Catalogue

Motion Control Valves

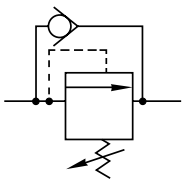
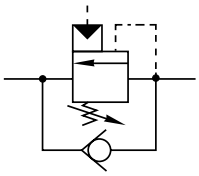
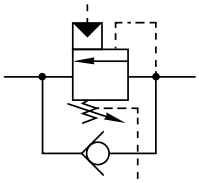
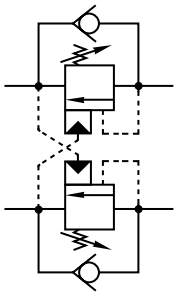
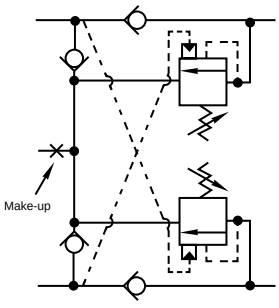
Fluid Power

HK.66.I1.02

General
Used to control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief.

Motion Control Valves can provide:
- Smoothly controlled loads, when starting, stopping and during operations.
- Load holding capability.
- Positive pump pressure or anti-cavitation.
- Single or dual models.
- Gasket or line mounted models.
- Thermal expansion relief.
- Full flow overload relief.

Types and Operation

Type	Description	Symbol	Models	Page
Counterbalance	A counterbalance valve is a relief valve with a free flow check valve in the reverse direction. Pump pressure must exceed relief setting in order to lower the load.		1B12 1LC11	4 5
Overcenter	Overcenter valves combine a differential area relief valve function with a pilot assist feature on the relief function. In the reverse direction, flow is directed around a free flow check valve. The pilot assist function reduces total pump pressure required to move the load during the work cycle. Most overcenter valves are mounted in, on, or directly next to the cylinder actuator to prevent run away as a result of a system or line failure.		1E11 1E15 1E80/81 1E16 1E80/82 1E21	7 8 9 11 12 13
Overcenter (Vented)	The overcenter function is the same as above except the vented feature is used to minimize back pressure which could affect response or performance.		1E90/91	10
Dual Overcenter	Two overcenter valves in one body allow cross-porting with a minimum of plumbing.		1EE13 1E80/1EE81 1EE15 1EE21	14 15 16 17
Motion Control and Lock (MUDROC)*)	These valves combine the features of a dual overcenter valve plus make-up port.		1EEC11 1EEC12	18 19

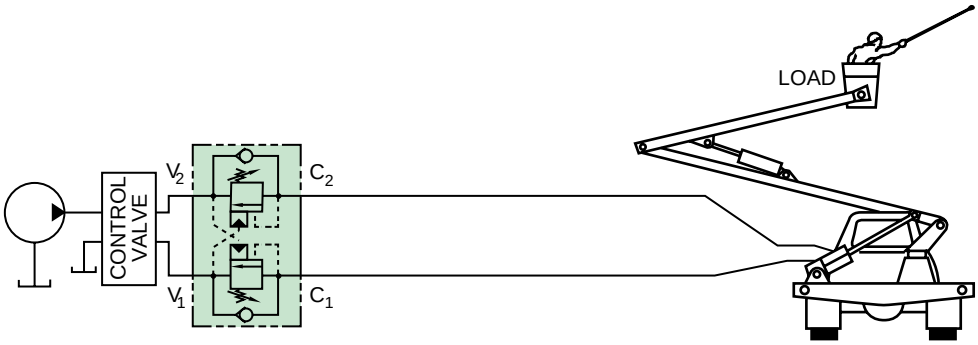
*) Acronym for Make-Up, Dual Relief, Over Centre

General Application
Counterbalance valves are used where loads being held in control are unchanging. Used when load does not go overcenter.

Overcenter Valves are available is single or dual models. Single overcenters are used when the cylinder actuator can run away in only one direction. The dual overcenter is best applied when the cylinder or actuator can run away in both directions of operation.

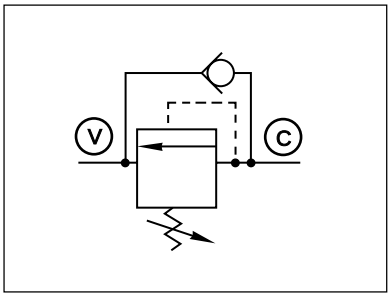
Motion Control and Loader Valves "MUDROC"* are typically used on hydraulic motor-driven swing or traction circuits.
*(MUDROC is an acronym for Make-Up, Dual Relief, Over Centre)

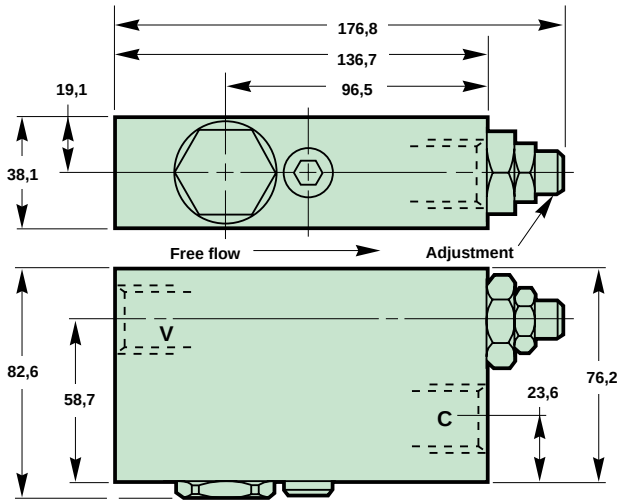
Typical Circuit

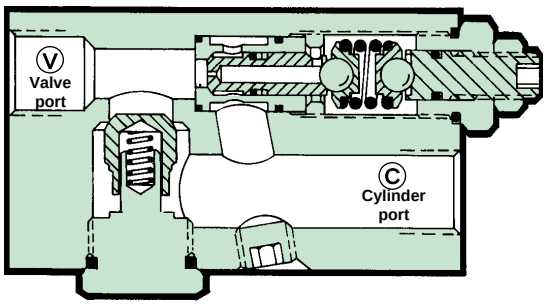


Dual overcenter

Parts in Body 1B12



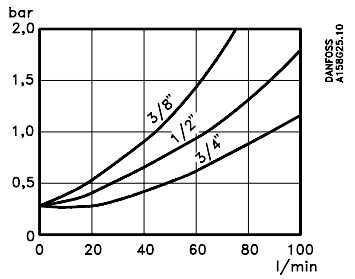




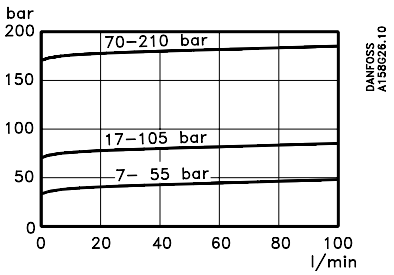
Specifications
- To 95 l/min and 210 bar.
- Weight: 1,63 kg.

Features
- Excellent pressure vs. flow characteristics.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Fast response.
- Rugged, dirt tolerant and reliable.
- Built-in reverse flow check.
- 100% performance tested.

Performance curves



Δp through free flow check



Used as relief

Use and operation
To hold and position heavy loads in the up position and prevent drifting.
Oil flows through the free flow check to raise the load. With control valve centered and relief set higher than load pressure, the load is held and will not move until "powered" down. Recommend setting relief valve at least 1.3 times maximum load induced pressure.

Materials
- Body — High-strength aluminium alloy.
- Check component — Hardened steel poppet.
- Internal parts — Hardened steel.
- Seals — Buna-N or Viton A.

How to order

1B12 - P 4 - 15 S

BASE PART NO.

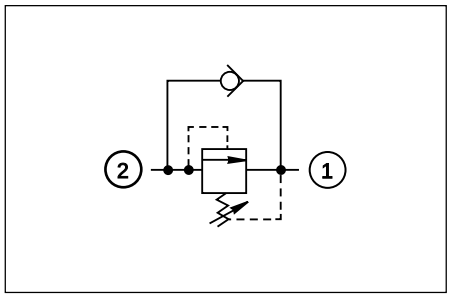
ADJUST. MEANS
P = Leak Proof Screw

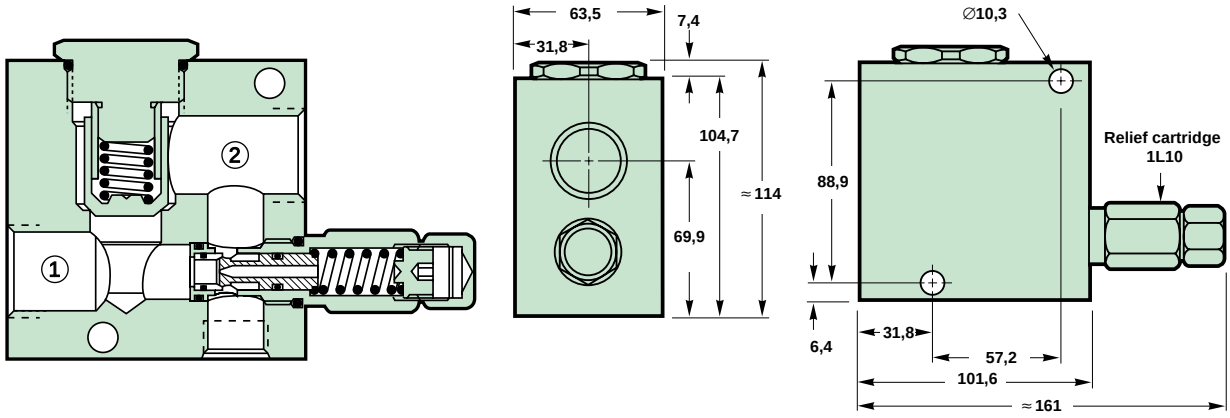
PORT SIZE
12T = 3/4" SAE
3 = 3/8" NPTF
4 = 1/2" NPTF
6 = 3/4" NPTF
4W = G 1/2
6W = G 3/4

ADJUSTMENT RANGE
8 = 7-55 bar
Std. Setting 41 bar
15 = 17-105 bar
Std. Setting 70 bar
30 = 70-210 bar
Std. Setting 105 bar

SEALS
S = Buna-N
SV = Viton A

Cartridge and Parts in Body 1LC11





Specifications

Aluminium Body
- To 150 l/min and 175 bar.
- Reseat pressure is 65% of setting.
- Maximum inlet pressure: 210 bar.
- Maximum load induced pressures to:
  67 bar for -15 range
  112 bar for -25 range
  (based on 65% reseat).
- Cavity number: FC-76 (see page 22).
- Weight: 2,00 kg.

Steel Body
- To 150 l/min and 350 bar.
- Reseat pressure is 65% of setting.
- Maximum inlet pressure: 350 bar.
- Maximum load induced pressures to:
  179 bar for -40 range
  224 bar for -50 range
  (based on 65% reseat).
- Cavity number: FC-76 (see page 22).
- Weight: 4,45 kg.

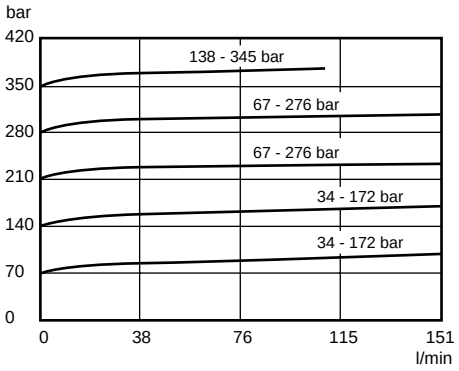
Features
- Excellent pressure vs. flow characteristics.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Fast response.
- Rugged, dirt tolerant and reliable.
- Built-in reverse flow check.
- Adjustable with min. and max. stops.
- 100% performance tested.

Use and operation
Used to position and lock heavy loads in the up position and prevent drifting.

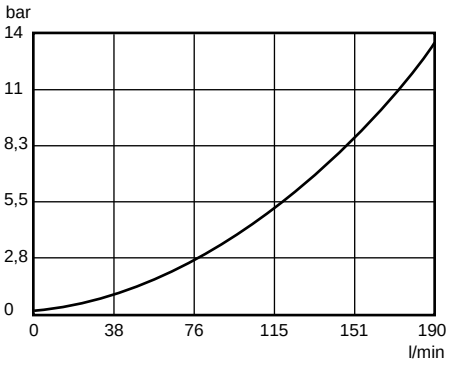
Oil flows through the free flow check to raise the load. With directional control valve centered and relief set higher than load pressure, the load is locked and will not move until “powered” down. Recommended relief setting is at least 1.5 times maximum load induced pressure.

Materials
- Body — High-strength aluminium alloy or high strength steel.
- Internal parts — Hardened steel.
- Cartridge — Hardened steel.
- Seals — Viton A standard.

Performance curves



Used as relief



ΔP throug free flow check

How to order

1LC11 - F 16T - 25 SV 33

BASE PART NO.

ADJUST. MEANS
F = Screw

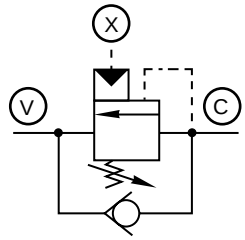
PORT SIZE (Body No.)
16T = 1" SAE
Aluminium (1LC11-16T-SV)
Steel (1LC11-16T-SV33)
8 = 1" NPTF
Aluminium (1LC11-8-SV)
Steel (1LC11-8-SV33)

ADJUSTMENT RANGE
15 = 14-103 bar
Std. Setting 55 bar
25 = 34-172 bar
Std. Setting 103 bar
40* =67-276 bar
Std. Setting 172 bar
50* =138-345 bar
Std. Setting 276 bar

SEALS
SV = Viton A

MODIFICATION
OMIT = Alum. Body for 210 bar Service
33 = Steel Body for 350 bar Service

***** For Use in Steel Body (MOD 33) Only



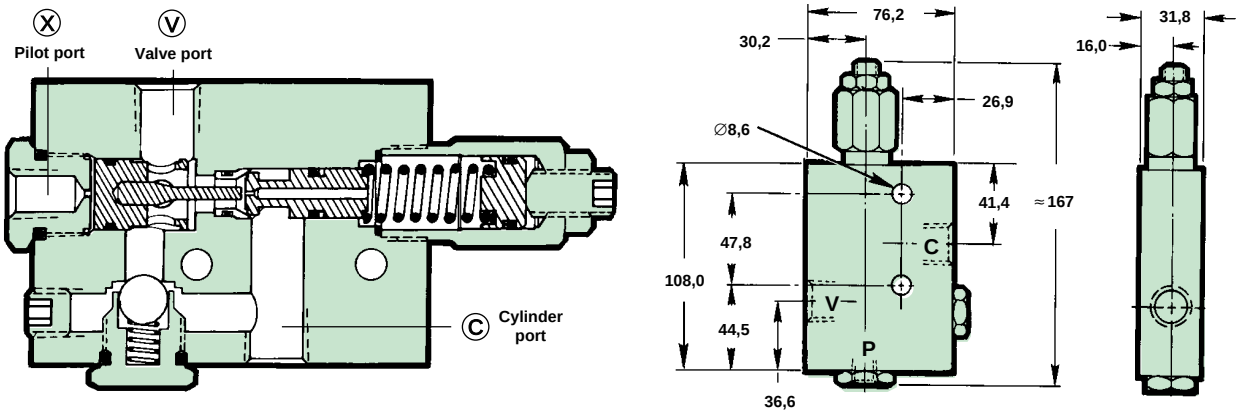
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$

Parts in Body 1E11



Specifications
- To 60 l/min and 350 bar.
- Maximum load induced pressures to:
  260 bar for -50 range
  155 bar for -30 range
  (based on 75% reseat)
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 0,91 kg.

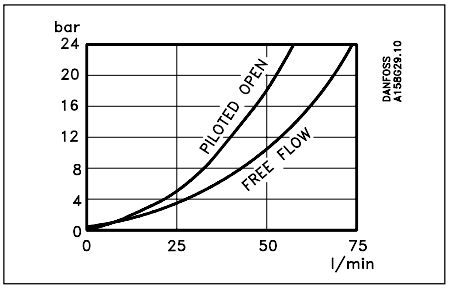
Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse flow check.
- Adjustable.
- 100% performance tested.

Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure.) When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check component — Hardened steel ball.
- Seals — Buna-N or Viton A.

How to order

1E11 - P 3 - 50 S 45

BASE PART NO.

ADJUST. MEANS
P = Leak Proof Screw

PORT SIZE
6T = 3/8" SAE (C & V Port) 1/4" SAE (X Port)
8T = 1/2" SAE (C & V Port) 1/4" SAE (X Port)
2 = 1/4" NPTF (C & V Port) 1/4" NPTF (X Port)
3 = 3/8" NPTF (C & V Port) 1/4" NPTF (X Port)
4 = 1/2" NPTF (C & V Port) 1/4" NPTF (X Port)
4W = G 1/2 (C & V Port) G 1/4 (X Port)

ADJUSTMENT RANGE
30 = 70-210 bar Std. Setting 175 bar
50 = 70-350 bar Std. Setting 280 bar

SEALS
S = Buna-N
SV = Viton A

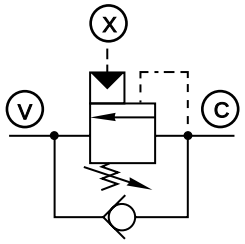
PILOT RATIO
OMIT = 10,75:1 Ratio
68 = 1,2:1 Ratio
45 = 2,75:1 Ratio
116 = 4,9:1 Ratio

Pilot Pressure Calculation Example

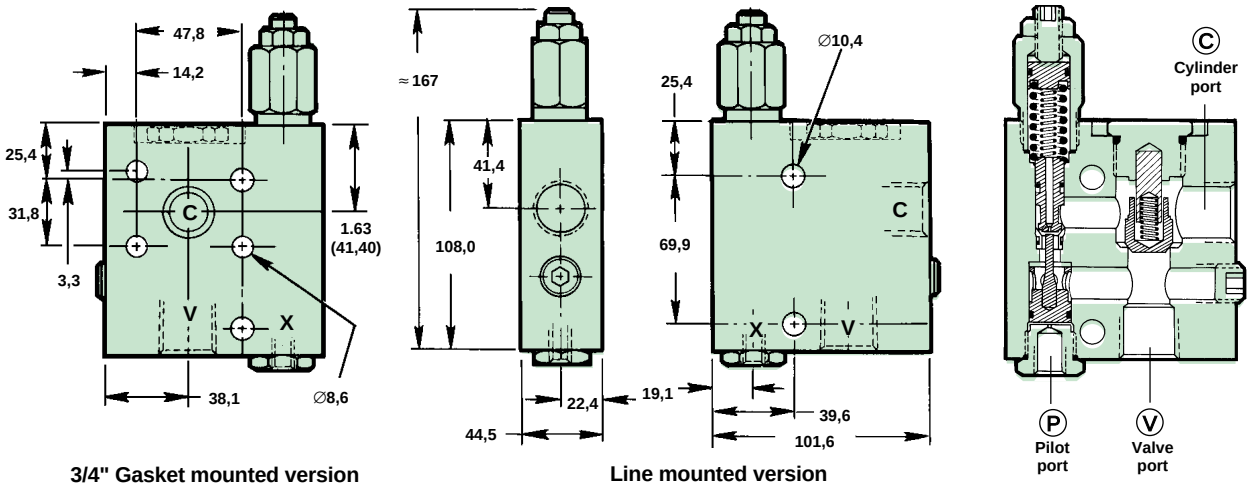
$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$



Parts in Body 1E15



3/4" Gasket mounted version **Line mounted version**

Specifications
- To 95 l/min and 350 bar.
- Maximum load induced pressures to:
  260 bar for -50S range
  155 bar for -30S range
  (based on 75% reseat)
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 1,32 kg.

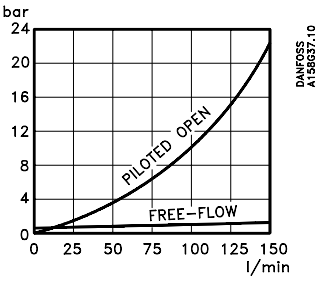
Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse flow check.
- Gasket mounted available.
- 100% performance tested.
- Adjustable.

Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves. Gasket mount is designed to be directly mounted to cylinder to maximize safety.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure.) When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check component — Hardened steel poppet.
- Seals — Buna-N or Viton A.

How to order

1E15 - P 12T - 30 S 45

BASE PART NO.

ADJUST. MEANS
P = Leak Proof Screw

PORT SIZE

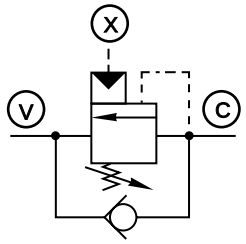
LINE MOUNTED
12T = 3/4" SAE (C & V)
3/8" SAE (X)
6 = 3/4" NPTF (C & V)
1/4" NPTF (X)
6W = G 3/4 (C & V)
G 1/4 (X)

GASKET MOUNTED
12T-12G = 3/4" SAE (V)
3/4" Gasket (C)
3/8" SAE (X)
6-12G = 3/4" NPTF (V)
3/4" Gasket (C)
1/4" NPTF (X)
6W-12G = G 3/4 (V)
3/4" Gasket (C)
G 1/4 (X)

ADJUSTMENT RANGE
30 = 70-210 bar
Std. Setting
175 bar
50 = 70-350 bar
Std. Setting
280 bar

SEALS
S = Buna-N
SV = Viton A

PILOT RATIO
OMIT = 10,75:1
68 = 1,2:1
45 = 2,75:1
116 = 4,9:1



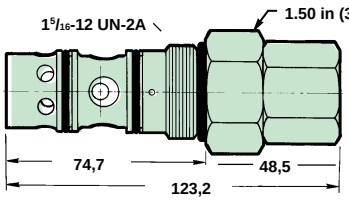
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

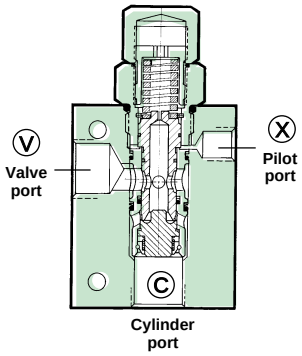
With 4:1 pilot ratio, relief set at 310 bar and 214 bar load pressure, then 24 bar pilot pressure is needed to move load.

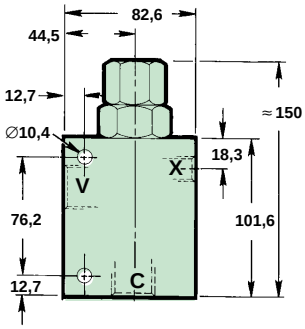
$$\frac{310 \text{ bar} - 214 \text{ bar}}{4} = 24 \text{ bar}$$

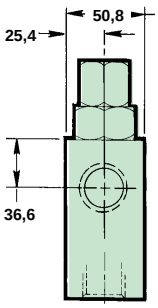
Cartridge 1E80



Cartridge in Body 1E81







Specifications
- To 95 l/min and 350 bar.
- Maximum load induced pressure to: 260 bar (based on 75% reseat).
- Cavity number: FC-173 (see page 22).
- Installation torque: 81-94 Nm.*
- Pilot ratios available: 4:1; 8,5:1
- Weight (1E80): 0,59 kg.
- Weight (1E81): 3,76 kg.

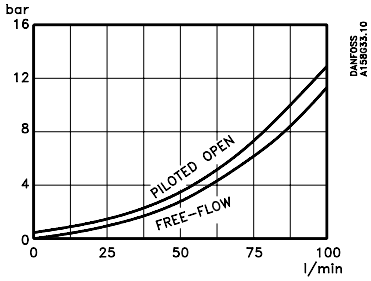
* With steel bodies.
For aluminium bodies consult factory.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse free flow check.
- Adjustable with min. & max. stops.
- 100% performance tested.

Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves. Cartridge construction allows installation in cylinder end for easy field replacement and maximum safety. The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure.) When lowering load, pilot pressure reduces the valve setting thus allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength steel.
- Cartridge — Steel.
- Internal parts — Hardened steel.
- Seals — Viton A standard.

How to order

1E81 - F 12T - 50 SV 4:1

BASE PART NO.
1E80 = Cartridge Only
1E81 = Cartridge in Body

ADJUST. MEANS
F = Screw

PORT SIZE (Body No.)
OMIT = Cartridge Only
12T = 3/4" SAE (C & V) 3/8" SAE (X) (981570-U)
6W = G 3/4 (C & V) G 1/4 (X) (981571W-U)

ADJUSTMENT RANGE
50 =70-350 bar Std. Setting 276 bar

SEALS
SV = Viton A

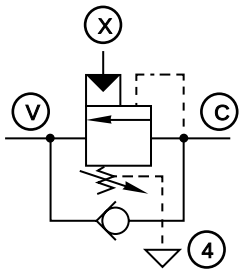
PILOT RATIO
4:1 = 4:1 Ratio
8.5:1 = 8,5:1 Ratio

Pilot Pressure Calculation Example

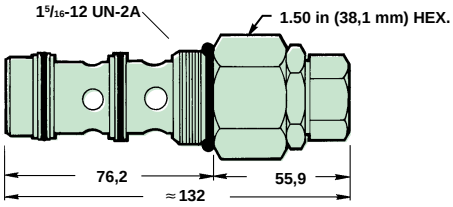
$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 4,25:1 pilot ratio, relief set at 157 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

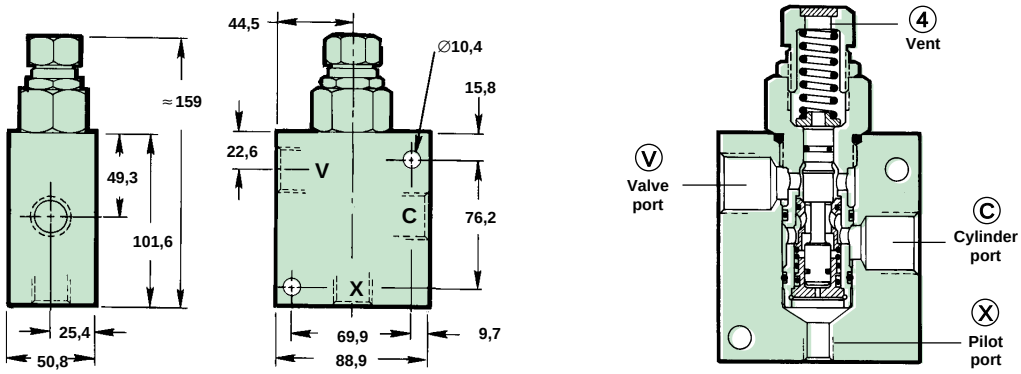
$$\frac{157 \text{ bar} - 70 \text{ bar}}{4{,}25} = 21 \text{ bar}$$



Cartridge 1E90



Cartridge in Body 1E91



Specifications
- To 95 l/min and 350 bar.
- Maximum load induced pressure to: 260 bar (based on 75% reseat)
- Cavity number: FC-173A (see page 22).
- Installation torque: 81-94 Nm.*
- Pilot ratio: 4,25:1
- Weight (1E90): 0,59 kg
- Weight (1E91): 3,76 kg

* With steel bodies.
For aluminium bodies consult factory.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse free flow check.
- Vented spring chamber allows valve to operate unaffected by back pressure downstream.
- Adjustable.
- 100% performance tested.

Use and operation

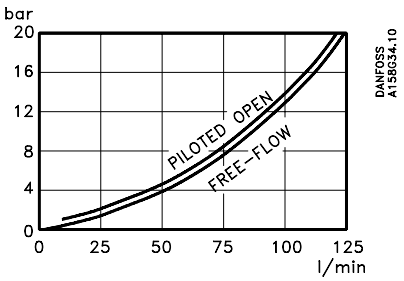
To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves. Cartridge construction allows installation in cylinder end for easy field replacement and maximum safety.

Vent feature allows valve to operate unaffected by back pressure.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure.)

When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength steel.
- Cartridge — Steel.
- Internal parts — Hardened steel.
- Seals — Viton A standard.

How to order

1E91 - F 12T - 50 SV

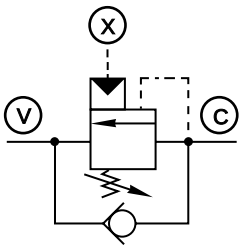
BASE PART NO.
1E90 = Cartridge Only
1E91 = Cartridge in Body

ADJUST. MEAN
F = Screw

PORT SIZE (Body No.)
OMIT = Cartridge Only
12T = 3/4" SAE (C & V), 3/8" SAE (X) (980969-U)
16T = 1" SAE (C & V), 3/8" SAE (X) (989033-U)
6W = G 3/4 (C & V), G 1/4 (X) (980968W-U)

ADJUSTMENT RANGE
50 = 70-350 bar
Std. Setting 280 bar

SEALS
SV = Viton A



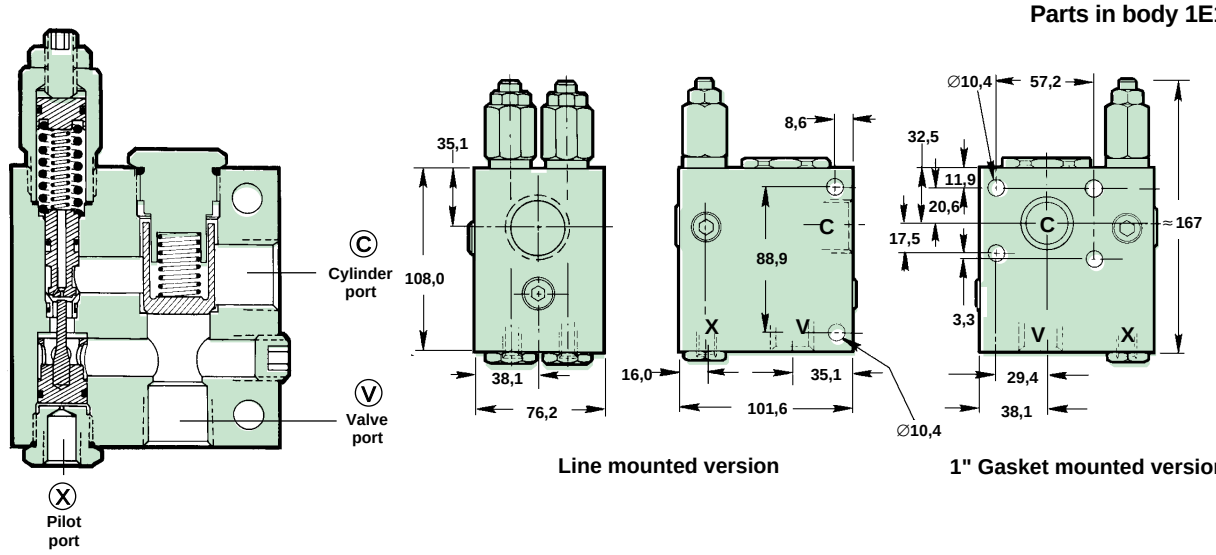
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$

Parts in body 1E16



Specifications
- To 150 l/min and 350 bar.
- Maximum load induced pressures to:
  260 bar for -50S range
  155 bar for -30S range
  (based on 65% reseat)
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 2,63 kg.

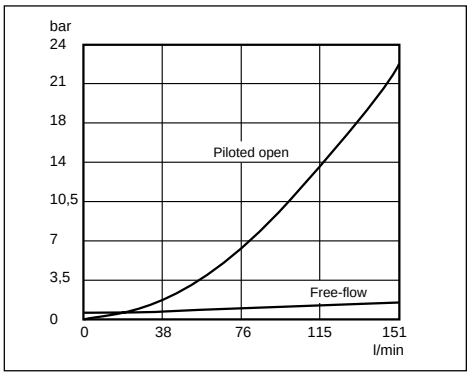
Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse flow check.
- Gasket mounted available.
- 100% performance tested.
- Adjustable.

Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves. Gasket mount is designed to be directly mounted to cylinder to maximize safety.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure). When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle closed to prevent runaway.

Performance curve



Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check component — Hardened steel poppet.
- Seals — Buna-N or Viton A.

How to order

1E16 - P 16T - 30 S 45

BASE PART NO.

ADJUST. MEANS
P = Leak Proof Screw

PORT SIZE

LINE MOUNTED
16T = 1" SAE (C & V)
3/8" SAE (X)
8 = 1" NPTF (C & V)
1/4" NPTF (X)
8W = G 1 (C & V)
G 1/4 (X)

GASKET MOUNTED
16T-16G = 1" SAE (V)
1" Gasket (C)
3/8" SAE (X)
8-16G = 1" NPTF (V)
1" Gasket (C)
1/4" NPTF (X)
8W-16G = G 1 (V)
1" Gasket (C)
G 1/4 (X)

ADJUSTMENT RANGE
30 = 70-210 bar
Std. Setting
175 bar
50 = 70-350 bar
Std. Setting
280 bar

SEALS
S = Buna-N
SV = Viton A

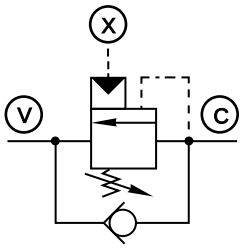
PILOT RATIO
OMIT = 10,75:1
68 = 1,2:1
45 = 2,75:1
116 = 4,9:1

Pilot Pressure Calculation Example

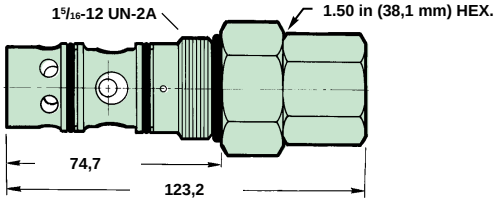
$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 4:1 pilot ratio, relief set at 310 bar and 214 bar load pressure, then 24 bar pilot pressure is needed to move load.

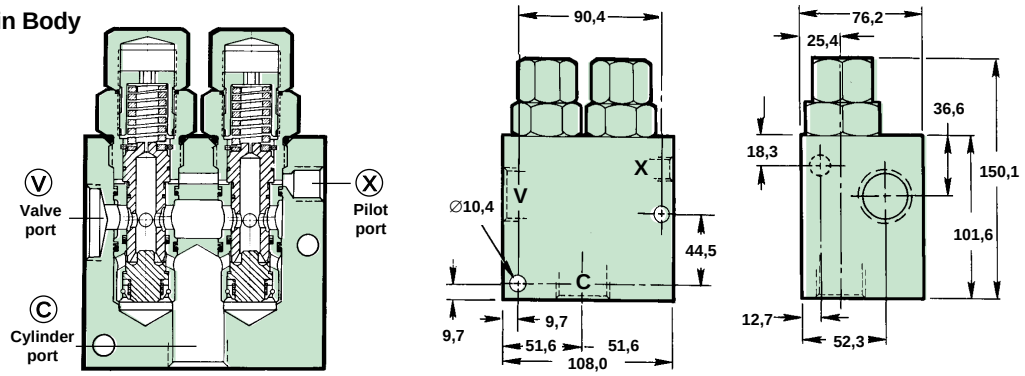
$$\frac{310 \text{ bar} - 214 \text{ bar}}{4} = 24 \text{ bar}$$



Cartridge 1E80



Cartridges in Body 1E82



Specifications
- To 190 l/min and 350 bar. Two 1E80 cartridges assembled in parallel to increase flow capacity.
- Maximum load induced pressure to: 260 bar (based on 75% reseat).
- Cavity number: FC-173 (see page 22).
- Installation torque: 81-94 Nm.*
- Pilot ratios available: 4:1, 8,5:1
- Weight (1E80): 0,59 kg.
- Weight (1E82): 7,08 kg.

* With steel bodies. For aluminium bodies consult factory.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse free flow check.
- Adjustable with min. & max. stops.
- 100% performance tested.

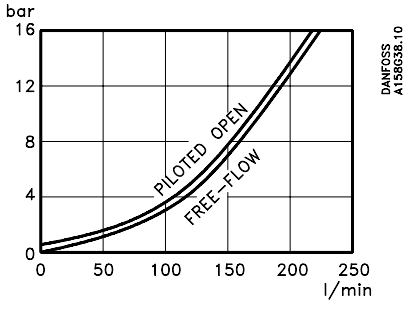
Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

Cartridge construction allows installation in cylinder end for easy field replacement and maximum safety.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure). When lowering load, pilot pressure reduces the valve setting thus allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength steel.
- Cartridge — Steel.
- Internal parts — Hardened steel.
- Seals — Viton A standard.

How to order

1E82 - F 16T - 50 SV 4:1

BASE PART NO.
1E80 = Cartridge Only
1E82 = Cartridges in Body

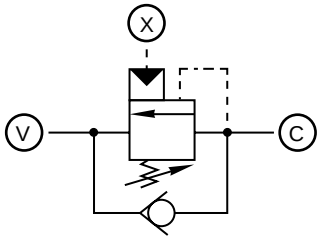
ADJUST. MEANS
F = Screw

PORT SIZE (Body No.)
OMIT = Cartridge Only
16T = 1" SAE (C & V) 3/8" SAE (X) (981577-U)
8W = G 1 (C & V) G 1/4 (X) (981576W-U)

ADJUSTMENT RANGE
50 = 70-350 bar Std. Setting 350 bar

SEALS
SV = Viton A

PILOT RATIO
4:1 = 4:1 Ratio
8.5:1 = 8,5:1 Ratio



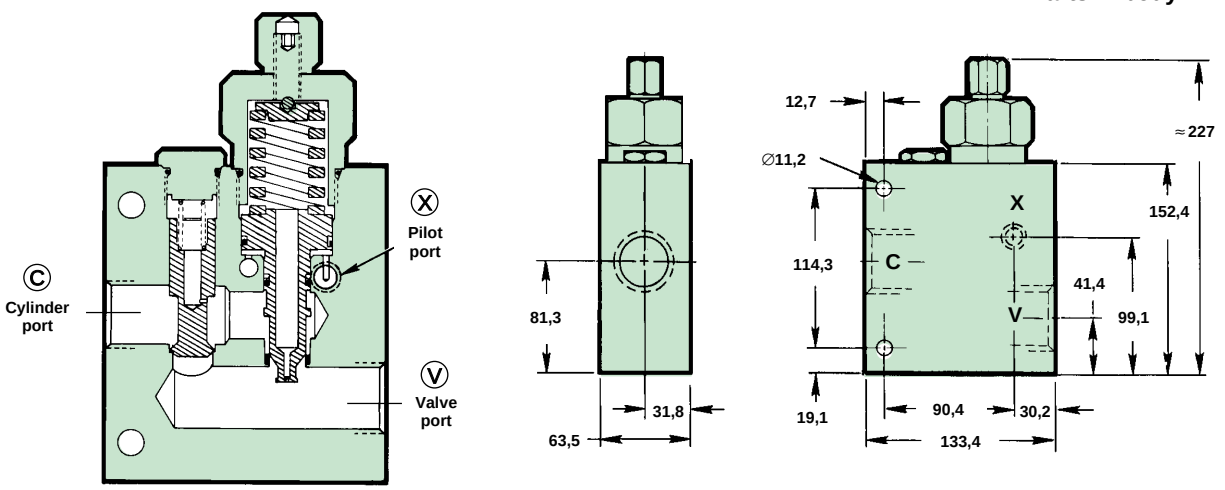
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,25:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 25 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}25} = 25 \text{ bar}$$

Parts in body 1E21



Specifications
- To 305 l/min and 210 bar.
- Maximum load induced pressure to: 155 bar (based on 75% reseat)
- Pilot ratios available: 2,25:1; 6,5:1
- Weight: 4,20 kg.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse flow check.
- Adjustable.
- 100% performance tested.

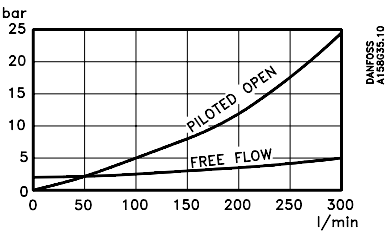
Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure).

When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength aluminium.
- Internal parts — Hardened steel.
- Check component — Hardened steel poppet.
- Seals — Buna-N or Viton A.

How to order

1E21 - F 16T - 30 S 88

BASE PART NO.

ADJUST. MEANS
F = Screw

PORT SIZE
16T = 1" SAE (C & V) 1/4" SAE (X)
20T = 1-1/4" SAE (C & V) 1/4" NPTF (X)
20F = 1-1/4" SAE Flange (C & V) 1/4" NPTF (X)
8 = 1" NPTF (C & V) 1/4" NPTF (P)
10 = 1-1/4" NPTF (C & V) 1/4" NPTF (X)
8W = G 1 (C & V) G 1/4 (X)
10W = G 1-1/4 (C & V) G 1/4 (X)

ADJUSTMENT RANGE
30 = 70-210 bar Std. Setting 175 bar

SEALS
S = Buna-N
SV = Viton A

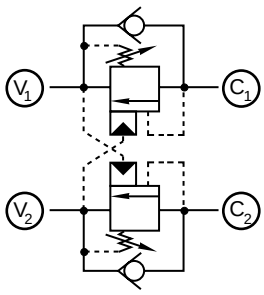
PILOT RATIO
OMIT = 6,5:1 Ratio
88 = 2,25:1 Ratio

Pilot Pressure Calculation Example

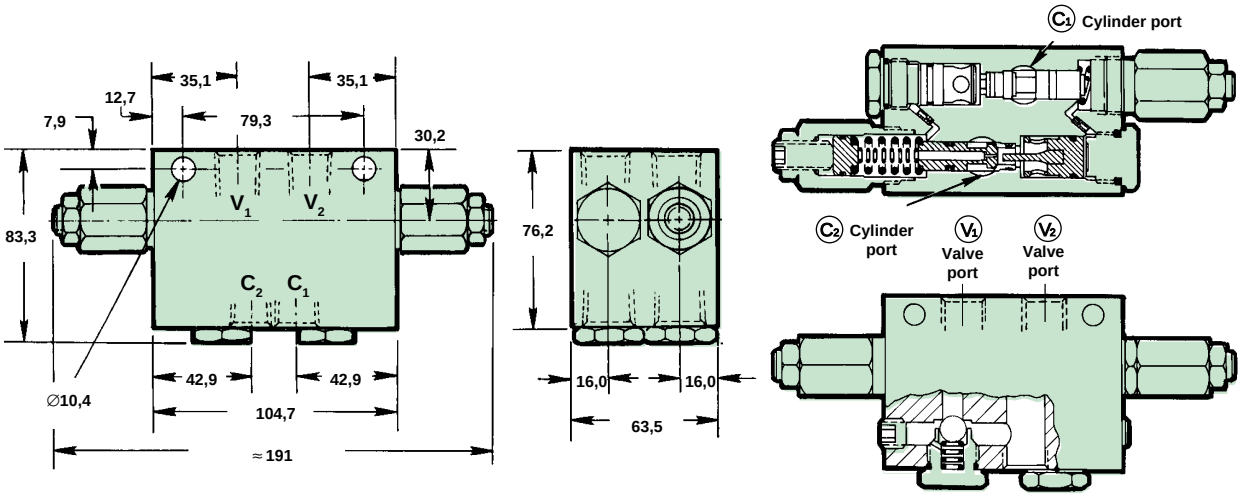
$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$



Parts in Body 1EE13



Specifications
- To 60 l/min and 350 bar.
- Maximum load induced pressures to:
  260 bar for -50 range
  155 bar for -30 range
  (based on 75% reseat)
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 1,81 kg.

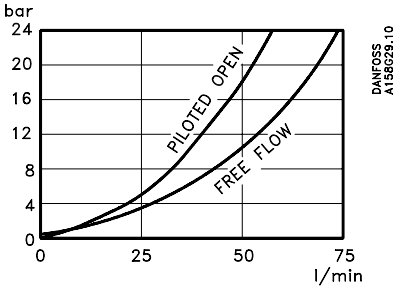
Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse free flow check.
- Dual design provides load control in both directions without plumbing cross pilot lines.
- Adjustable.
- 100% performance tested.

Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure). When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check components — Hardened steel balls.
- Seals — Buna-N or Viton A.

How to order

1EE13 - P 4 - 30 S 45

BASE PART NO.

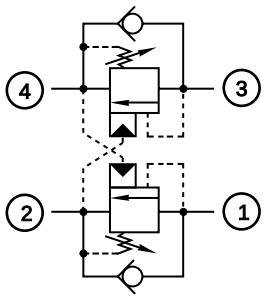
ADJUST. MEANS
P = Leak Proof Screw

PORT SIZE (Body No.)
6T = 3/8" SAE
8T = 1/2" SAE
3 = 3/8" NPTF
4 = 1/2" NPTF
4W = G 1/2

ADJUSTMENT RANGE
30 = 70-210 bar
Std. Setting 175 bar
50 = 70-350 bar
Std. Setting 280 bar

SEALS
S = Buna-N
SV = Viton A

PILOT RATIO
OMIT = 10,75:1 Ratio
68 = 1,2:1 Ratio
45 = 2,75:1 Ratio
116 = 4,9:1 Ratio



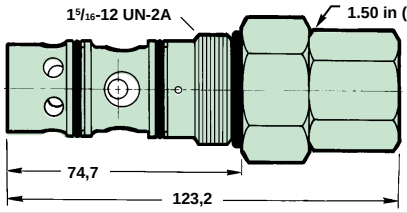
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

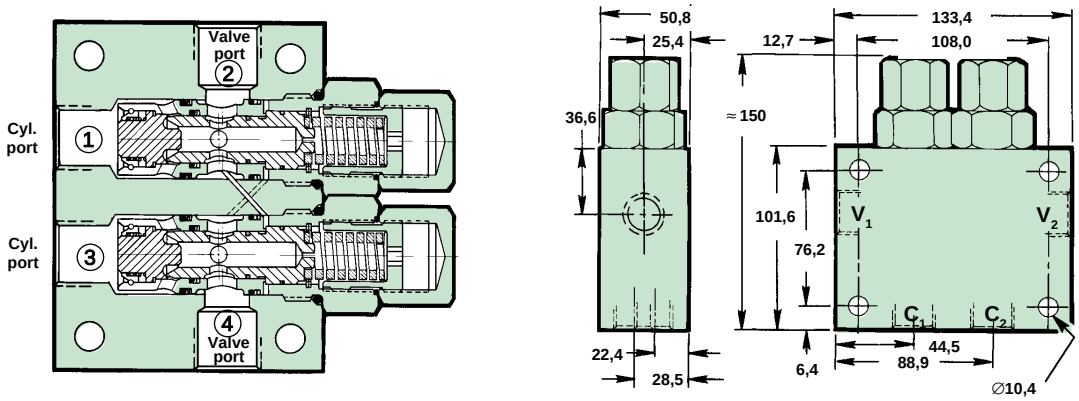
With 4:1 pilot ratio, relief set at 310 bar and 214 bar load pressure, then 24 bar pilot pressure is needed to move load.

$$\frac{310 \text{ bar} - 214 \text{ bar}}{4} = 24 \text{ bar}$$

Cartridge 1E80



Cartridges in Body 1EE81



Specifications
- To 95 l/min and 350 bar.
- Maximum load induced pressure to 260 bar (based on 75% reseat).
- Cavity number: FC-173 (see page 22).
- Installation torque: 81-94 Nm.*
- Pilot ratios available: 4:1, 8,5:1.
- Weight: 10,30 kg.

* With steel bodies.
For aluminium bodies, consult factory.

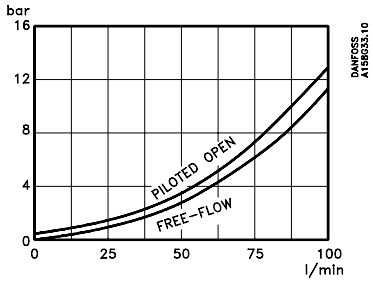
Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Matched, lapped assemblies.
- Built-in reverse free flow check.
- Dual design provides load control in both directions without plumbing cross pilot lines.
- Adjustable.
- 100% performance tested.

Use and operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure). When lowering load, pilot pressure reduces the valve setting thus allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressures will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Δp versus flow

Materials
- Body — High strength steel.
- Cartridges — Hardened steel.
- Internal parts — Steel.
- Seals — Viton A standard.

How to order

1EE81 - F 12T - 50 SV 4:1

BASE PART NO.
1E80 = Cartridge Only
1EE81 = Cartridge in Body

ADJUST. MEANS
F = Screw

PORT SIZE (Body No.)
OMIT = Cartridge Only
12T = 3/4" SAE (981572-U)
6W = G 3/4 (981573W-U)

ADJUSTMENT RANGE
50 = 70-350 bar
Std. Setting 280 bar

SEALS
SV = Viton A

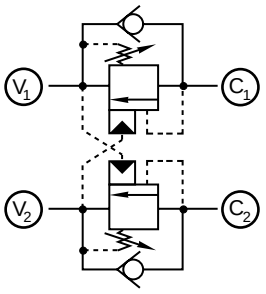
PILOT RATIO
4:1 = 4:1 Ratio
8.5:1 = 8,5:1 Ratio

Pilot Pressure Calculation Example

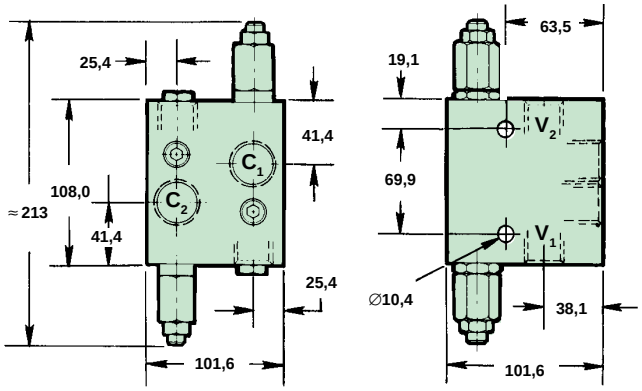
$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

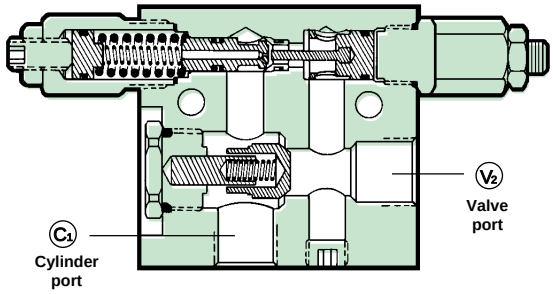
With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$



Parts in Body 1EE15





Specifications
- To 95 l/min and 350 bar.
- Maximum load induced pressures to: 260 bar for -50 range 155 bar for -30 range (based on 75% reseat)
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 2,63 kg.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse flow check.
- Dual design provides load control in both directions without plumbing cross pilot lines.
- Adjustable.
- 100% performance tested.

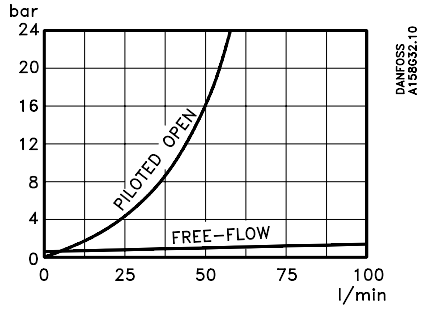
Use and Operation

To control moving loads and prevent loads from running ahead of pump. Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure.) When lowering load, pilot pressure reduces the valve setting, allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check components — Hardened steel poppets.
- Seals — Buna-N or Viton A.

Performance curve

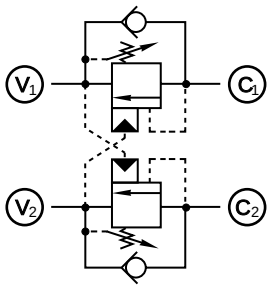


Δp versus flow

How to order

1EE15 - P 12T - 30 S 45

BASE PART NO.	ADJUST. MEANS	PORT SIZE	ADJUSTMENT RANGE	SEALS	PILOT RATIO
	P = Leak Proof Screw	**12T**= 3/4" SAE **6** = 3/4" NPTF **6W** = G 3/4	**30** = 70-210 bar Std. Setting 172 bar **50** = 70-350 bar Std. Setting 280 bar	**S** = Buna-N **SV** = Viton A	**OMIT** = 10,75:1 Ratio **68** = 1,2:1 Ratio **45** = 2,75:1 Ratio **116** = 4,9:1 Ratio



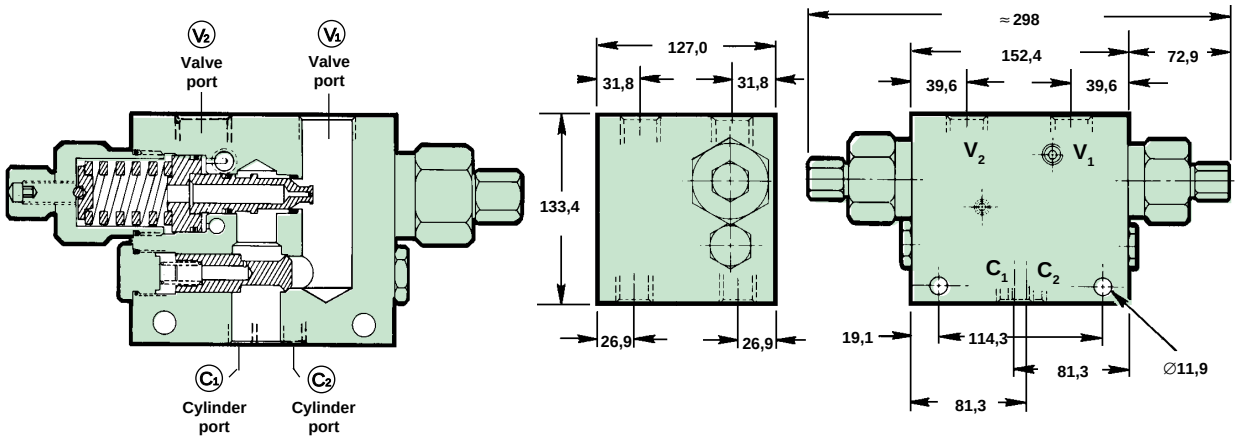
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,25:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 25 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}25} = 25 \text{ bar}$$

Parts in Body 1EE21



Specifications
- To 305 l/min and 210 bar.
- Maximum load induced pressure to 155 bar (based on 75% reseat).
- Pilot ratios available: 2,25:1; 6,5:1.
- Weight: 8,39 kg.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse free flow checks.
- Dual design provides load control in both directions without plumbing cross pilot lines.
- Adjustable.
- 100% performance tested.

Use and operation

To control moving loads and prevent loads from running ahead of pump.

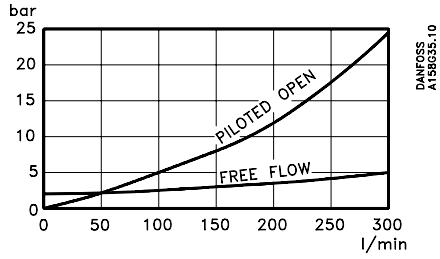
Holds load in any position without drift and provides overload relief and thermal expansion relief with open center control valves.

The load is raised by free flow of oil through check section. With control valve centered, load is held (relief must be set at least 30% higher than the maximum load induced pressure).

When lowering load, pilot pressure reduces the valve setting, this allowing the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Materials
- Body — High strength aluminium alloy.

Performance curve



Δp versus flow

- Internal parts — Hardened steel.
- Check components — Hardened steel poppets.
- Seals — Buna-N or Viton A.

How to order

1EE21 - F 16T - 30 S 88

BASE PART NO.

ADJUST. MEANS
F = Screw

PORT SIZE
16T = 1" SAE
20T = 1-1/4" SAE
20F = 1-1/4" SAE Flange
8 = 1" NPTF
10 = 1-1/4" NPTF
8W = G 1

ADJUSTMENT RANGE
30 = 70-210 bar
Std. Setting 172 bar

SEALS
S = Buna-N
SV = Viton A

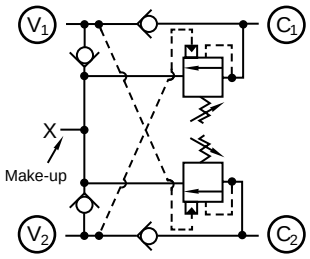
PILOT RATIO
OMIT = 6,5:1 Ratio
88 = 2,25:1 Ratio

Pilot Pressure Calculation Example

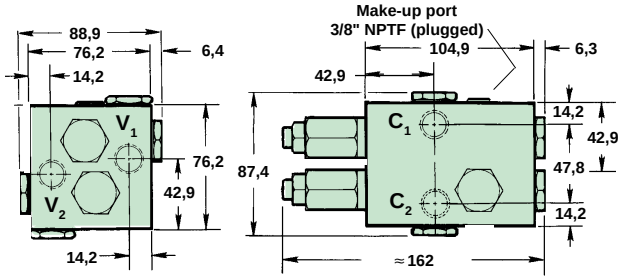
$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

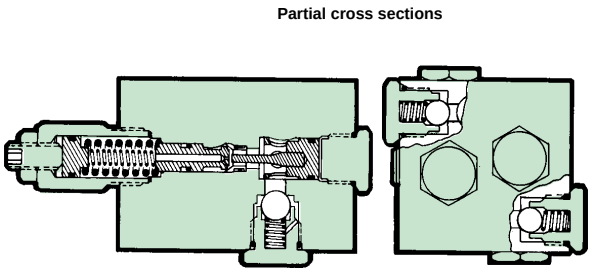
With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$



Parts in Body 1EEC11





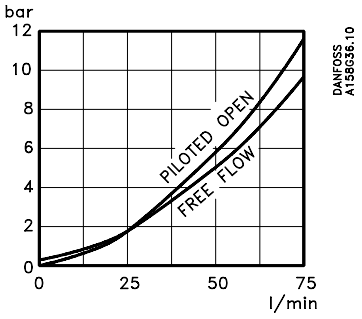
Specifications
- To 60 l/min and 350 bar.
- Maximum load induced pressure to:
  260 bar for -50 range
  155 bar for -30 range
  (based on 75% reseat).
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 2,04 kg.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse flow and make-up checks.
- Dual design provides load control in both directions without plumbing cross pilot lines.
- Adjustable.
- 100% performance tested.

Use and operation
To smoothly control loads when starting, stopping and during operation.

Prevents load runaway, provides dual relief protection, holds load and provides make-up oil. Also gives thermal and overload relief protection.
Oil passes through the free-flow check moving the load. Oil from the actuator outlet is blocked and must pass over the opposite relief section. The reliefs are pilot assisted as in the overcenter valve. Pressure in the free-flow direction is needed to move the load, which also provides pilot pressure to the opposite relief valve. This pilot pressure effectively lowers the relief setting, allowing the load to be moved with minimum pressure. With control valve centered, valve functions as a dual relief. When make-up feature is needed, remove pipe plug in optional make-up port and connect to reservoir or charge system. This allows the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Δp versus flow

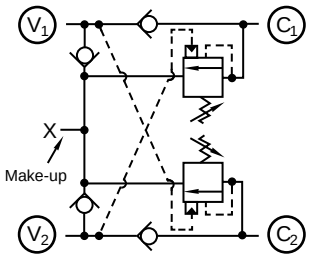
Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check components — Hardened steel balls.
- Seals — Buna-N or Viton A.

How to order

1EEC11 - P 6T - 30 S 45

BASE PART NO.	ADJUST. MEANS	PORT SIZE	ADJUSTMENT RANGE	SEALS	PILOT RATIO
	P = Leak Proof Screw	**6T** = 3/8" SAE **3** = 3/8" NPTF **3W** =G 3/8	**30** = 70-210 bar Std. Setting 175 bar **50** = 70-350 bar Std. Setting 280 bar	**S** = Buna-N **SV** = Viton A	**OMIT** = 10,75:1 Ratio **68** = 1,2:1 Ratio **45** = 2,75:1 Ratio **116** = 4,9:1 Ratio

*** Acronym for Make-Up, Dual Relief, Over Center.**



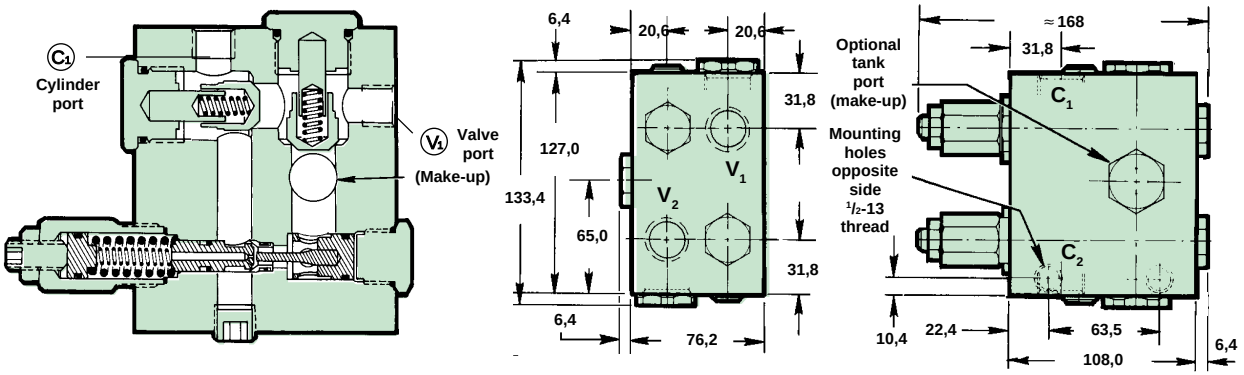
Pilot Pressure Calculation Example

$$\frac{\text{Relief Setting} - \text{Load Pressure}}{\text{Pilot Ratio}} = \text{Pilot Pressure Required}$$

With 2,75:1 pilot ratio, relief set at 126 bar and 70 bar load pressure, then 21 bar pilot pressure is needed to move load.

$$\frac{126 \text{ bar} - 70 \text{ bar}}{2{,}75} = 21 \text{ bar}$$

Parts in Body 1EEC12



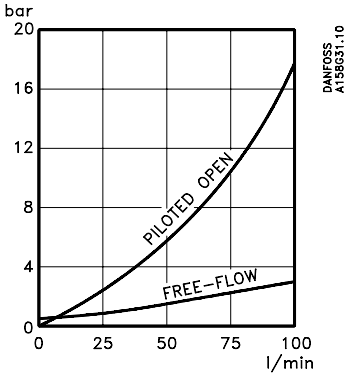
Specifications
- To 95 l/min and 350 bar.
- Maximum load induced pressure to: 260 bar for -50S range 155 bar for -30S range (based on 75% reseat).
- Pilot ratios available: 1,2:1; 2,75:1; 4,9:1; 10,75:1.
- Weight: 3,76 kg.

Features
- Fast acting, reliable operation.
- Lapped, hardened steel working parts for long life.
- Low leakage.
- Built-in reverse free flow and make-up checks.
- Dual design provides load control in both directions without plumbing cross pilot lines.
- Adjustable.
- 100% performance tested.

Use and operation
To smoothly control loads when starting, stopping and during operation.

Prevents load runaway, provides dual relief protection, holds load and provides make-up oil. Also gives thermal and overload relief protection.
Oil passes through the free-flow check moving the load. Oil from the actuator outlet is blocked and must pass over the opposite relief section. The reliefs are pilot assisted as in the overcenter valve. Pressure in the free-flow direction is needed to move the load, which also provides pilot pressure to the opposite relief valve. This pilot pressure effectively lowers the relief setting, allowing the load to be moved with minimum pressure. With control valve centered, valve functions as a dual relief. When make-up feature is needed, remove pipe plug in optional make-up port and connect to reservoir or charge system. This allows the load to be smoothly controlled with minimum energy loss. If load tries to run ahead of pump, pilot pressure will decrease and the relief section will throttle or close to prevent runaway.

Performance curve



Δp versus flow

Materials
- Body — High strength aluminium alloy.
- Internal parts — Hardened steel.
- Check components — Hardened steel poppets.
- Seals — Buna-N or Viton A.

How to order

1EEC12 - P 6 - 30 S 45

BASE PART NO.

ADJUST. MEANS
P = Leak Proof Screw

PORT SIZE
8T = 1/2" SAE
12T = 3/4" SAE
4 = 1/2" NPTF
6 = 3/4" NPTF
4W = G 1/2
6W = G 3/4

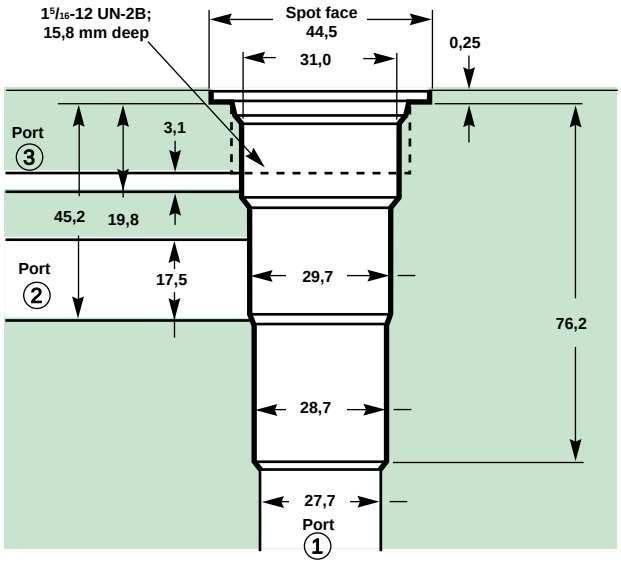
ADJUSTMENT RANGE
30 = 70-210 bar Std. Setting 175 bar
50 = 70-350 bar Std. Setting 280 bar

SEALS
S = Buna-N
SV = Viton A

PILOT RATIO
OMIT = 10,75:1 Ratio
68 = 1,2:1 Ratio
45 = 2,75:1 Ratio
116 = 4,9:1 Ratio

*** Acronym for Make-Up, Dual Relief, Over Center.**

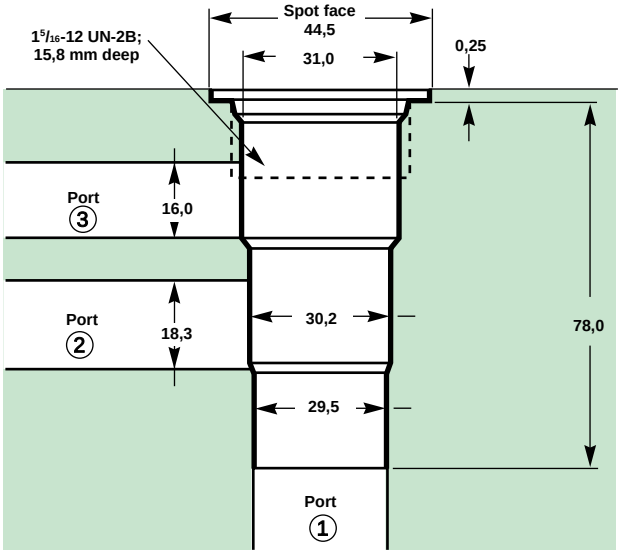
FC-173
Three port



Note: Please obtain certified cavity and tool drawings before machining.

Tools Required for Machining Cavity
Drill: D-1238
Reamer: R-1175
Tap: T-1051

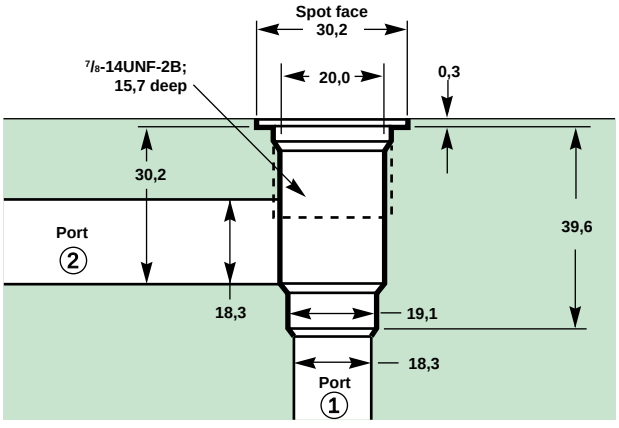
FC-173A
Three port



Note: Please obtain certified cavity and tool drawings before machining.

Tools Required for Machining Cavity
Drill: D-1770
Reamer: R-1650
Tap: T-1130

FC-76
Two port



Note: Please obtain certified cavity and tool drawings before machining.

Tools Required for Machining Cavity
Drill: D-1137
Reamer: R-140
Tap: T-1014

Fluid Power

Fluid Power

Product and catalogue survey

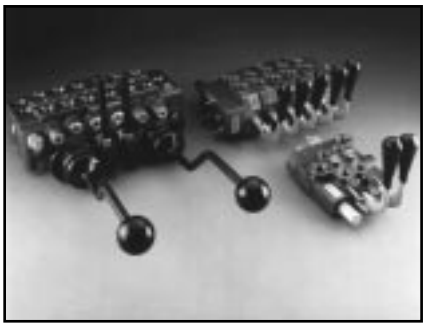
Products	Catalogue Ordering No.
Spreader Valves	HK.66.B -.02
600 Series Valves	HK.66.C -.02
400 Series Valves	HK.66.D -.02
Relief Valves	HK.66.F -.02
Sequence Valves	HK.66.G -.02
Pressure Reducing Valves	HK.66.H -.02
Motion Control Valves	HK.66.I -.02
Unloading Valves and Pressure Intensifying Valves	HK.66.J -.02
Needles and Restrictor Valves	HK.66.K -.02
Flow Regulator Valves and Flow Divider Valves	HK.66.L -.02
Pilot operated Check Valves	HK.66.M-.02
Directional Control/Logic Valves	HK.66.N -.02
Solenoid Directional Control Valves	HK.66.O -.02

World Class Leadership in Technology

Danfoss Fluid Power, a division of Danfoss, Inc., offers one of the world's largest selections of quality fluid power components. An exceptional overall offering of Danfoss, Dukes, Fluid Controls and Webster components allows you to choose the right products to meet your application. All of our units are manufactured and tested to exacting engineering and quality control standards to provide reliable long lasting performance.

Danfoss Products

Danfoss products are known throughout the world for their quality, reliability and flexibility. From hydraulic motors, pumps, actuators and hydrostatic steering components, to proportional hydraulics and electronics, Danfoss components redefine the leading edge.



Dukes Products

The Dukes name is recognized as the premier U.S. manufacturer of mobile directional control valves for applications to 115 l/min. Your specific needs can be addressed with mono-block or stack valves, or if required, a custom designed valve.

Fluid Controls Products

Beginning with the development of a compact, pilot-operated hydraulic relief valve over 40 years ago, Fluid Controls has remained a pioneer in hydraulic product miniaturization. Along with the wide variety of cartridge valves currently available, Fluid Controls also features parts-in-body valves, and hydraulic integrated circuits to meet all of your requirements.

Webster Products

Since 1945, Webster has been at the forefront in the development of hydraulic gear pumps and cost effective multi-circuit components. Offering a wide range of gear pumps and motors, Webster products can be found in a multitude of applications. The AC and DC power unit lines offer dependable, self-contained sources of hydraulic power. Flow dividers and rotary shear valves further enhance the Webster line and expand the choices available from Danfoss Fluid Power.