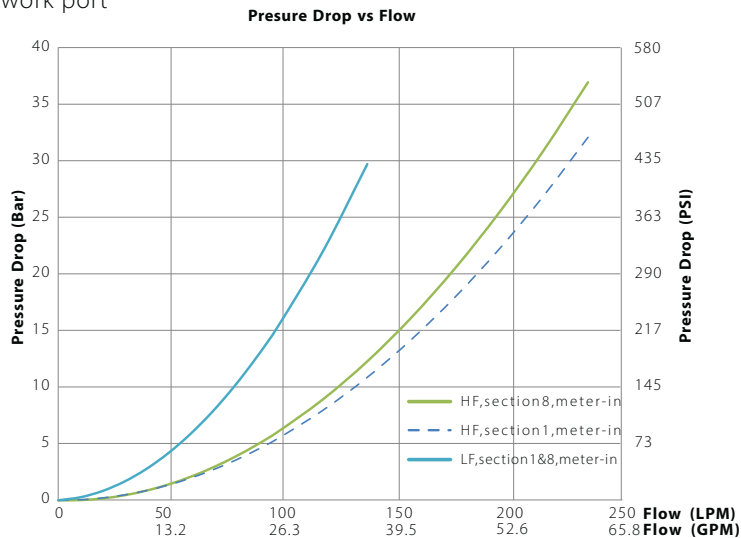
Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Z (mm)	265.0	321.0	377.0	433.0	489.0	545.0	601.0	657.0
Weights (kg)	22.5	30.1	37.6	45.1	52.6	60.1	67.6	75.1

CMA200 Advanced sectional mobile valves

Typical curves

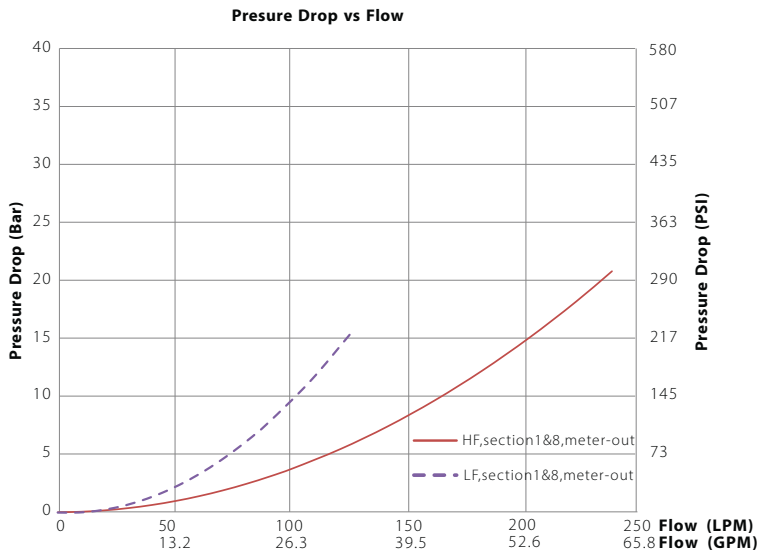
Work section - pressure drop

Measured with external pressure sensors, inlet to work port

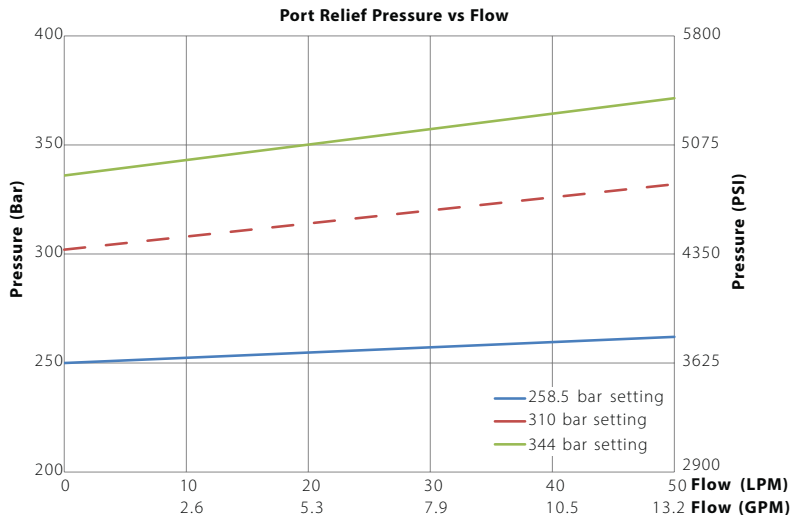


Work section - pressure drop

Measured with external pressure sensors, work port to tank



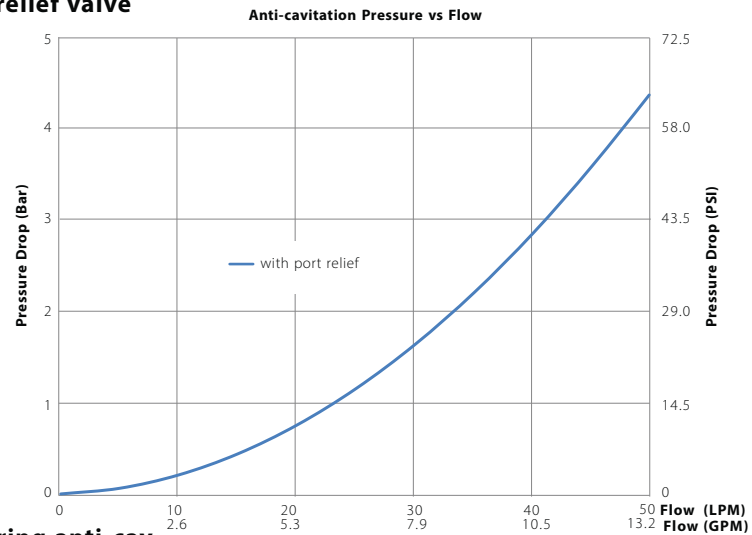
Work section - work port relief valve



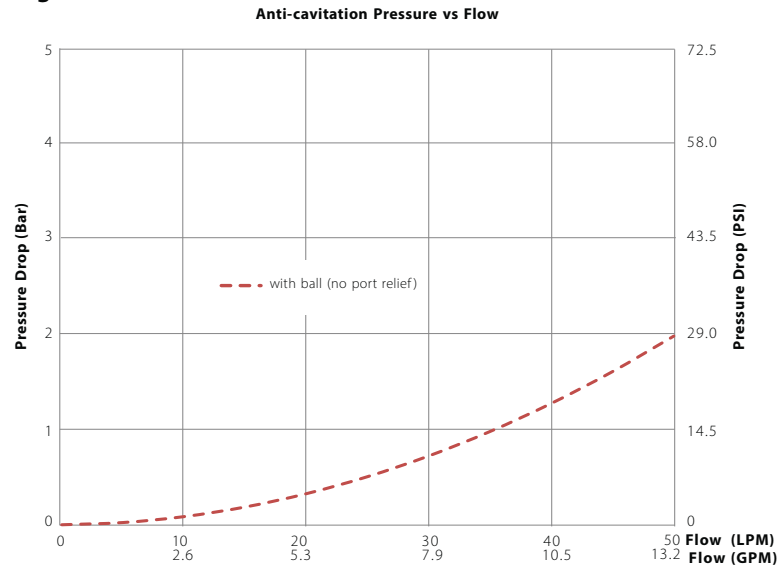
CMA200 Advanced sectional mobile valves

Typical curves

Work section - pressure drop across anti-cav of relief valve



Work section - pressure drop across ball and spring anti-cav



CMA200 Advanced sectional mobile valves

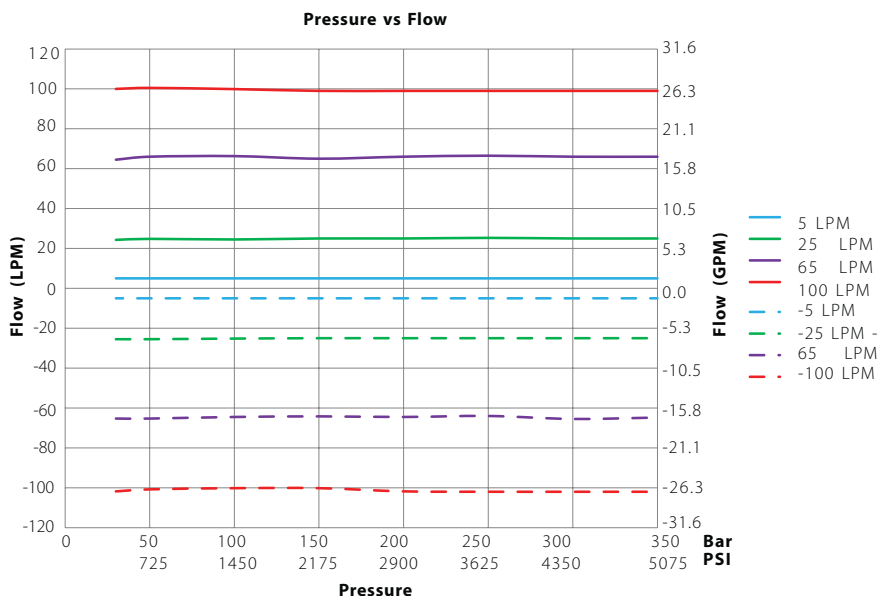
Typical curves

Work section - pressure compensation

Low flow spool

Positive flows indicate Meter In response

Negative flows indicate Meter Out response

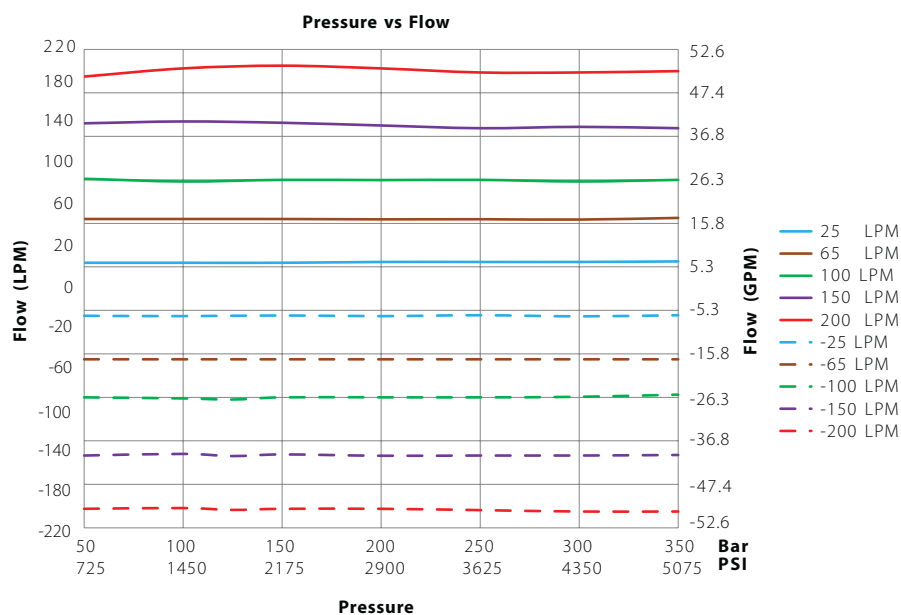


Work section - pressure compensation

High flow spool

Positive flows indicate Meter In response

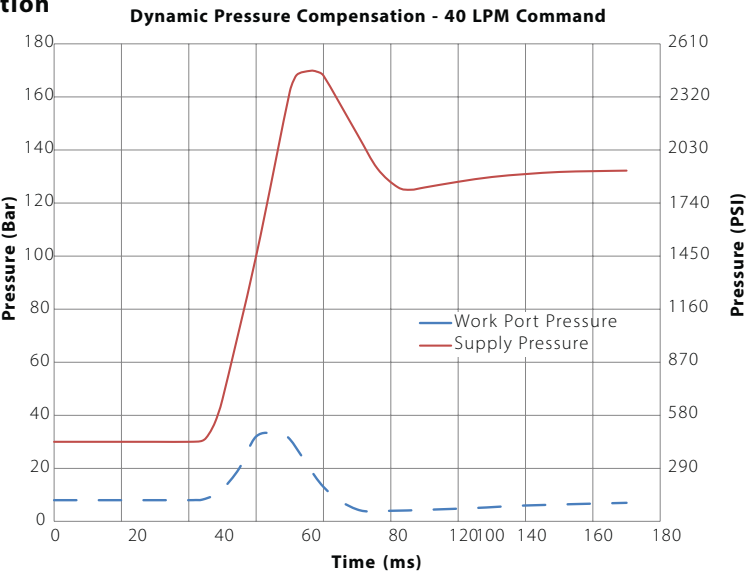
Negative flows indicate Meter Out response



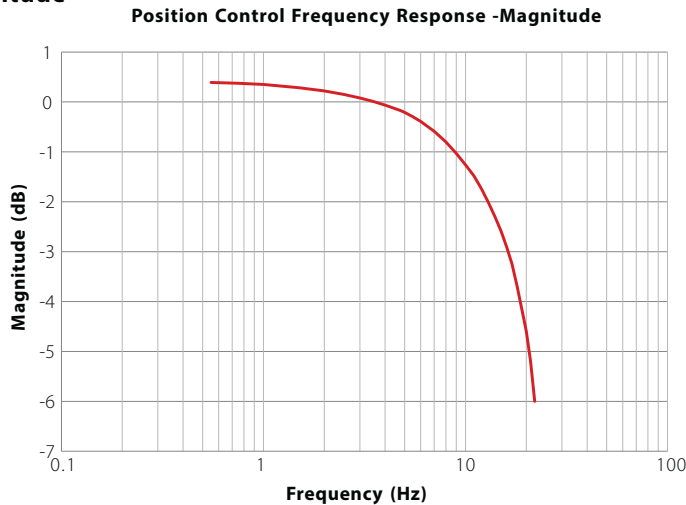
CMA200 Advanced sectional mobile valves

Typical curves

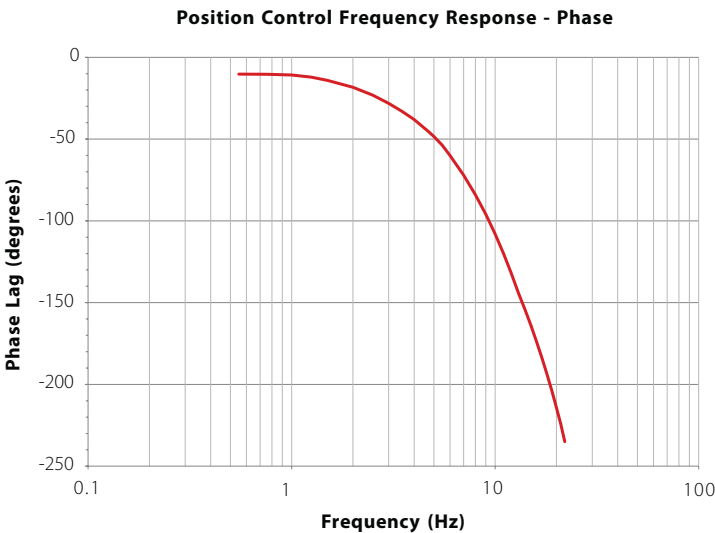
Work section - dynamic pressure compensation



Position control frequency response - Magnitude



Position control frequency response - Phase



CMA200 Machine integration process

Because of CMA200 CAN communication and advanced software features, there are a couple of other additional steps to integrating a CMA200 valve into your machine. The following steps outline a typical integration process.

1. Specify inlet, sections and purchase valve block assemblies.
Please refer to page 71 for more information in specifying a CMA200 system.
2. Develop software for CAN communication to CMA as well as the machine's application software
 - a. Communication libraries in CoDeSys 3.5.5 are available for use on Danfoss' HFX Controller or other CoDeSys programmed ECUs
 - b. If programming in another language, reference CMA's Application Developer's Guide for J1939 or CANOpen for definition of the necessary communication message structure.
3. Design and build wiring harnesses to connect from the machine to each CMA system as well as harnesses to connect between CMA valve blocks.
 - a. Cables connecting valves within a blocks will be provided by Danfoss
 - b. See wiring schematic and suggested components.
Please reference page 85 "CMA Wiring Harness Details" for more information.
4. Procure CAN card. (Please reference page 92) Pro-FX Configure® for more information.
5. Once the CMA valve is received and installed on the machine, setup and tune CMA's software features using Pro-FX Configure®.

Specifying a CMA200 system

For each CMA200 valve block desired, develop 1 inlet section model code and a work section model code for each work section on the block. When dividing work sections across multiple valve blocks, the following rules must be followed. Note, a system here refers to all of the valve blocks wired electrically together to a single VSM.

- One and only one VSM and inlet pressure controller are required per system
- Maximum of 8 work sections per block
- Maximum of 15 work sections per system
- If more than 15 work sections are required, this can be accomplished by using additional CMA systems. Each additional system will appear as another node on the User CAN network

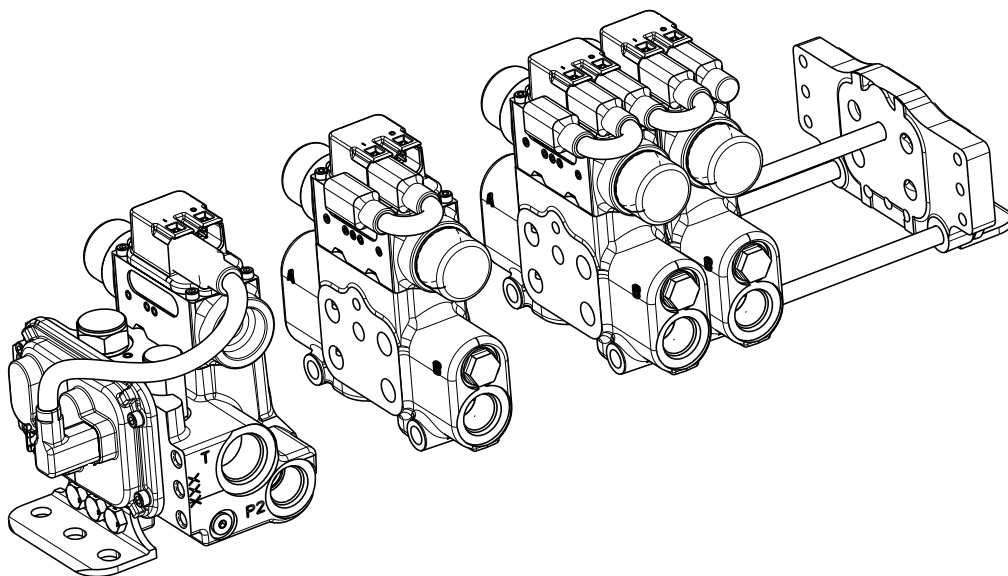


Valve block order example

1. Inlet	CM A200 J M S V 3 0 000 K 1 00 XXA 10
2. Section 1	CMZ200 B HC B 379 MC B 379 0 K 1 00 XXA 10
3. Section 2	CMZ200 B LC B 379 MC B 379 0 K 1 00 XXA 10
4. Section 3	CMZ200 B LT B 379 MC B 379 0 K 1 00 XXA 10

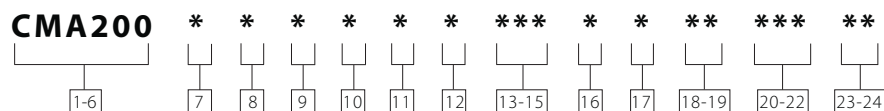
Note: Repeat section model code for additional sections.

Note: End cover, tie rods, and cables to connect between the valves on the block are provided by default.



Model code: CMA200 inlet

CMA200



1-6 CMA200 Series

7 Communication protocol

- J J1939
- C CAN OPEN
- 0 None

8 Interface module

- M VSM
- E VSE
- 0 None

9 Port types

- S SAE P1 = 1 1/16"-12 UN (SAE-12)
- P2 = 1 1/16"-12 UN (SAE-12)
- T = 1 5/16"-12 UN (SAE-16)
- LS = 7/16"-20 UNF (SAE-04)
- B BSP P1= G 3/4
- P2= G 3/4
- T = G 1
- LS= G 1/4

10 Inlet pressure controller

- V Variable Displacement
- F Fixed Displacement
- 0 none, Used on VSE or extension block

11 Active pressure port

- 1 P1
- 2 P2
- 3 P1 & P2

12 Manual override

- 0 None
- M Manual Override on CV

13-15 main relief setting (In bar)

- 000, 086, 103, 121, 138, 155, 172, 190, 207, 224, 241, 259, 276, 293, 310, 328, 345, 362, 279, 397, 414, 431*

16 Paint type

- K Std. Flat Black

17 Seals

- 1 Default (NBR)

18-19 Special Features

- 00 None

20-22 Software version

- XXA Standard Software

23-24 Design code

- 10 Design Code

Note: An electronic pressure limit can be set on the valve in software to any value in increments of 0.01 bar using available configuration software suite. This applies to both inlet and work port settings.

Note: No relief valve is available for extension inlets.

* Contact Danfoss for 431 bar relief setting

CMA200 Inlet – Communication protocol

Model code position 7

CMA is a CAN controlled valve that can communicate with either J1939 or CAN open protocols.

- J** - The J1939 version of the valve is seen as one node on the user CAN network and operates at 250 kb/sec as specified by J1939. The valve is addressed using a single 29 bit extended identifier.
- C** - The CANOpen version of the valve utilizes an 11 bit identifier with configurable baud rates of 125, 250, and 500 kb/sec. The valve system will be one node on the CAN open network.
- 0** - If the inlet section is an extension block with or without VSE, Communication protocol needs not to be selected as the block is a slave with no VSM.

CMA200 Inlet – Interface module

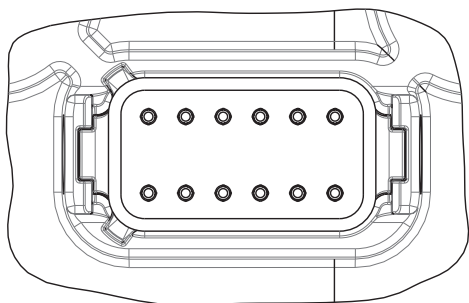
Model code position 8

CMA200

M - VSM (Valve System Module)

This is the interface module for the valve – it acts as a CAN gateway, a DC to DC power supply, and a supervisory controller for the system.

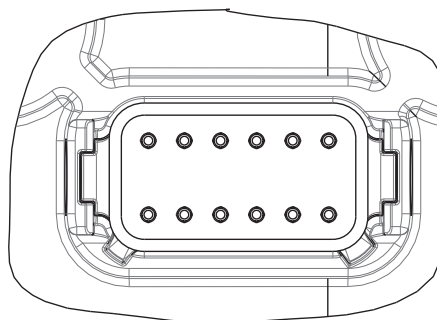
Every CMA system must have one and only one VSM.



VSM 12 pin connector "B" Keying

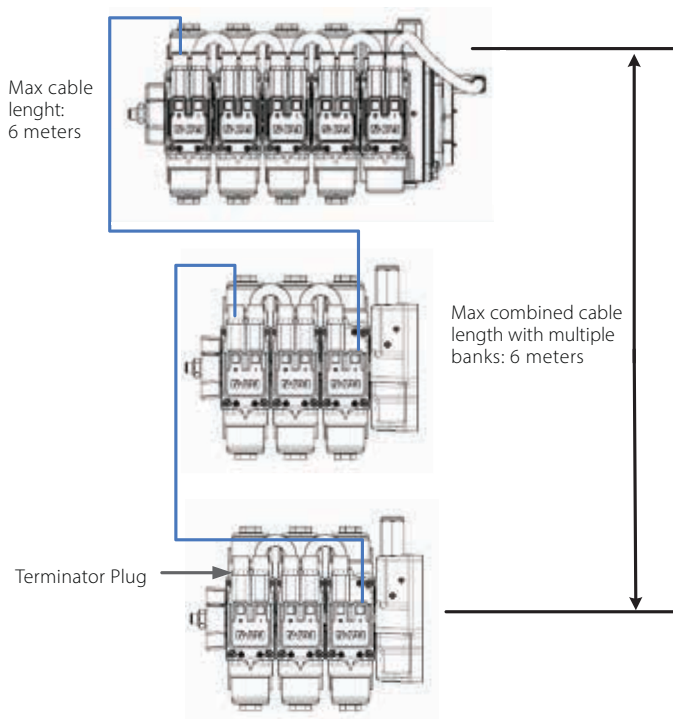
E - VSE (Valve System Extender)

This is used on blocks where the distance between it and the VSM or a VSE is greater than 6 meters (19.6 feet). Maximum distance between a VSE and its VSM is 30 meters (98.4 feet)

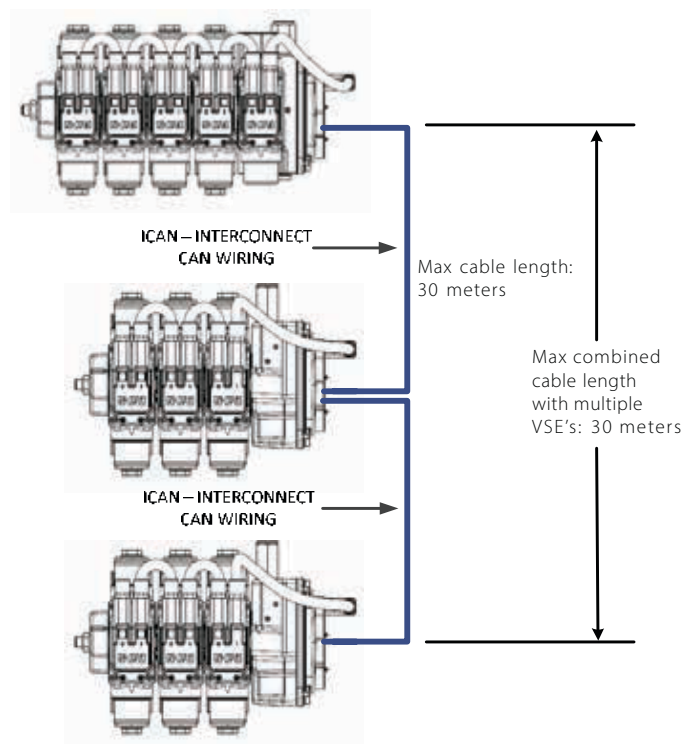


VSE 12 pin connector "A" Keying

System layout without VSE's



System layout with VSE's



0 - None

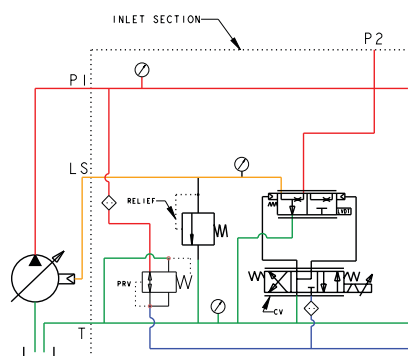
This is selected for blocks where the distance between it and the VSM or a VSE is less than 6 meters (19.6 feet). This block would be connected with an extension cable to the last PV on the closest block.

CMA200 Inlet – Inlet pressure controller

Model code position 10

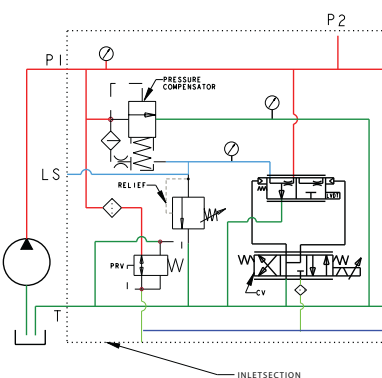
V – Variable displacement

A variable displacement inlet has a load sense port for connecting to a variable displacement pump. Each CMA system needs one and only one Inlet Pressure Controller.



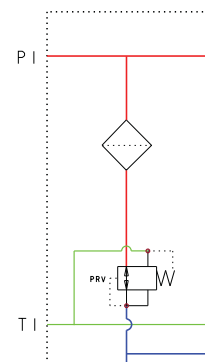
F – Fixed displacement

A fixed displacement inlet has a DPST or unload flow to keep system pressure to that demanded by the work sections. Each CMA system needs one and only one Inlet Pressure Controller.



0 – None

If this is for an extension block, with or without a VSE, no Inlet Pressure Controller is needed. An extension inlet will be installed on the block that has supply and tank ports but no load sense port.

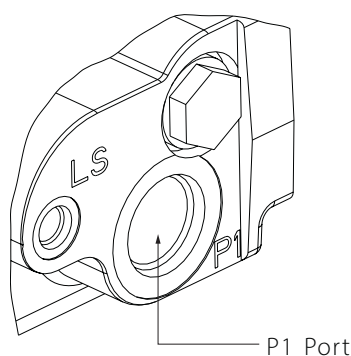


CMA200 Inlet – Active pressure port

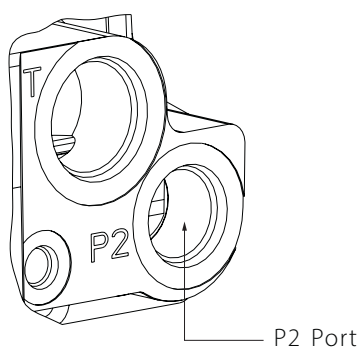
Model Code Position 11

Multiple pressure ports can be machined to provide easier hose routing to additional CMA valve blocks. Specify which Inlet pressure port location is required.

1 – P1



2 – P2



3 – P1 & P2

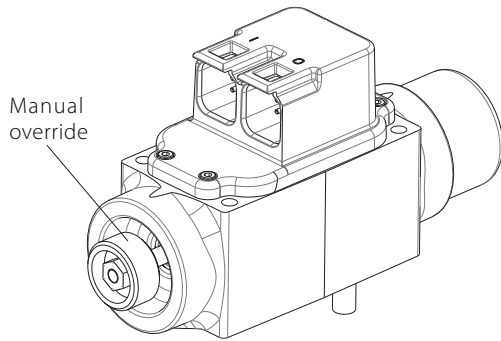
CMA200 Inlet – Manual override

Model code position 12

CMA200

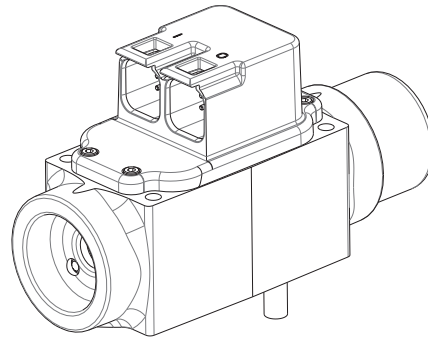
M – Manual override on CV

A manual override is installed on the CV, or Conditioning Valve, that can be used to control the supply pressure. This manual override allows a user to force supply pressure to its maximum if electrical power is lost. This would be necessary if a manual override needed to be actuated to raise a service without electrical power. Electrical power is necessary for the work sections to be able to communicate their load sense demands to the Inlet over CAN.



0 – None

No manual override is installed



CMA200 Inlet – Software versions

Model code position 20-22

The software version position is broken up into two sections, the first 2 characters designating the major software version, and the last character designates the software options desired

Software major version

The first two characters in software version should indicate the major version of software desired.

If a specific major version is desired, the major version desired is indicated, for example, 03 for software with a major version 3. For CMA, all versions of software that have the same major version are compatible, for example, version 3.8 and version 3.9. The software version of CMA valves already purchased can be found using Pro-FX® Configure.

If the latest major version of software available is desired, these characters should be XX.

The valve will always be shipped with the most up-to-date minor software version available for the designated major version.

CMA200 Inlet – Software versions (Continued)

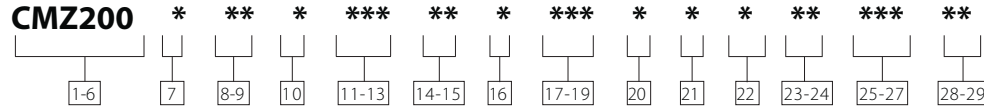
Model code position 22

CMA200

A - Standard software control features

Software	Description
Autoload sense	A mode that controls the pump to provide pressure to be above the highest detected load in the system
Pressure control	A mode that allows the user to command a desired pump pressure
Smart data	The valve can transmit data such as: supply pressure, load sense pressure, tank pressure, spool position, and oil temperature
Ratio Flow Share	An anti-saturation method that reduces the flow to all services by the same percentage when the pump is saturated. Similar to "Post-compensated" hydraulic valves. Individual services can be exempted from flow share, giving them priority
Uniform Flow Share	An anti-saturation method that reduces the flow to all services by the same amount of flow when the pump is saturated. Similar to "Post-compensated" hydraulic valves. Individual services can be exempted from flow share, giving them priority
Cascade Flow Share	An anti-saturation method that reduces the flow to services in a specified order of priority

Model code – Work section



1-6 Product series

CMZ200 - Advanced mobile valve series

7 Body port thread sizes

- A 3/4" 16 UNF (SAE-8)
- B 7/8" 14 UNF (SAE-10)
- C 1-1/16" 12 UN (SAE-12)
- D G 1/2"
- E G 3/4"

8-9 Spool type at position A

- HC 200 lpm, biased to center
- HT 200 lpm, biased to tank
- HP 200 lpm, biased to pressure
- LC 100 lpm, biased to center
- LT 100 lpm, biased to tank
- LP 100 lpm, biased to pressure

10 Valve option at A

- 0 None
- B Anti-cavitation valve with relief valve
- C Anti-cavitation valve
- S Relief valve

11-13 Relief setting at position A

RV Setting in Bar
000, 086, 103, 121, 138, 155, 172, 190, 207, 224, 241, 259, 276, 293, 310, 328, 345, 362, 279, 397, 414, 431*

14-15 Spool type at position B

- B
- HC 200 lpm, biased to center
- HT 200 lpm, biased to tank
- HP 200 lpm, biased to pressure
- LC 100 lpm, biased to center
- LT 100 lpm, biased to tank
- LP 100 lpm, biased to pressure

16 Valve option at B

- 0 None
- B Anti-cavitation valve with relief valve
- C Anti-cavitation valve
- S Relief valve

17-19 Relief setting at position B

RV Setting in Bar
000, 086, 103, 121, 138, 155, 172, 190, 207, 224, 241, 259, 276, 293, 310, 328, 345, 362, 279, 397, 414, 431*

20 Manual override type

- 0 None
- A Lever-handle toward port A
- B Lever-handle toward port B

21 Paint type

- K Std. Flat Black

22 Seal

- 1 Default (NBR)

23-24 Special features

- 00 None

25-27 Software version

- XXA Standard
- XXU Advanced control
- XXV Boom stability control
- XXT A, U and B packages

28-29 Design code

- 10 Design code

Note: An electronic pressure limit can be set on the valve in software to any value in increments of 0.01 bar using available configuration software suite. This applies to both inlet and work port settings.

Note: If an option without a relief is selected for port A or B, no relief valve setting should be selected in corresponding Relief Setting position (i.e., select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

Note: High flow or low flow spools must be selected for both work ports. They cannot be mixed (i.e. a high flow spool on work port A and low flow spool on work port B).

* Contact Danfoss for 431 bar relief setting

CMA200 work section options - Spool type at position

A and position B

Model code position 8-9 and 14-15

The spool type positions are made up of two characters: one represents the spool's flow rating and the other represents the spool's bias.

H - High flow spool

200 lpm flow from supply to workport @ 24 bar dp, measured with external pressure sensors. Reference "Work section - pressure drop" graphs on page 66 for more detail.

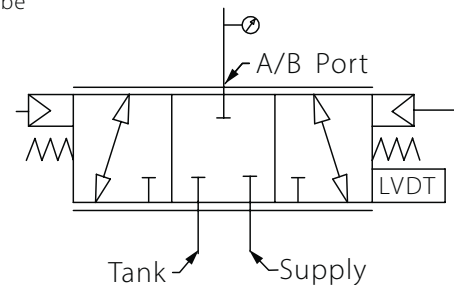
L - Low flow spool

100 lpm flow from supply to workport @ 16 bar dp, measured with external pressure sensors. Reference "Work section - pressure drop" graphs on page 66 for more detail.

Note: High flow or low flow spools must be selected for both work ports. They cannot be mixed (i.e. a high flow spool on work port A and low flow spool on work port B).

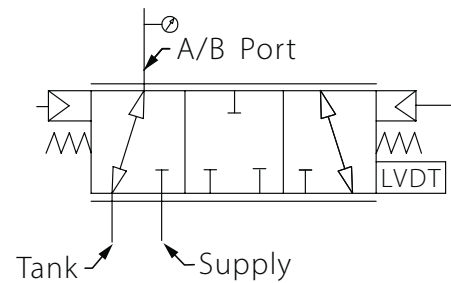
C - Biased to center

In biased to center, the spring will move the spool to the center position when there is no power to the coils or no pilot pressure. In the center position, the flow to both pressure and tank is blocked.



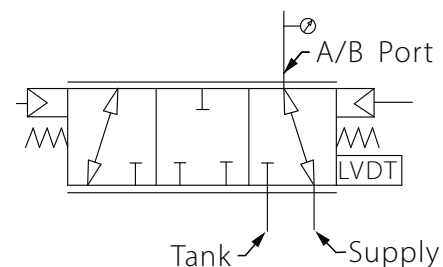
T - Biased to tank

With a tank-biased spool, the spring will push the spool to fully open the Work Port (A or B) to the Tank rail when the valve receives an Idle demand or when there is no electrical power.



P - Biased to pressure

With a pressure-biased spool, the spring will push the spool to fully open the Work Port (A or B) to the Pump rail when the valve receives an Idle demand or when there is no electrical power.



Choosing the mechanical bias condition

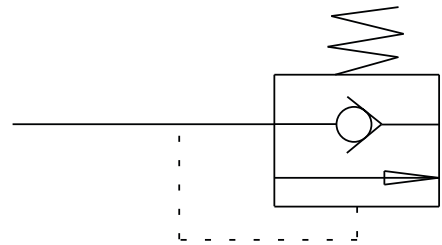
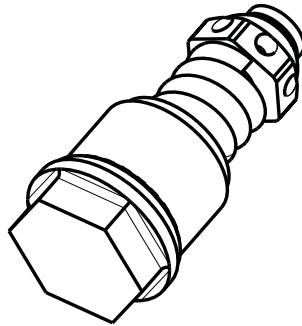
For most applications it's recommended to use a center-biased spool (HC). Otherwise, a Tank-biased (HT) or Pressure-biased (HP) can be used depending on the behavior desired when the valve is at idle or electrical power is lost.

Note: Since control behavior of each spool can be commanded from the vehicle's controller, any combination of spools can act like a cylinder spool arrangement, motor spool arrangement, etc. Thus, many different spool options are not necessary for CMA like for a traditional Mobile Valve.

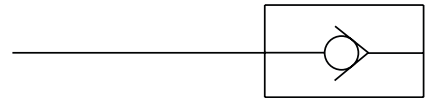
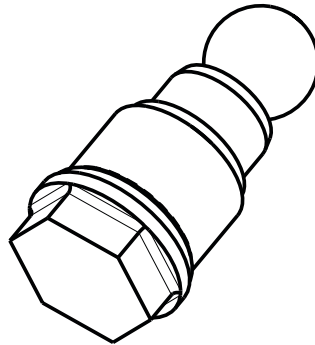
CMA200 work section options - Port A & B functions and settings

Model code position 10 and 16

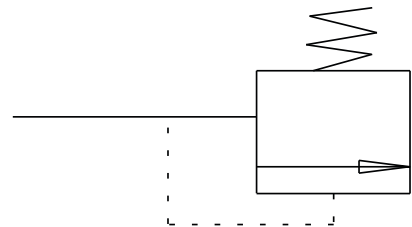
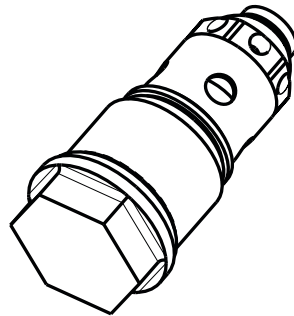
B - Anti-cavitation valve with relief valve



C - Anti-cavitation valve



S - Relief valve



0 - None No port for auxiliary valves is machined.

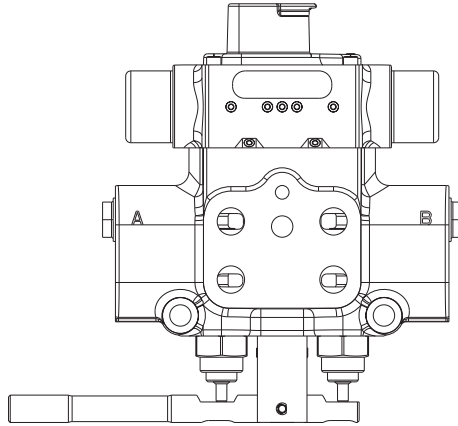
Note: If an option without a relief is selected for port A or B, no relief valve setting should be selected in the corresponding Relief Setting position (i.e. select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

CMA200 work section options - manual override types

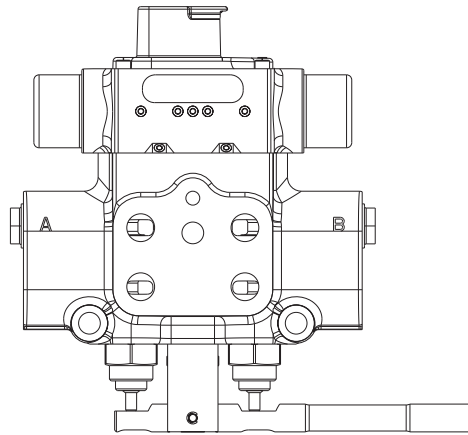
Model code position 20

CMA200

A - Lever-handle toward port A



B - Lever-handle toward port B



0 - None

Note: Manual override is for emergency use only. If a Work Section's manual override is actuated alone, the pump will not respond to the load in the cylinder and the load can only be lowered. In order to raise a load, if electrical power is lost but hydraulic power remains, a manual override on the inlet must have been selected in its model code to be able to force the supply pressure to be increased to its maximum. A manual override does not have fine metering control, therefore personnel should be clear from the service prior to its actuation.

CMA200 work section options – Software versions

Model code position 25-27

The software version position is broken up into two sections, the first 2 characters designating the major software version, and the last character designates the software options desired.

Software major version

The first two characters in software version should indicate the major version of software desired.

If a specific major version is desired, the major version desired is indicated, for example, 03 for software with a major version 3. For CMA, all versions of software that have the same major version are compatible, for example, version 3.8 and version 3.9. The software version of CMA valves already purchased can be found using Pro-FX® Configure.

If the latest major version of software available is desired, these characters should be XX.

The valve will always be shipped with the most up-to-date minor software version available for the designated major version.

CMA200 work section options – software versions (continued)

Model code position 27

CMA200

A - Standard software control features

Software	Description
Pressure compensated flow control	Flow from the valve will remain constant regardless of the supply and load pressures. This applies to both meter-in AND meter-out flows
Flow compensated pressure control	A mode that maintains the pressure on a workport regardless of the flow into or out of the workport
Intellifloat	A mode that lowers a service to the ground at a controlled rate then fully opens the spool(s) to tank when it detects the service is on the ground.
Intelligent twin spool flow control (IFC)	Versatile flow controller which maintains the desired flow independent of transitions between passive and overrunning loads
Load damping	A feature in flow control, which reduces service oscillation induced by moving large structures, such as a boom
Electronic load sense	Broadcast the pump pressure demand on the CAN bus
Electronic port relief	A feature that opens the valve from neutral to tank when the port pressure exceeds the maximum pressure
Electronic pressure limit	A feature that limits port pressure to the specified maximum pressure while the service is being commanded to move.
Single spool flow control	Controls the flow into or out of a single workport
Single spool position control	A mode that commands the position of the spool, causing it to behave as a proportional orifice
Smart data	The valve can transmit data such as: work port pressures, spool positions, work port flows, and oil temperature
Limp mode	If a sensor fails, the valve will continue to work with reduced performance until the machine can be serviced

U – Advanced control

Includes standard package and following features

Software	Description
Torque control	Advanced force or torque control for double-acting cylinders or motors
Slew control	A twin-spool controller that reduces oscillations and the hard stop often associated with inertial loads
Hose burst detection	Prevents major oil spill events by monitoring flow consumption on each service and closing the spools for that circuit if a major leak is detected

B – Boom stability control

Includes standard package and following features

Software	Description
Boom Stability Control (BSC)	A controller designed to actively dampen oscillations in flexible services that tend to vibrate

T – A, U and B packages

Includes Standard, Advanced control and Boom stability control packages

CMA Wiring harness details

All CMA blocks ship from the factory with cables installed for communication within the valve block. Danfoss does not supply user cables and extension cables to connect CMA blocks to the machine and each other. As a courtesy to the user, the following pages provide recommended parts and schematics for building these harnesses. Danfoss recommends that the user cables and extension cables be assembled and verified by a licensed electrician. Danfoss provides no warranties, representations and guarantees regarding the user cables and extension cables. The user bears full responsibility for proper assembly, installation and operation of the user cables and extension cables.

User cables

The following diagrams provide information on how the user cable interfaces with a number of different CMA system configurations. Throughout these diagrams User CAN (UCAN) refers to the machine's CAN network (either J1939 or CANOpen) and Interconnect CAN (ICAN) refers to the internal CAN network within CMA that jumps between CMA valve blocks. If application specific electromagnetic compatibility testing indicates CAN cable shielding is needed, connect CAN shield as shown

Recommended parts for building user cables

The following parts are recommended when building a cable. Reference the schematics on the following pages for how to build the user cables. Or for a sample user cable assembly drawing, please locate the drawings 6034034-001 (1 VSM block, 2 VSE blocks) or 6035189-001 (1 VSM block) on the PowerSource Application.

	Part number	Description
Compatible interface deutsch connector	DT06-12SB-P012	12-way plug connector body (VSM)
	DT06-12SA-P012	12-way plug connector body (VSE)
Deutsch wedge locks	W12S-P012	Wedge locks for 12-way plugs
Deutsch sockets	0462-201-16141	Sockets for 18AWG wires
	0462-20X-16141	Sockets for Battery +, Battery - for VSM and VSE. Select "X" based on wire gage selected*
Deutsch backshells	1028-043-1205	Backshell for 12-way plugs
Deutsch sealing plugs	0413-217-1605	Plugs for empty pins on connectors
Wire	SAE J1128 GXL, Crosslinked Polyethylene, 18AWG	Wire for UCAN and ICAN
	SAE J1128 GXL, Crosslinked Polyethylene, wire gage dependent on power consumption*	Wire for Battery +, Battery - for VSM and VSE
Corrugated loom	Panduit CLTS50NC630 or Delfingen 34442	Corrugated loom for wire protection

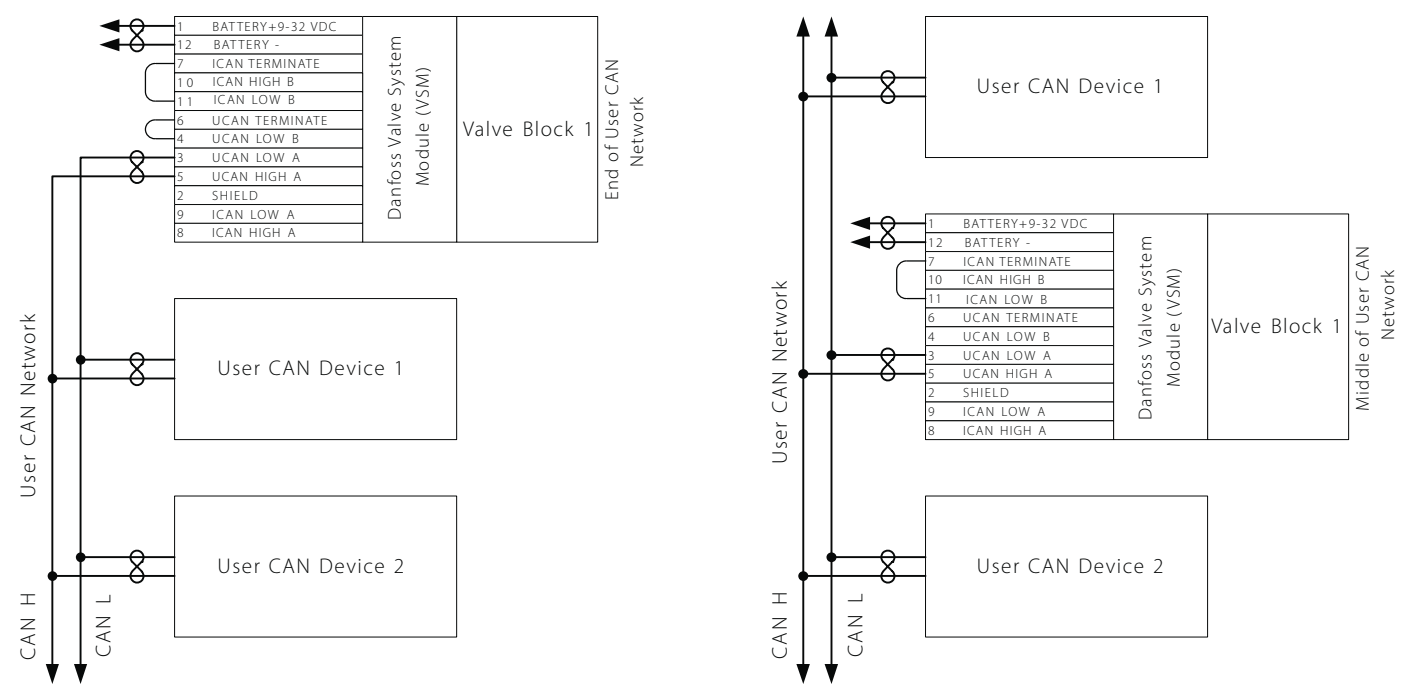
* Wire AWG for the Power wires to the VSM and VSE assemblies may be increased up to a maximum of 14 AWG w/GXL type insulation. This should be done to guarantee a minimum voltage of 9.5vdc is supplied to the VSM/VSE under worst case supply and load conditions.

CMA Wiring harness details

User cables termination

User CAN, or UCAN, is the machine's CAN network that communicates with the VSM. If the VSM is at the end of the UCAN network, a 120 Ω termination resistor built into the VSM can be used to terminate the UCAN with the installation of a wire jumper, as shown in the left figure below.

If the VSM is in the middle of the bus, no UCAN termination is necessary. The UCAN lines to the VSM must be a branch off of the main CAN harness, as shown in the right figure below.



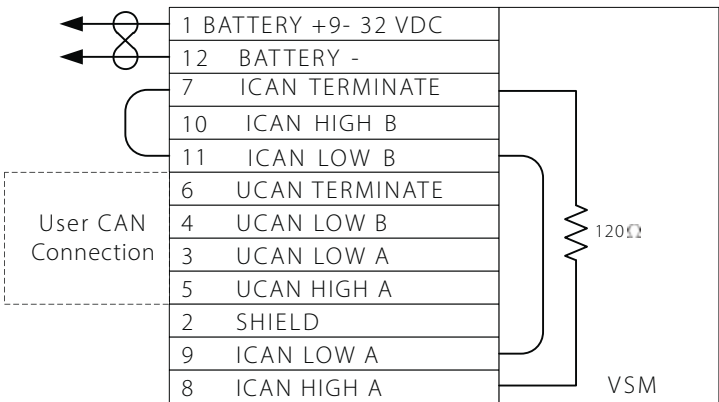
Note: Symbol  is used to represent twisted pair wires. Shielding is not recommended and was not used to meet CE EMC requirements.

CMA Wiring harness details

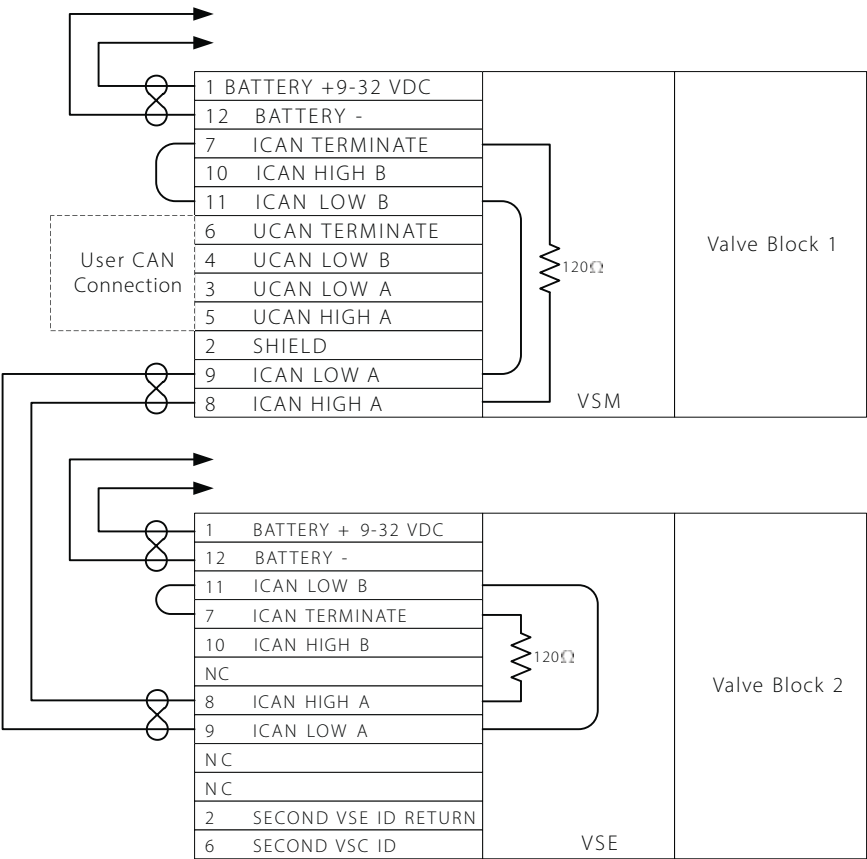
Interconnect CAN Termination

Interconnect CAN, or ICAN, is the CAN network between the VSM and VSE's. 120 Ω Termination resistors in the VSM and VSE circuits can be connected with the installation of wire jumpers on each device. Two sets of ICAN pins are available in a VSM or VSE to allow daisy chaining of the ICAN if a VSM or VSE is in the middle of the CMA system. If no VSEs exist in a CMA system, it is still necessary to install a jumper to activate one 120 Ω termination resistor on the ICAN bus.

Single block system

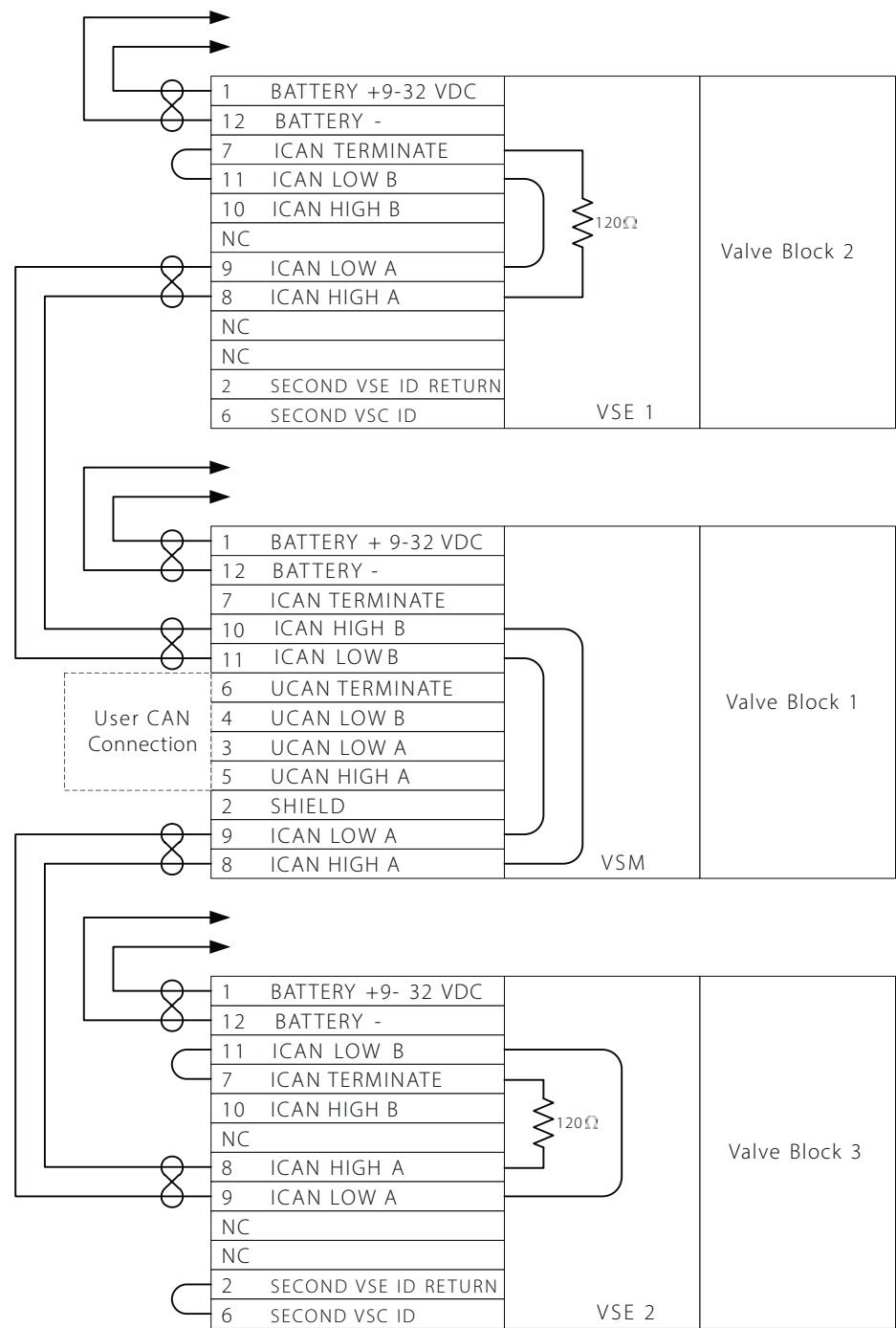


Double block system with valve system extender (VSE)



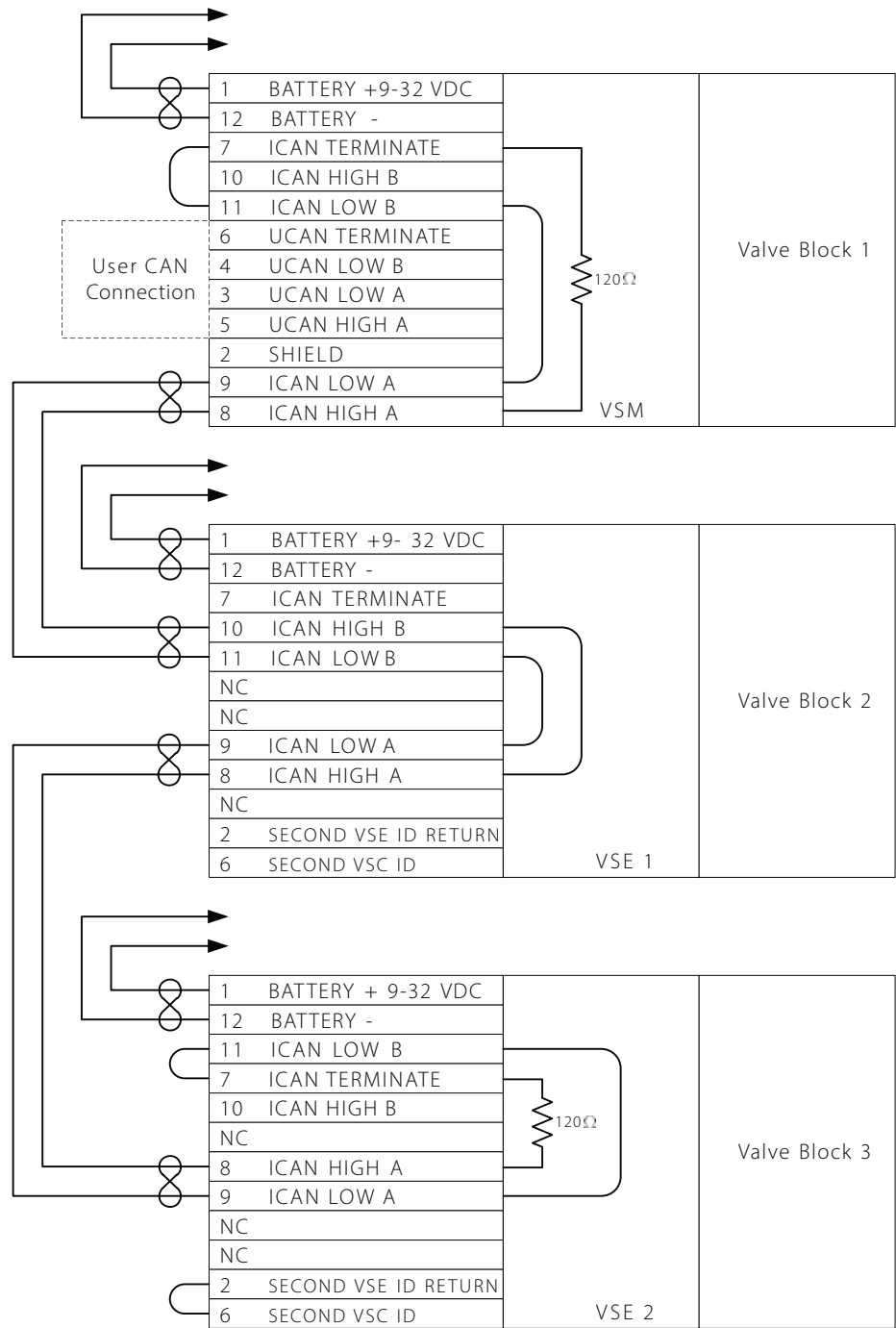
CMA Wiring harness details

Triple block system with VSM between VSEs



CMA Wiring harness details

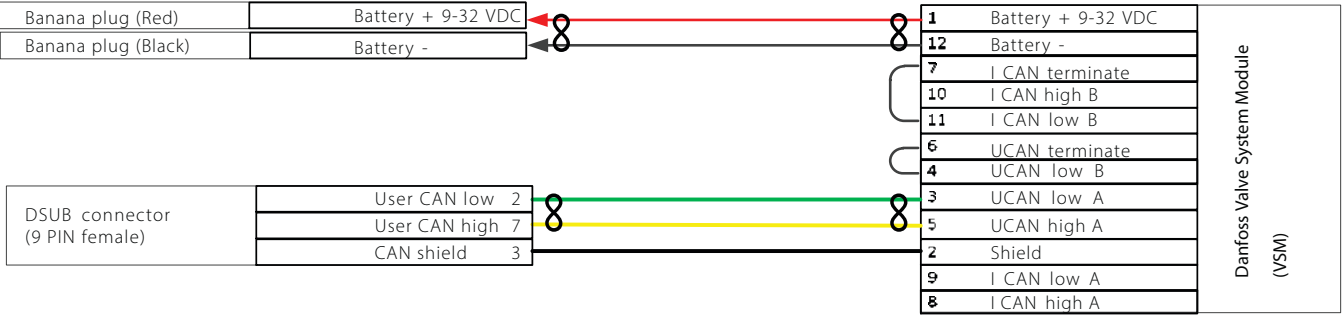
Triple valve block system with VSM at the start of the system



CMA Wiring harness details

Example bench testing harness

When connecting to a CMA valve not installed on a machine, for example on a test bench, wiring is necessary to provide electrical power and CAN communication to a CAN card. The schematic below could be used to connect to a 1 block CMA system. The schematic would need to be modified per the previous wiring harness pages if there were additional blocks within the system that had VSE's.



CMA Wiring harness details

Extension cables

An extension cable can be used to connect from one CMA block to another block that is within 6 m of a VSM or VSE. This cable can either be purchased from Danfoss or built using the recommendations below. To install an extension cable, remove the termination plug from the last section of the block and insert the extension cable. Connect the other end of the extension cable to the extension block.

Available extension cables

Danfoss offers extension cables for connecting an extension block to a VSM block (<6 m)

	Part number	Description
Extension cables	6034654-201	2.0 meter interconnection cable
	6034654-401	4.0 meter interconnection cable

Notes: If more than one cable is used in a single daisy chain with multiple valve blocks, then the combined lengths must be less than 6 m.

Recommended parts for building cables

If an extension cable of a different length than 2 or 4 meters is desired, the following parts are recommended when building a cable. Reference the schematic below for how to build an extension cable. A sample extension cable assembly drawing, 6034654-001, can also be located in the PowerSource[®] Application

Part name	Part number	Description
Compatible interface Deutsch connector	DT06-6S-P012	6-way plug connector body
Deutsch wedge locks	W6S-P012	Wedge locks for 6-way plugs
Deutsch sockets	0462-201-16141	Sockets for 18AWG wires
Deutsch backshells	1011-239-0605	Backshell for 6-way plugs
Wire	SAE J1128 GXL, Crosslinked Polyethylene, 18AWG	Wire for extension cables
Corrugated loom	Panduit CLTS50NC630 or Delfingen 34442	Corrugated loom for extension cables

Extension cable schematic



Pro-FX[®] Configure

Pro-FX[®] Configure is the PC tool used to configure the various software features of the CMA valve. It can also be used to check alerts, take and load backups of the valve, plot data from the valve, and send commands to the valve.

Pro-FX[®] Configure can be downloaded from the PowerSource[®] Application.

Supported CAN cards

Pro-FX[®] Configure 1.0: Softing USB
 Softing CANPro USB
 Value CAN

Pro-FX[®] Configure 2.0: Softing USB
 Softing CANPro USB All Kvaser CAN cards

PC requirements

Operating system: Windows 7, 8 or 8.1

Processor: 1 GHz

RAM: 512 MB

Disk space (minimum): 4.6 GB

Minimum screen resolution: 1366x768

Hydraulic fluid recommendations

Introduction

Oil in hydraulic systems performs the dual function of lubrication and transmission of power. It is a vital element in a hydraulic system, and careful selection should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components, especially hydraulic pumps and motors.

Generally, oil selected for use with pumps and motors is acceptable for use with valves. Critical servo valves may need special consideration.

When selecting oil for use in an industrial hydraulic system be sure the oil:

- Contains the necessary additives to ensure excellent anti-wear characteristics
- Has proper viscosity to maintain adequate sealing and lubrication at the expected operating temperature of the hydraulic system
- Includes rust and oxidation inhibitors for satisfactory system operation

Types of hydraulic fluids

Hydraulic fluids are classified by the type of base stock used. Some fluids are further classified by fluid formulation and performance.

Anti-wear hydraulic fluids

For general hydraulic service, Danfoss recommends the use of mineral base anti-wear (AW) hydraulic oils meeting Danfoss specification E-FDGN-TB002-E.

Danfoss requests that fluid suppliers test newly developed lubricants on Danfoss 35VQ25A high pressure vane pump, according to Danfoss ATS-373 test procedure, ASTM D 6973 test method and meet

other requirements of the Danfoss specification E-FDGN-TB002-E. Lubricants meeting the Danfoss specification are considered good quality anti-wear hydraulic fluids that can be used with Danfoss components at maximum allowable operating conditions. They offer superior protection against pump wear and long service life.

Crank case oils

Automotive-type crankcase oils with American Petroleum Institute (API) letter designation SE, SF, SG, SH or higher per SAE J183 classes of oils are recommended for hydraulic service. The "detergent" additive tends to hold water in a tight emulsion and prevents separation of water.

Automotive type crankcase oils generally exhibit less shear stability, which can result in higher loss of viscosity during service life.

Multiple-viscosity, industrial grade hydraulic fluids with better shear stability will provide improved viscosity control. Other mineral oil based lubricants commonly used in hydraulic systems are Automatic Transmission Fluids (ATFs) and Universal Tractor Transmission Oils (UTTOs).

Synthetic hydrocarbon

Synthetic hydrocarbon base stocks, such as polyalphaolefins (PAOs), are also used to formulate AW hydraulic fluids, crankcase oils, ATFs and UTTOs.

Synthetic hydrocarbon

Synthetic hydrocarbon base stocks, such as polyalphaolefins (PAOs), are also used to formulate AW hydraulic fluids, crankcase oils, ATFs and UTTOs.

Environment friendly hydraulic fluids

Eco-friendly characteristics is becoming a critical need, and a number of biodegradable hydraulic fluids are being used more and more in environmentally sensitive areas.

Biodegradable hydraulic fluids are generally classified as vegetable oil based (HETG), synthetic ester (HEES), polyalkyleneglycol (HEPG) and polyalphaolefin (HEPR). In addition, special water glycol hydraulic fluids are used in applications in which water miscibility is necessary, along with biodegradable properties.

Fire-resistant hydraulic fluids

Fire-resistant fluids are classified as water containing fluids or synthetic anhydrous fluids. Water acts as the fire retarding agent in water containing fluids. The chemical structure of synthetic anhydrous fluids provides fire resistance.

Many applications that are prone to fire hazard, such as steel mills, foundries, die casting, mines, etc., require the use of fire resistant hydraulic fluid for improved fire safety. Fire resistant fluids may not be fireproof, but they have better fire resistance compared to mineral oil.

The alternative fluids are recommended when specific properties, such as fire resistance, biodegradability etc., are necessary for the application. Keep in mind that alternative fluids may differ from AW petroleum fluids in properties such as pressure viscosity coefficient, specific gravity, lubricity etc. Hence certain pumps / motors may need to be de-rated, some can be operated under full ratings and others are not rated. Be sure to confirm

product ratings with the specific fluid in the intended application.

Viscosity

Viscosity is the measure of a selection of hydraulic fluid with a specific viscosity range should be based on the needs of the system, limitations of critical components, or proper performance of specific types of units. At system startup and during operation, Danfoss recommends maintaining the fluid's maximum and minimum viscosity ranges (see chart). Very high viscosities at startup temperatures can cause noise and cavitation damage to pumps.

Continuous operation at moderately high viscosities will tend to hold air in suspension in the fluid, as well as generate higher operating temperatures. This can cause noise, early failure of pumps and motors and erosion of valves. Low viscosities result in decreased system efficiency and impairment of dynamic lubrication, causing wear.

It is important to choose the proper fluid viscosity for your particular system in order to achieve the startup viscosity and running viscosity range (see chart) over the entire temperature range encountered. Confirm with your fluid supplier that the fluid viscosity will not be less than the minimum recommended at the maximum fluid temperature of your application.

A number of anti-wear hydraulic fluids containing polymeric thickeners (Viscosity Index Improvers [VII]) are available for use in low temperature applications. Temporary or permanent viscosity loss of some of these fluids at operating temperature may adversely affect the life and

Hydraulic fluid recommendations

performance of components. Before using polymer containing fluids, check the extent of viscosity loss (shear stability) to avoid hydraulic service below the recommended minimum viscosity. A fluid with good shear stability is recommended for low temperature applications.

Multi-grade engine oils, ATFs, UTTOs etc., also contain VIs, and viscosity loss will be encountered during use.

Cleanliness

Fluid cleanliness is extremely important in hydraulic systems. More than 70% of all failures are caused by contamination, which can reduce hydraulic system efficiency up to 20% before system malfunction may be recognized. Different hydraulic components require different cleanliness levels. The cleanliness of a hydraulic system is dictated by the cleanliness requirement of the most stringent component in the system. OEMs and distributors should provide their customers with cleanliness requirements for Danfoss hydraulic components used in their system designs. Refer to Danfoss product catalogs for specific cleanliness requirements of individual components.

Fluid maintenance

The condition of a fluid has a direct bearing on the performance and reliability of the system. Maintaining proper fluid

viscosity, cleanliness level, water content, and additive level is essential for excellent hydraulic system performance. In order to maintain a healthy fluid, Danfoss recommends performing periodic checks on the condition of the fluid.

System design considerations

When designing a hydraulic system, the specific gravity of the hydraulic fluid needs to be taken into consideration. If the specific gravity of the fluid is higher than that of mineral oil, be sure the reservoir fluid level is adequately above the pump inlet to meet the recommended inlet operating condition of minimum 1.0 bar absolute pressure at the pump inlet.

Filters

Proper filter type and size, which vary depending on the type of fluid used in a system, are essential for healthy system function. The primary types of filter materials are paper, cellulose, synthetic fiber, and metal.

Filter media, adhesive, and seals must be compatible with the fluid used in the system. To lengthen fluid change out intervals, special absorbent filter media may be used to remove moisture and acids from phosphate esters.

Seals/elastomers

Select seal/elastomer materials that are suitable for the application, minimum

and maximum operating temperature, and compatible with the type of fluid used in the hydraulic system. The effect of hydraulic fluid on a particular elastomer depends on the constituents of the fluid, temperature range, and level of contaminants.

Replacing hydraulic fluid

Although sometimes valid, arbitrary hydraulic fluid change-outs can result in wasting good fluid and unnecessary machine downtime.

A regularly scheduled oil analysis program is recommended to determine when fluid should be replaced. The program should include inspection of the fluid's color, odor, water content, solid contaminants, wear metals, additive elements, and oxidation products. Clean the system thoroughly and flush with fresh, new fluid to avoid any contamination with the previous fluid/lubricant. Replace all seals and filters with new, compatible parts. Mixing two different fluids in the same system is not recommended.

Contact your Danfoss representative with questions concerning hydraulic fluid recommendations.

Appendix

Random vibration profile

Break-point Frequency	PSD (G ² /Hz)	PSD (m ² /s ³)	Grms
10	0.52	0.1	*
20	0.375	0.5	2.09
30	0.375	0.5	1.94
70	0.35	0.5	3.80
150	0.06	0.5	3.43
1000	0.06	0.5	7.14
2000	0.01	0.5	5.02
2500	0.001	0.5	1.37

Power consumption

Device	Power Consumption (Watts)
VSM or VSE	20
PV/CV - Idle	3.5
PV/CV - Active	9

Calculating power consumption

This calculation must be done for each VSM or VSE in the system. PV/CV's corresponds to those connected to the VSM or VSE in question.

Power Calculation: $20W + (\# \text{ Idle PV/CV's} * 3.5W) + (\# \text{ Active PV/CV's} * 9W)$

Notes

1. VSM or VSE was designed assuming PV/CV load will not exceed 95 watts. Load to the VSM or VSE should not exceed 115watts (95W for PV/CV and 20W for VSM or VSE).
2. Choose wire gage properly to ensure that voltage at VSM or VSE does not drop below 9.5V during normal operation.

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**Danfoss
Power Solutions (US) Company**
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239 6000

**Danfoss
Power Solutions GmbH & Co. OHG**
Krokamp 35
D-24539 Neumünster, Germany
Phone: +49 4321 871 0

**Danfoss
Power Solutions ApS**
Nordborgvej 81
DK-6430 Nordborg, Denmark
Phone: +45 7488 2222

**Danfoss
Power Solutions Trading
(Shanghai) Co., Ltd.**
Building #22, No. 1000 Jin Hai Rd
Jin Qiao, Pudong New District
Shanghai, China 201206
Phone: +86 21 2080 6201