

## KCB

### LOAD HOLDING VALVES

max operating pressure **350** bar

max set pressure **420** bar

#### SAE CAVITIES

KCB08 max 30 l/min

KCB10 max 60 l/min

KCB12 max 120 l/min

KCB16 max 200 l/min

KCB20 max 350 l/min

#### SUN CAVITIES

KCB1S max 75 l/min

KCB4S max 150 l/min

#### EATON CAVITY

KCB1E max 30 l/min



**INTRODUCTION**

Each size currently available consists of several versions (normal or vented design), with different pilot ratios, fixed or variable pressure settings, and with different Q – Δp characteristics (from the most restrictive for particularly fine movements to the largest openings the size can allow).

For special needs, we recommend contacting us.

**FLUIDS**

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

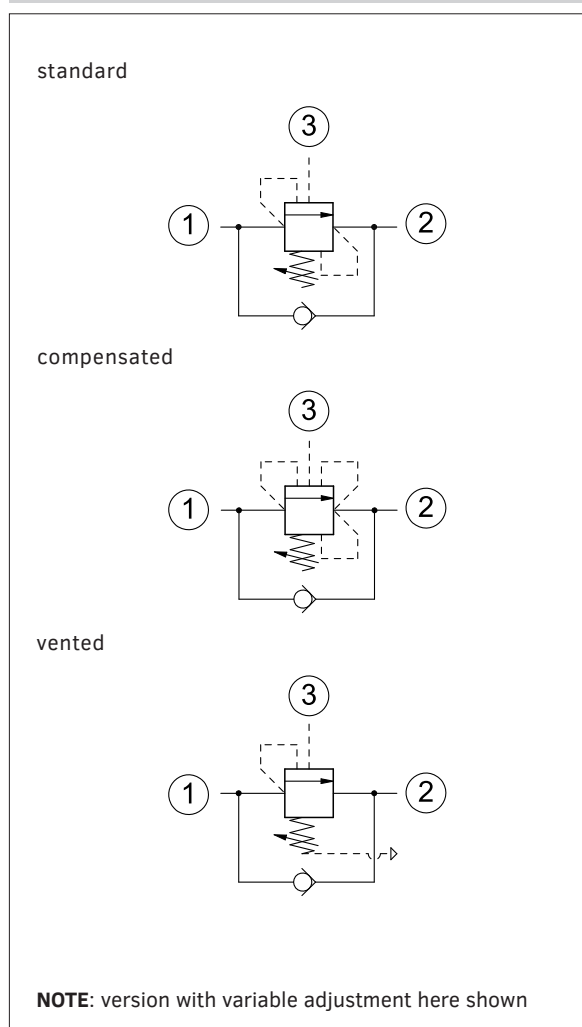
**KCB\*\* OPERATING PARAMETERS**

<b>MAXIMUM OPERATING PRESSURE</b>		350 bar	5000 psi
<b>FLOW CAPACITY</b>	KCB08 (SAE 08)	30 l/min	8 gpm
	KCB10 (SAE 10)	60 l/min	16 gpm
	KCB12 (SAE 12)	120 l/min	32 gpm
	KCB16 (SAE 16)	200 l/min	53 gpm
	KCB 20 (SAE 20)	350 l/min	92.5 gpm
	KCB1S (SUN T11A)	75 l/min	20 gpm
	KCB4S (SUN T2A)	150 l/min	39.5 gpm
	KCB1E (EATON A6610)	30 l/min	8 gpm

<b>RESEAT</b>	>85%
<b>MAXIMUM VALVE LEAKAGE AT RESEAT</b>	5 drops / minute
<b>ADJUSTMENT DIRECTION</b>	clockwise increases pressure

<b>TEMPERATURE RANGE</b>	ambient	-30 to +100 °C	-22 to +212 °F
	fluid	-20 to +82 °C	-4 to +180 °F
<b>FLUID VISCOSITY</b>	range	10 - 500 cSt	60-1900 SUS
	recommended	25 cSt	120 SUS
<b>FLUID CONTAMINATION</b>	ISO 4406:1999 class 19/17/14		

**HYDRAULIC SYMBOLS**



## FUNCTIONS

KCB valves control the movement of a hydraulic actuator (cylinder or motor), specifically:

- Safe locking of actuator with directional valve in idle position (or with pump stopped).
- Controlled movements of the actuator when the load is descending. Due to the presence of the pilot line, the velocity of the actuator is always due to the flow rate from the pump, even in the case of dragging load, cavitation phenomena that can cause serious accidents due to loss of control are avoided.
- Limit the maximum pressure in the service due to any shocks, overloads or abrupt manoeuvres.
- Allow free rise of the load thanks to a built-in check valve.

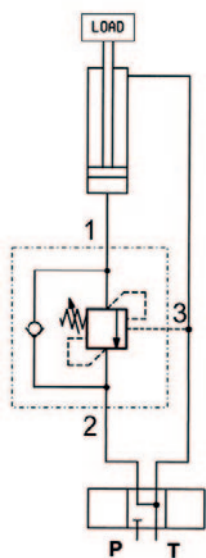


FIGURE 1  
Typical use of a counterbalance valve to control the descent of a load.

## PILOT RATIO

The quotient of the active area on the pilot line and the active area of the valve acting as a pressure limiter defines the pilot ratio  $R$  of the counterbalance valve:

$$R = \frac{\text{pilot area}}{\text{relief area}}$$

With reference to Figure 1, during descent, the pressure acting on the rod side of the cylinder also acts on the pilot line (3) of the valve, aiding its opening.

Load-induced pressure also pushes the cylinder downward. We call the pressure on the port (3)  $P_p$ , the load-induced pressure  $P_c$ , the setting pressure of the valve  $P_{TAR}$  and the pilot ratio  $R$ . Neglecting back pressure, for a scheme as in Figure 1, we have that the minimum pressure required to operate the valve descent

$$P_p \text{ is: } P_p = \frac{P_{TAR} - P_c}{R}$$

Example:  
valve set to  $P_{TAR} = 350$  bar, load-induced pressure  $P_c = 250$  bar, pilot ratio 4:1 ( $R = 4$ ).

$$P_p = \frac{350 - 250}{4} = 25 \text{ bar}$$

## VALVES IN NORMAL, COMPENSATED OR VENTED DESIGN

Due to the construction geometry, a normal counterbalance valve is strongly affected by back pressure at the port (2).

If this pressure is not zero, then the pilot pressure in the previous example should be fixed with:

$$P'_p = P_p + P_2 \cdot \frac{R+1}{R}$$

In addition, the pressure will be relieved to an upper value that can be calculated by:

$$P_R = P_{TAR} + P_2 \cdot (R + 1)$$

If in the example above we had a back pressure of  $P_2 = 20$  bar, then:

$$P'_p = 25 + 20 \cdot \frac{4+1}{4} = 50 \text{ bar}$$

While the valve set at 350 bar would relieve the pressure to:

$$P_R = 350 + 20 \cdot (4 + 1) = 450 \text{ bar}$$

If this is not acceptable, there is the vented version that makes the counterbalance valve completely insensitive to back pressure because the spring is air-vented.

Such valves are commonly used in directional control valves with services locked in the idle position, with antishock auxiliary valves on the ports.

Typical use cases are:

- Counterbalance valves operating with limited pilot pressures, or in the presence of back pressure (example: regenerative circuits or with actuators connected in series).
- Progressive and stable opening is required in the presence of oscillating back pressure.
- Counterbalance valves with opening piloted directly by hydraulic joystick pressure.

In the compensated versions, the spring chamber is connected to the discharge port (2). However, this valve type has a special configuration on the relief piston that allows the relief opening independently from any back pressure. The pilot opening pressure, instead, remains influenced by backpressure at port 2.

These valves may be employed in those applications that require to relieve pressure at the established pressure setting value, independently from any backpressure in the return line.

They are frequently fitted in systems with directional valves with closed center spools equipped with port relief valves.

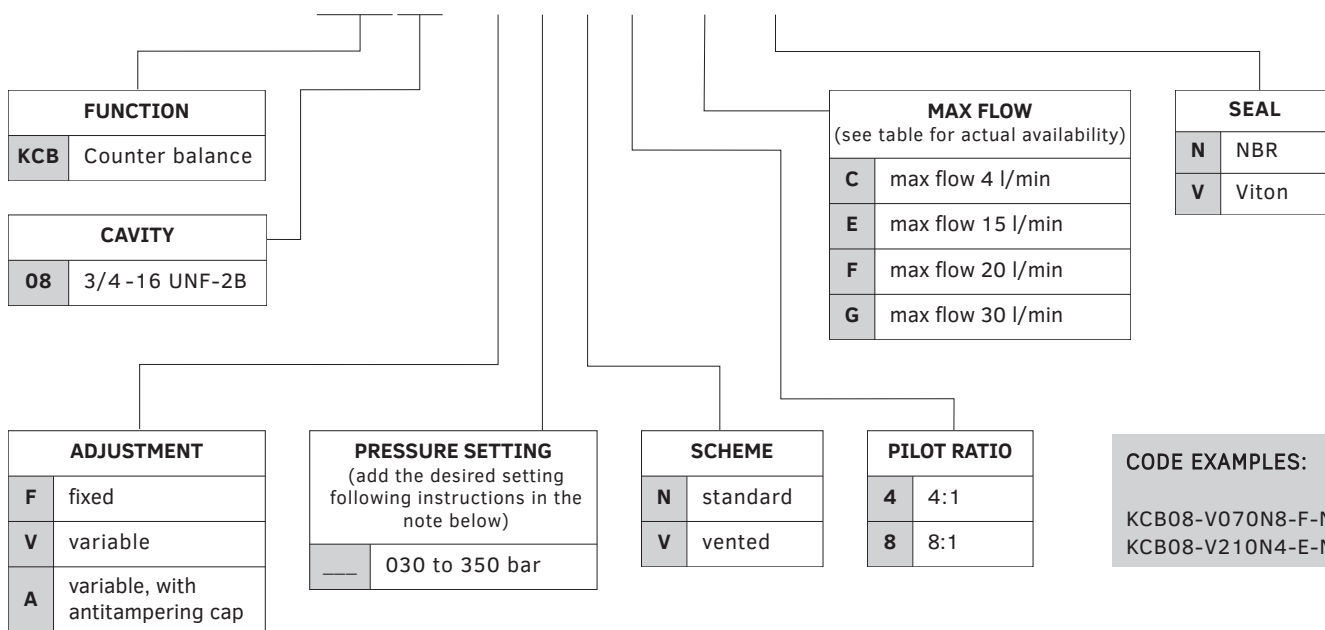
## PRESSURE SETTING

For the pressure relief function, the valve must remain closed even when the utility is subjected to the maximum load allowed by the application ( $P_{max}$ ).

For this purpose, it is generally required that **the set pressure is at least 30% more than the pressure induced by the maximum permissible load, thus:  $P_t \geq 1.3 \cdot P_{max}$**

CARTRIDGES FOR SAE 08 CAVITY

**KCB08** - ■ ■ ■ ■ - ■ - ■ -1 ————— design mark



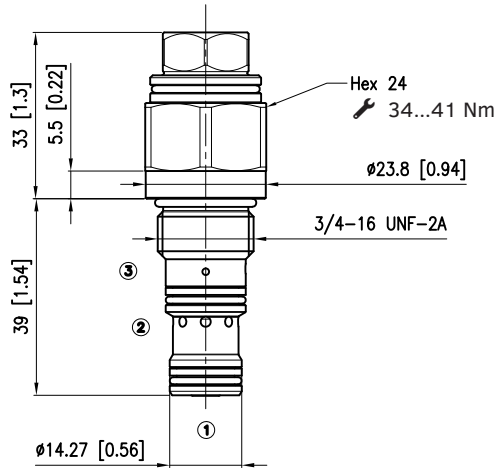
AVAILABILITY TABLE								
ADJUSTMENT	SCHEME	PRESSURE RANGE	PILOT RATIO	MAX FLOW (l/min)				SEAL
				C (4)	E (15)	F (20)	G (30)	
F / V / A	N	030 ÷ 350	4	■	■		■	N / V
	N	070 ÷ 350	8			■		
	V		4	■	■		■	

**AVAILABLE SETTINGS**

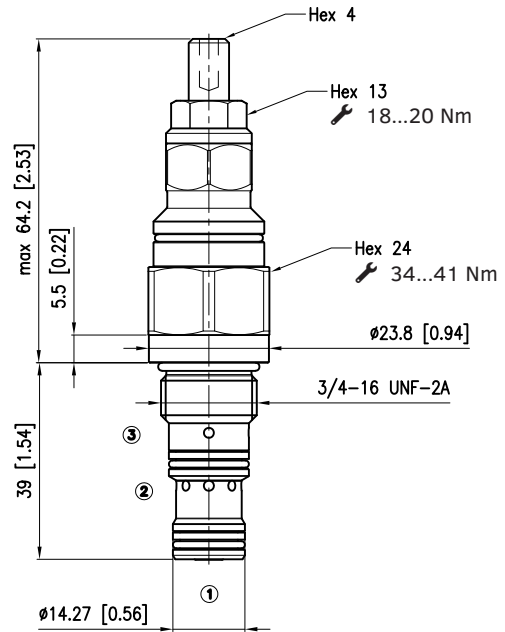
- Adjustments types **V** and **A**: choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)

- Adjustment type **F**: choose the desired pressure value within the pressure range, 5 bar step, indicated in the availability table (e.g. 080 bar, 085 bar, etc).

KCB08-F - FIXED ADJUSTMENT

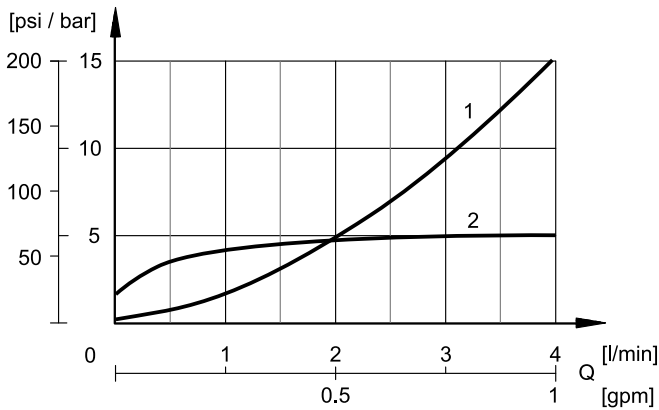


KCB08-V - VARIABLE ADJUSTMENT

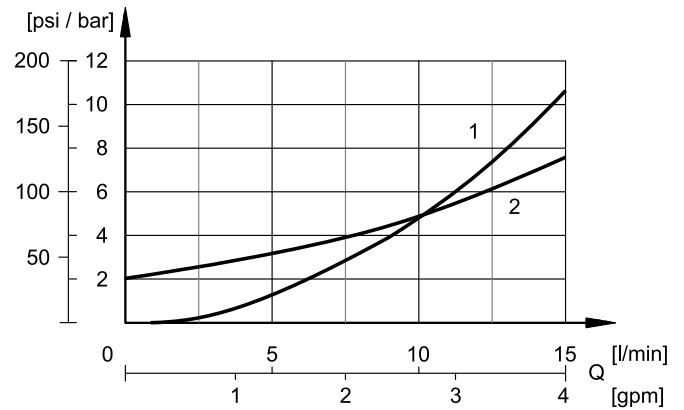


dimensions in mm [inch]

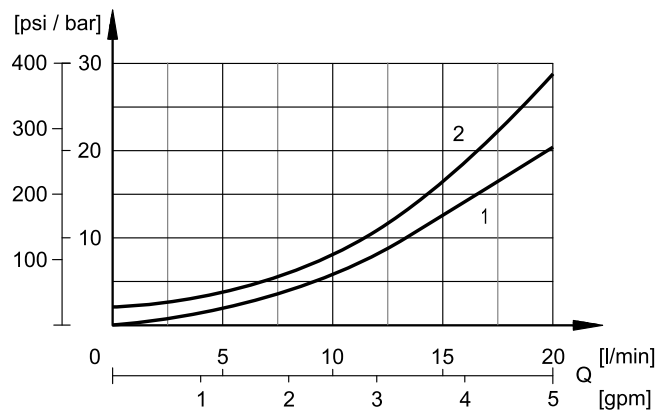
KCB08-\*\*\*4-C-\*-1



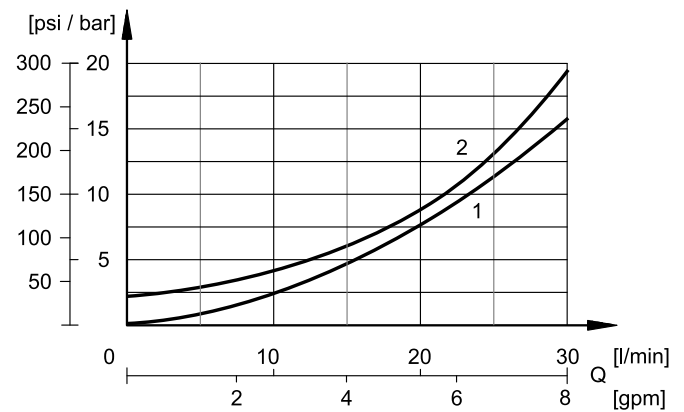
KCB08-\*\*\*4-E-\*-1



KCB08-\*\*\*8-F-\*-1



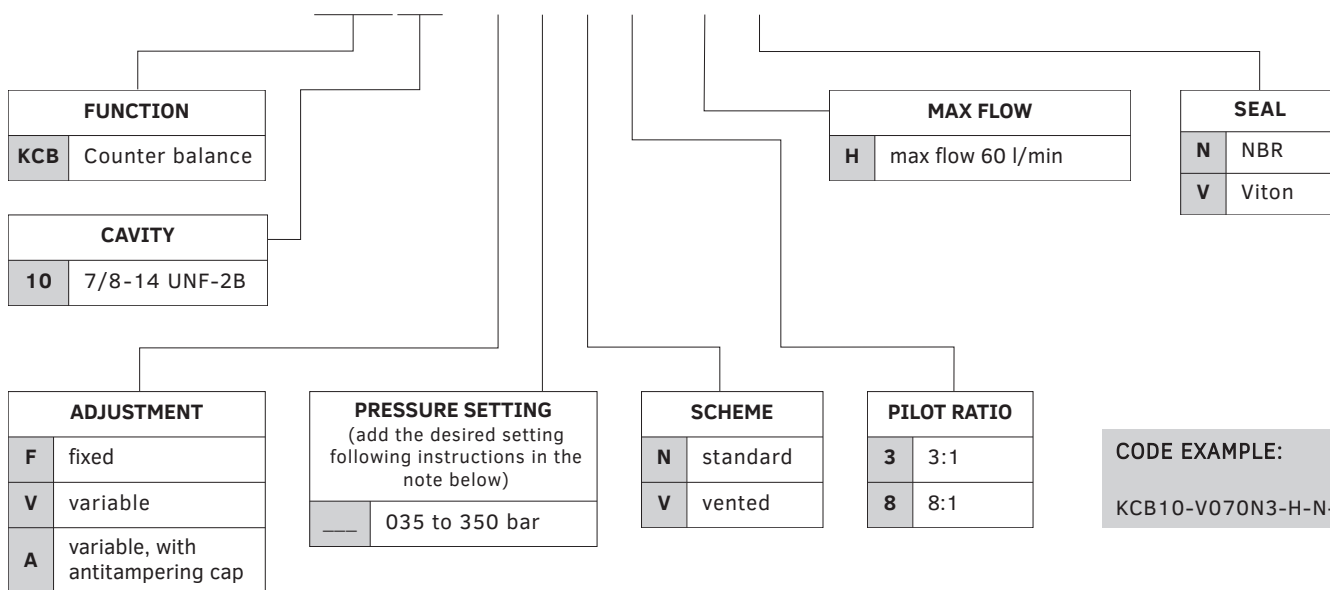
KCB08-\*\*\*4-G-\*-1



1 = piloted open  
2 = free flow

CARTRIDGES FOR SAE 10 CAVITY

**KCB10-■■■■-H-■-1** ————— design mark



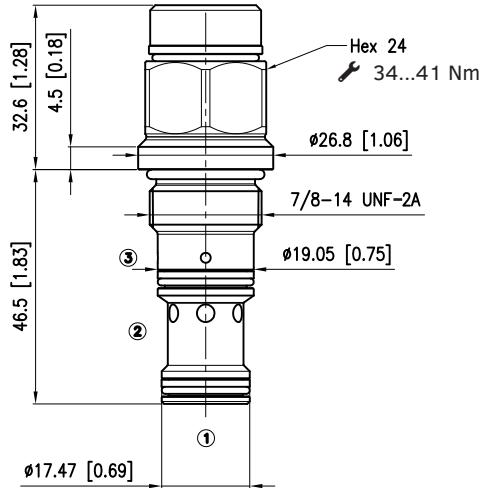
**CODE EXAMPLE:**  
KCB10-V070N3-H-N-1

AVAILABILITY TABLE					
ADJUSTMENT	SCHEME	PRESSURE RANGE	PILOT RATIO	MAX FLOW (l/min)	SEAL
				H (60)	
F / V / A	N	030 ÷ 350	3	■	N / V
	N		8	■	
	V	070 ÷ 350	3	■	

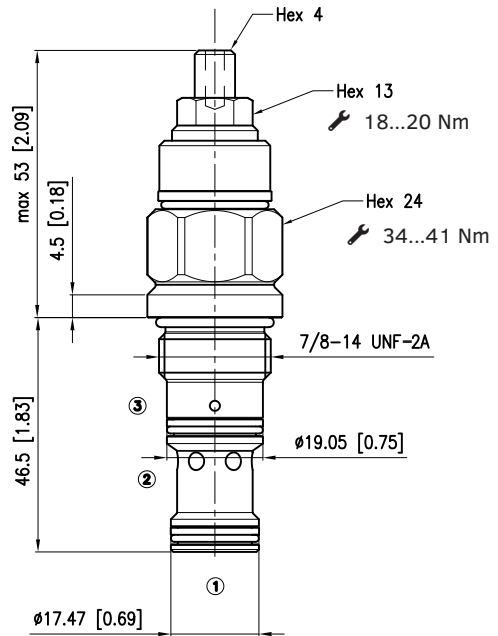
**AVAILABLE SETTINGS**

- Adjustments types **V** and **A**: choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)
- Adjustment type **F**: choose the desired pressure value within the pressure range, 5 bar step, indicated in the availability table (e.g. 080 bar, 085 bar, etc).

KCB10-F - FIXED ADJUSTMENT

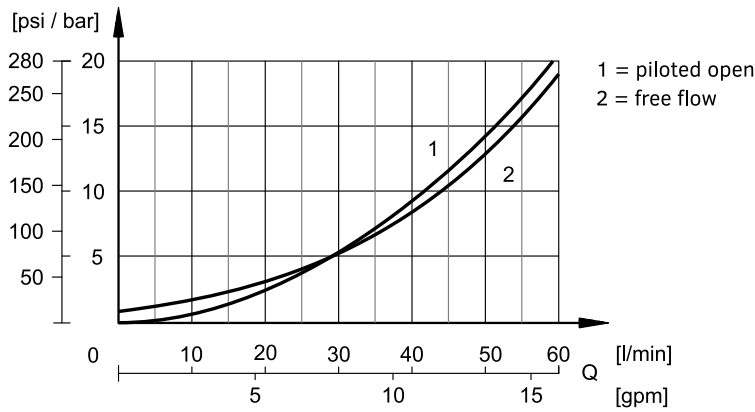


KCB10-V - VARIABLE ADJUSTMENT



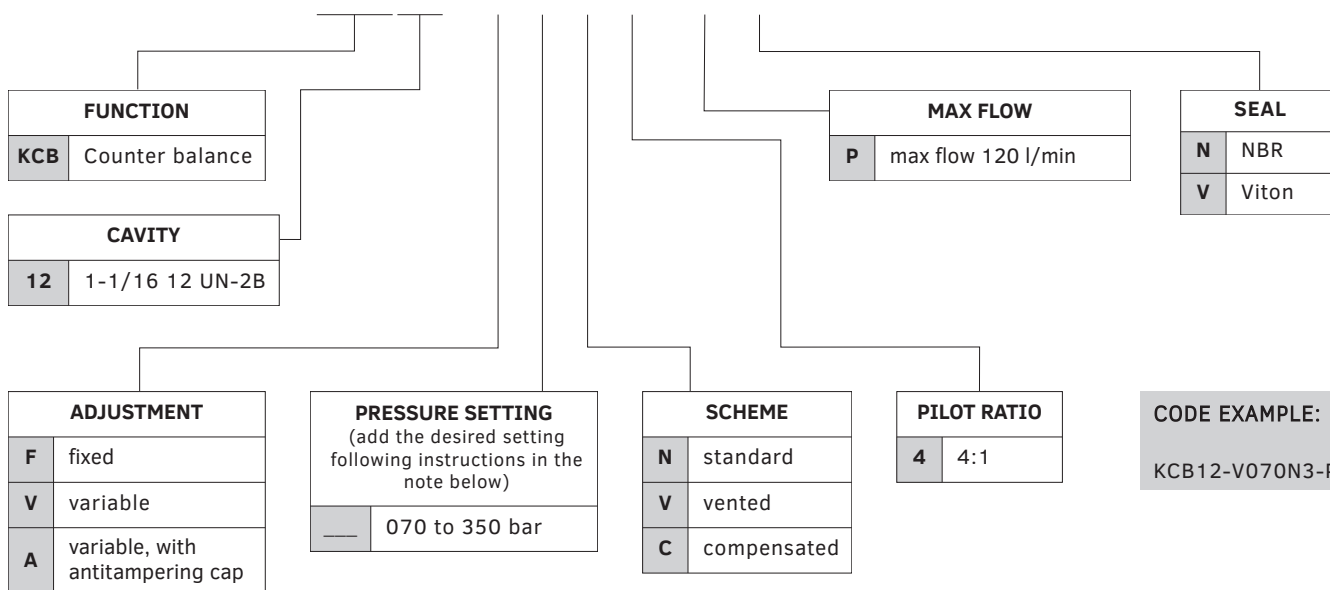
dimensions in mm [inch]

KCB10-\*\*\*\*-H-\* -1



CARTRIDGES FOR SAE 12 CAVITY

**KCB12- ■■■ 4-P-■ -1** ————— design mark



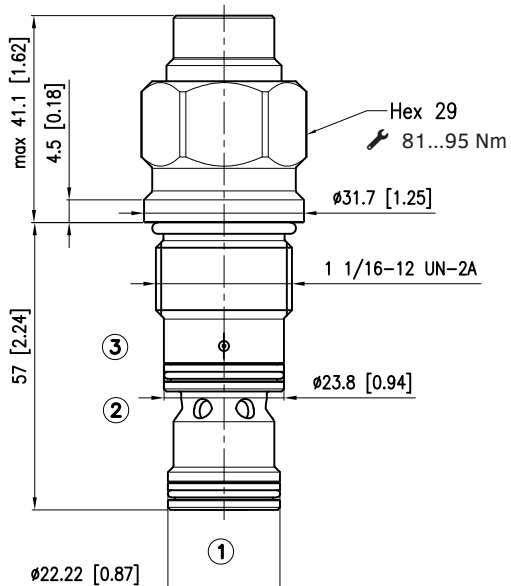
**CODE EXAMPLE:**  
KCB12-V070N3-P-N-1

**AVAILABLE SETTINGS**

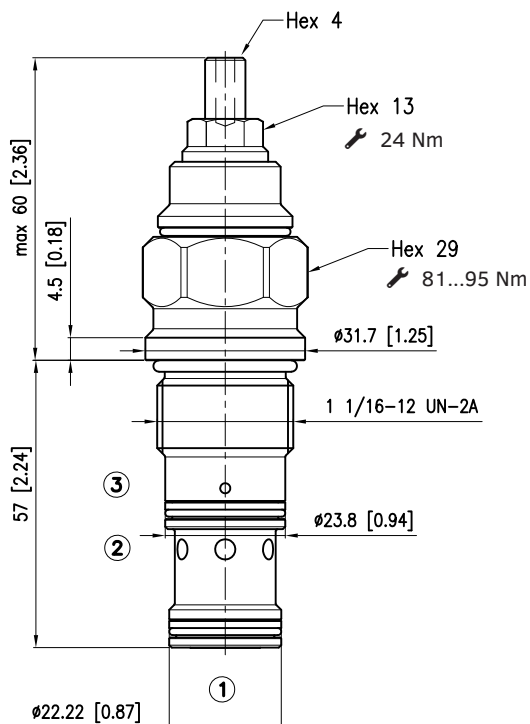
- Adjustments types **V** and **A**: choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)
- Adjustment type **F**: choose the desired pressure value within the pressure range, 5 bar step, indicated in the availability table (e.g. 080 bar, 085 bar, etc).



KCB12-F - FIXED ADJUSTMENT

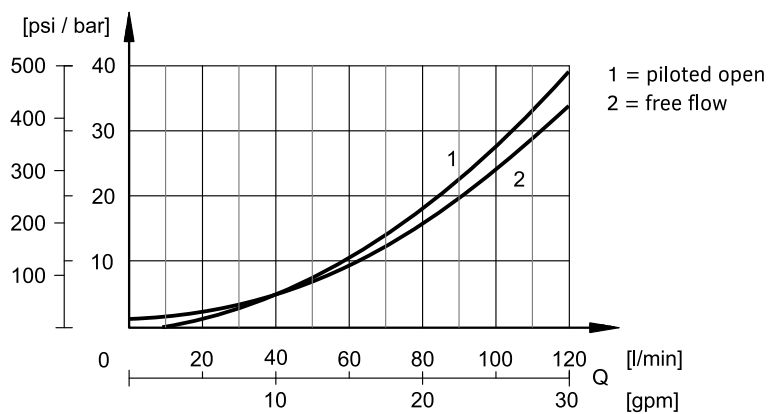


KCB12-V - VARIABLE ADJUSTMENT



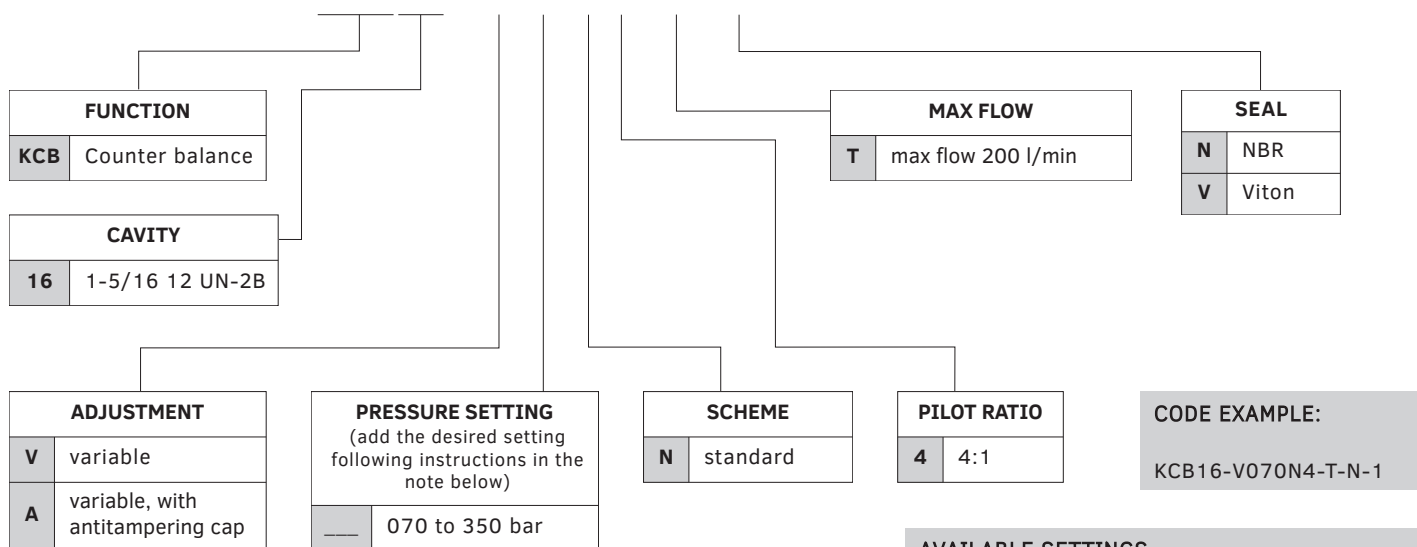
dimensions in mm [inch]

KCB12-\*\*\*4-P-\*-1



CARTRIDGES FOR SAE 16 CAVITY

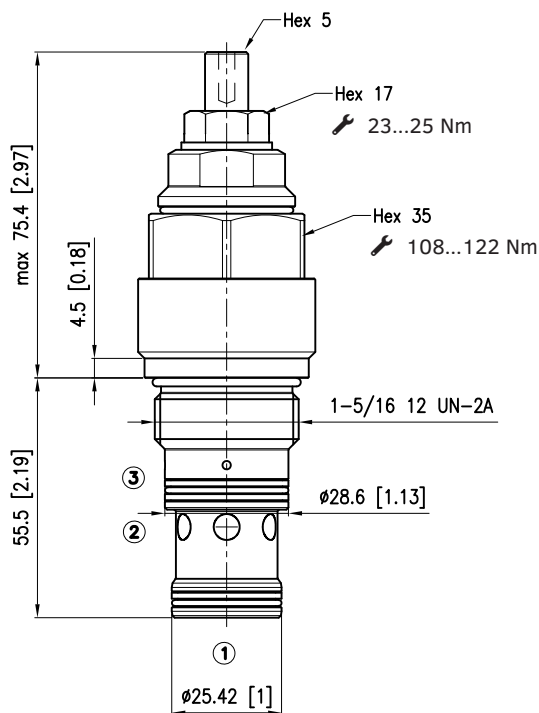
**KCB16- ■■■ N4-T- ■■ -1** ————— design mark



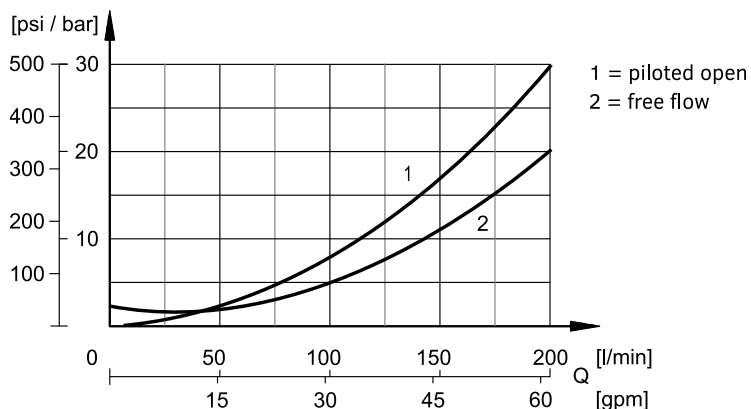
**AVAILABLE SETTINGS**  
Choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)

KCB16-V - VARIABLE ADJUSTMENT

KCB16-\*\*\*\*-T-\*-1

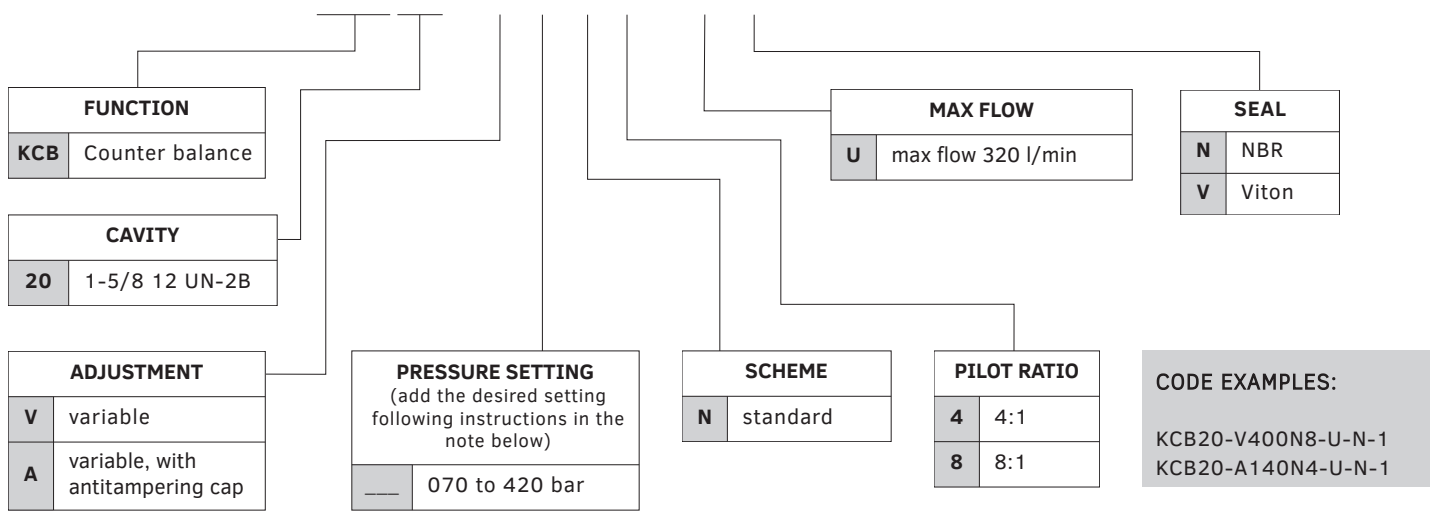


dimensions in mm [inch]



CARTRIDGES FOR SAE 20 CAVITY

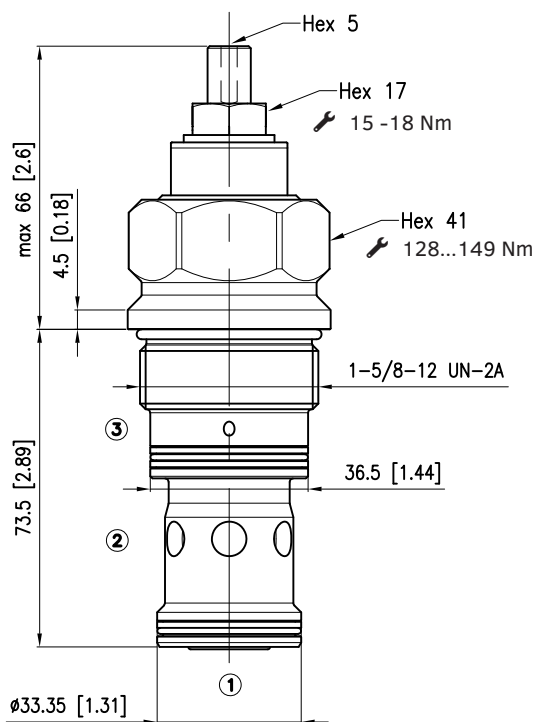
**KCB20- ■ ■ N ■ -U- ■ -1** ————— design mark



AVAILABILITY TABLE					
ADJUSTMENT	SCHEME	PRESSURE RANGE	PILOT RATIO	MAX FLOW (l/min)	SEAL
				U (320)	
V / A	N	140 ÷ 350	4	■	N / V
	N	070 ÷ 420	8	■	

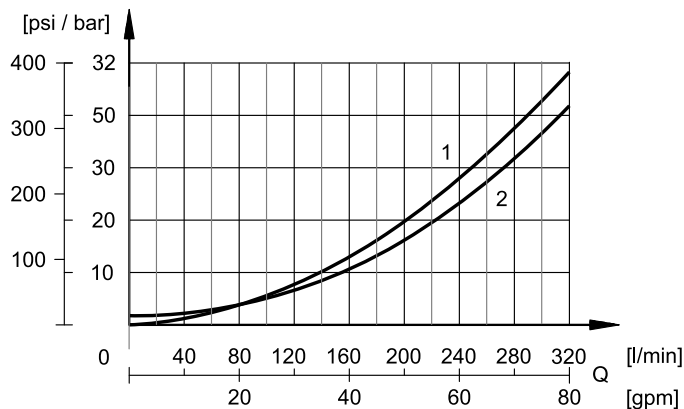
**AVAILABLE SETTINGS**  
Choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)

**KCB20-V - VARIABLE ADJUSTMENT**



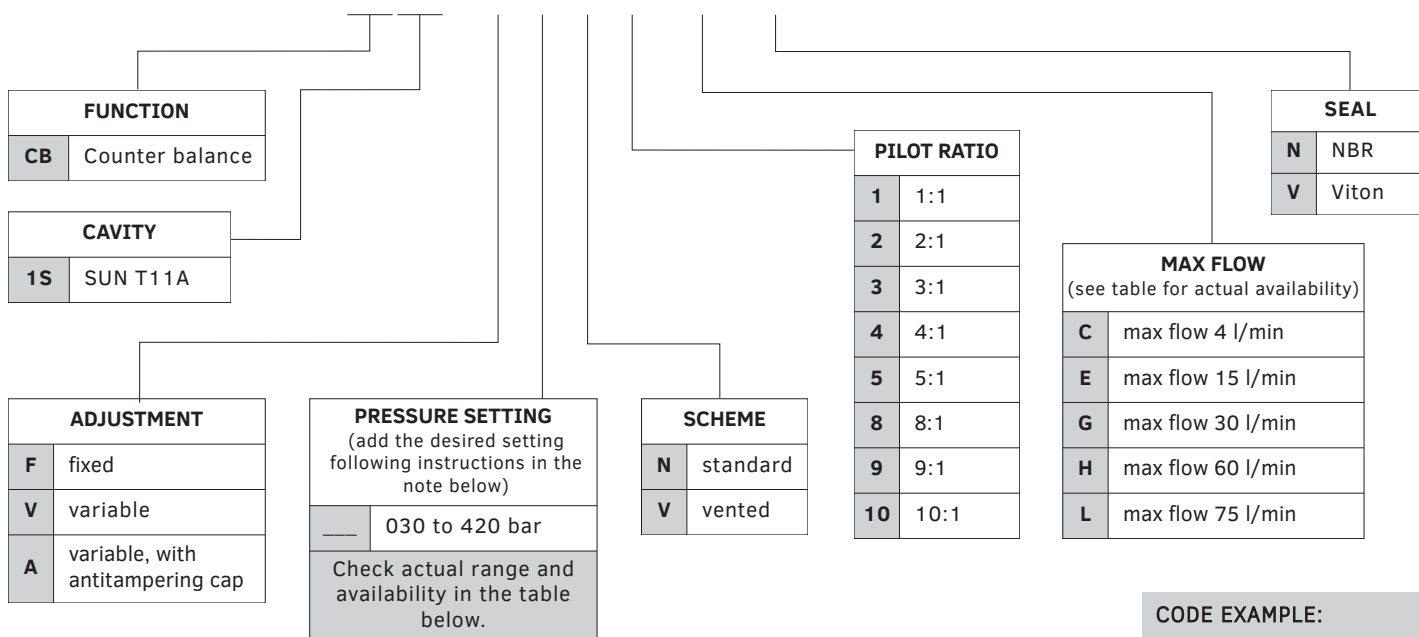
dimensions in mm [inch]

**KCB20-\*\*\*\*-U-\*-1**



CARTRIDGES FOR SUN T11A CAVITY

**KCB1S- ■■■■ - ■ - ■ -1** ————— design mark



CODE EXAMPLE:

KCB1S-V420V1-H-N-1

AVAILABILITY TABLE

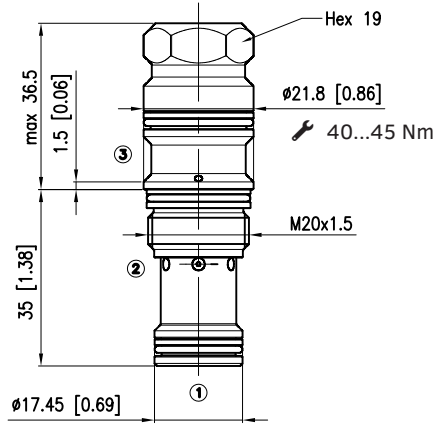
ADJUSTMENT	SCHEME	PRESSURE RANGE	PILOT RATIO	MAX FLOW (l/min)					SEAL
				C (4)	E (15)	G (30)	H (60)	L (75)	
V / A	V	40 ÷ 420	1				■		N / V
F / V / A	N	30 ÷ 390	2			■			
		30 ÷ 420				■			
V / A	V	40 ÷ 420	3				■	■	
F / V / A	N	30 ÷ 420		■	■	■			
		30 ÷ 390		■	■	■			
		40 ÷ 390					■		
V / A	V	40 ÷ 420					■		
F / V / A	N	30 ÷ 390	4	■	■	■			
V / A	V	40 ÷ 390		■	■	■			
F / V / A	N	30 ÷ 420	5				■		
V / A	V	40 ÷ 420					■		
F / V / A	N	70 ÷ 350	8				■	■	
V / A	V	40 ÷ 420					■		
F / V / A	N	30 ÷ 390	9			■			
F / V / A	N	70 ÷ 420	10				■	■	
V / A	V	40 ÷ 420					■		

AVAILABLE SETTINGS

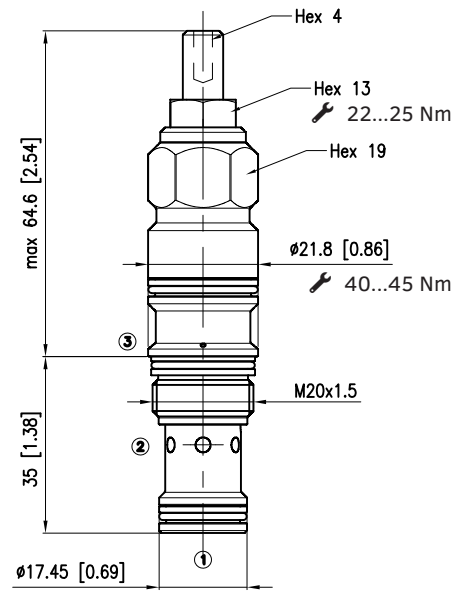
- Adjustments types **V** and **A**: choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)

- Adjustment type **F**: choose the desired pressure value within the pressure range, 5 bar step, indicated in the availability table (e.g. 080 bar, 085 bar, etc).

KCB1S-F - FIXED ADJUSTMENT

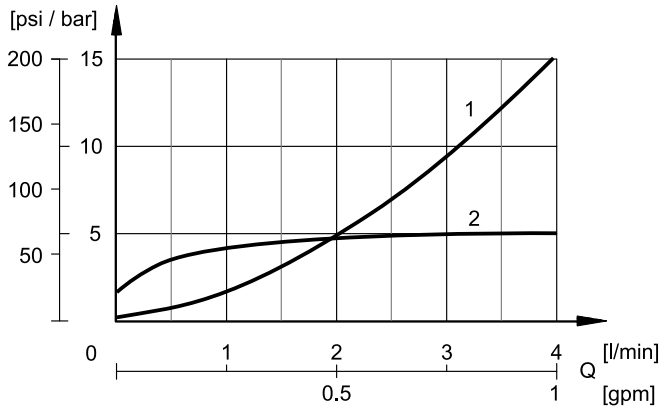


KCB1S-V - VARIABLE ADJUSTMENT

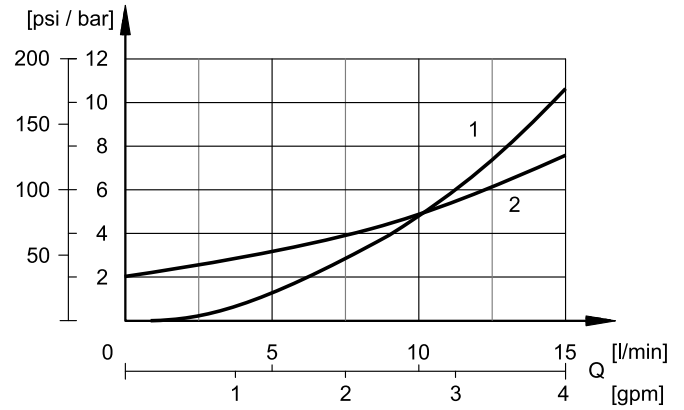


dimensions in mm [inch]

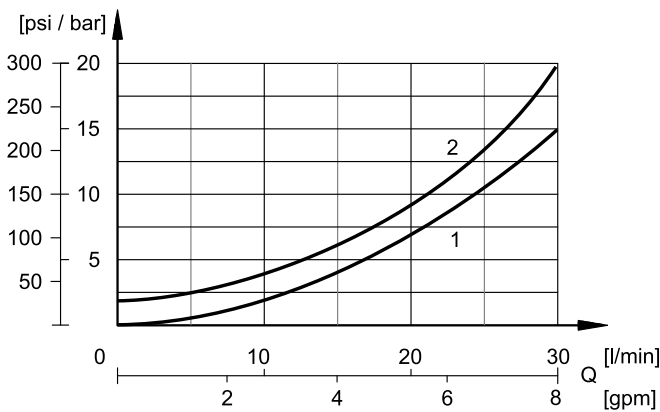
KCB1S-\*\*\*\*-C-\*-1



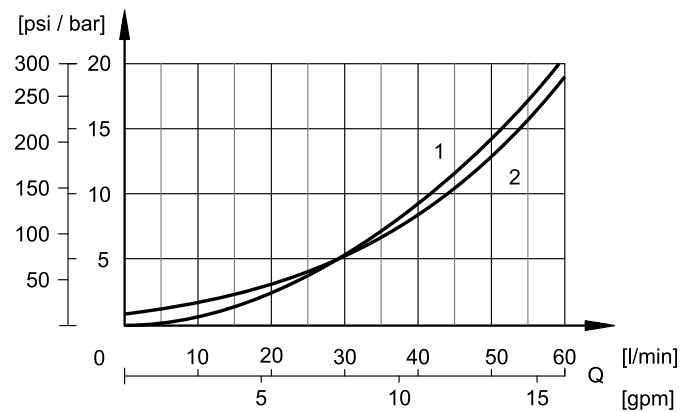
KCB1S-\*\*\*\*-E-\*-1



KCB1S-\*\*\*\*-G-\*-1

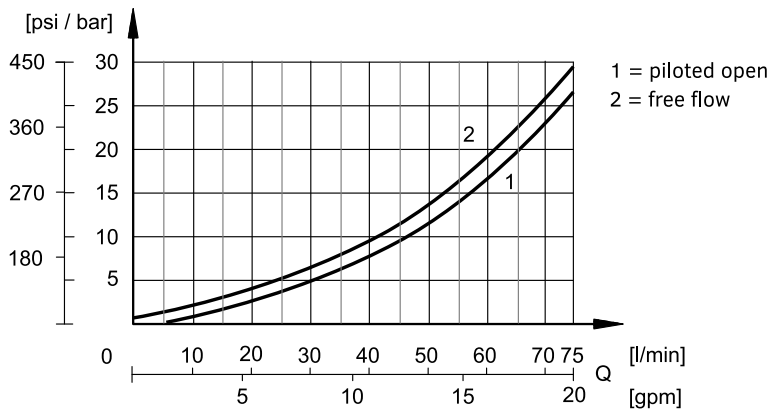


KCB1S-\*\*\*4-H-\*-1



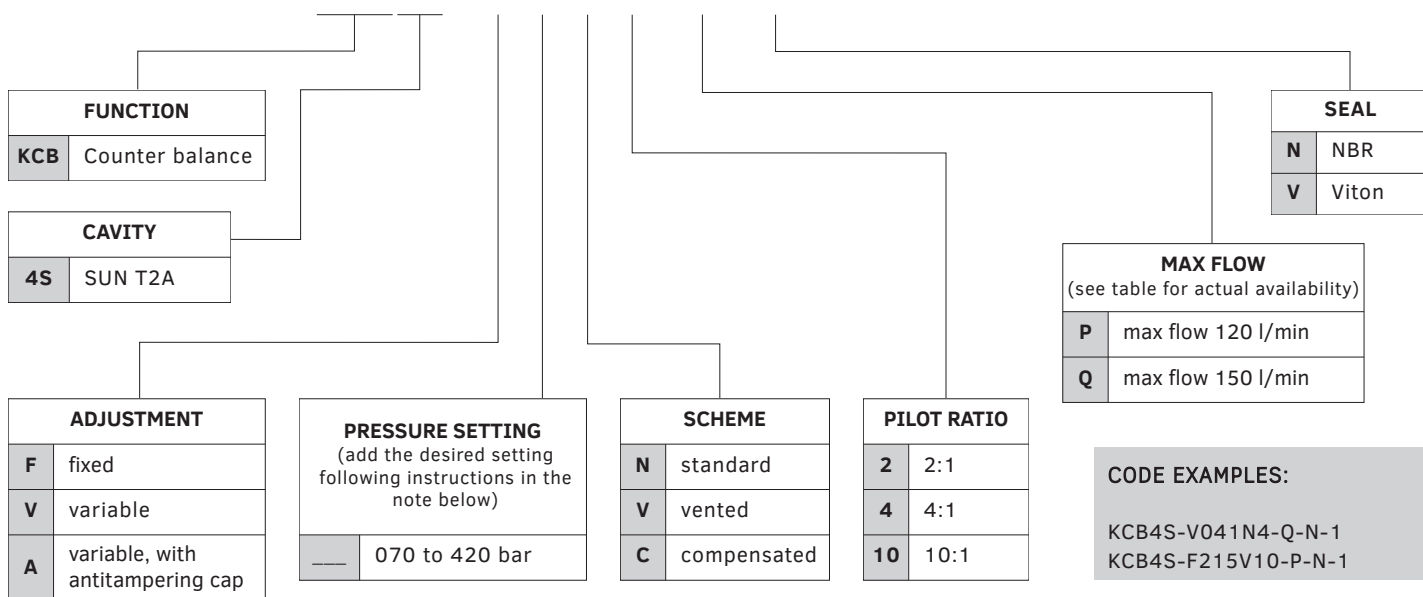
1 = piloted open  
2 = free flow

KCB1S-\*\*\*\*-L-\*-1



CARTRIDGES FOR SUN T2A CAVITY

**KCB4S-■■■■-■■-■■-1** ————— design mark

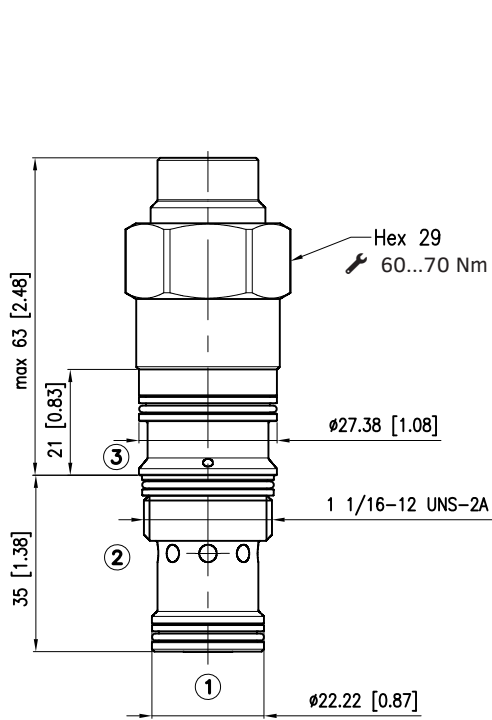


AVAILABILITY TABLE						
ADJUSTMENT	SCHEME	PRESSURE RANGE	PILOT RATIO	MAX FLOW (l/min)		SEAL
				P (120)	Q (150)	
F / V / A	V	070 ÷ 350	2	■		N / V
	N	070 ÷ 350	4	■	■	
		070 ÷ 420			■	
	V	070 ÷ 350		■		
	C	070 ÷ 350		■		
	N	070 ÷ 350	10	■		
070 ÷ 420				■		
V		070 ÷ 350		■		

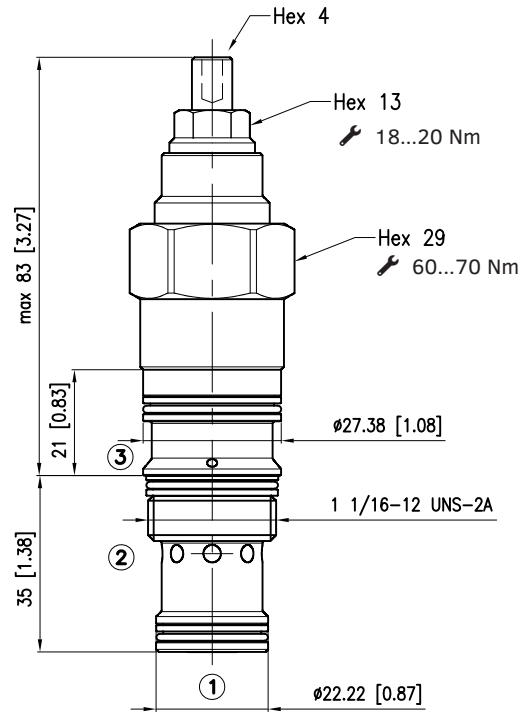
**AVAILABLE SETTINGS**

- Adjustments types **V** and **A**: choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)
- Adjustment type **F**: choose the desired pressure value within the pressure range, 5 bar step, indicated in the availability table (e.g. 080 bar, 085 bar, etc).

KCB4S-F - FIXED ADJUSTMENT

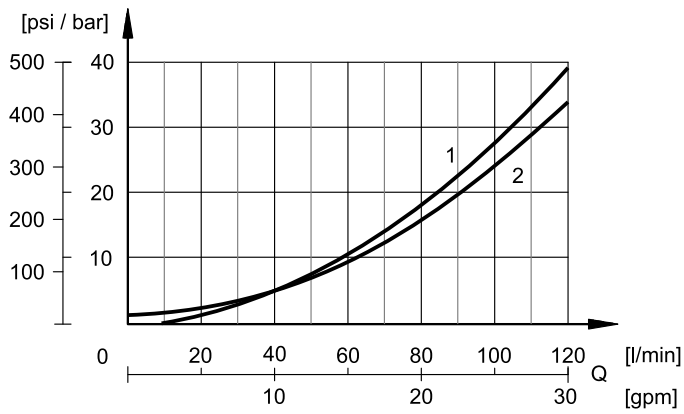


KCB4S-V - VARIABLE ADJUSTMENT

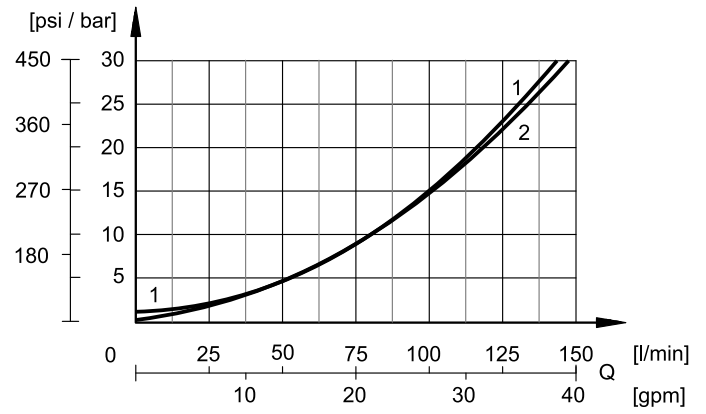


dimensions in mm [inch]

KCB4S-\*\*\*\*-P-\*-1



KCB4S-\*\*\*4-Q-\*-1

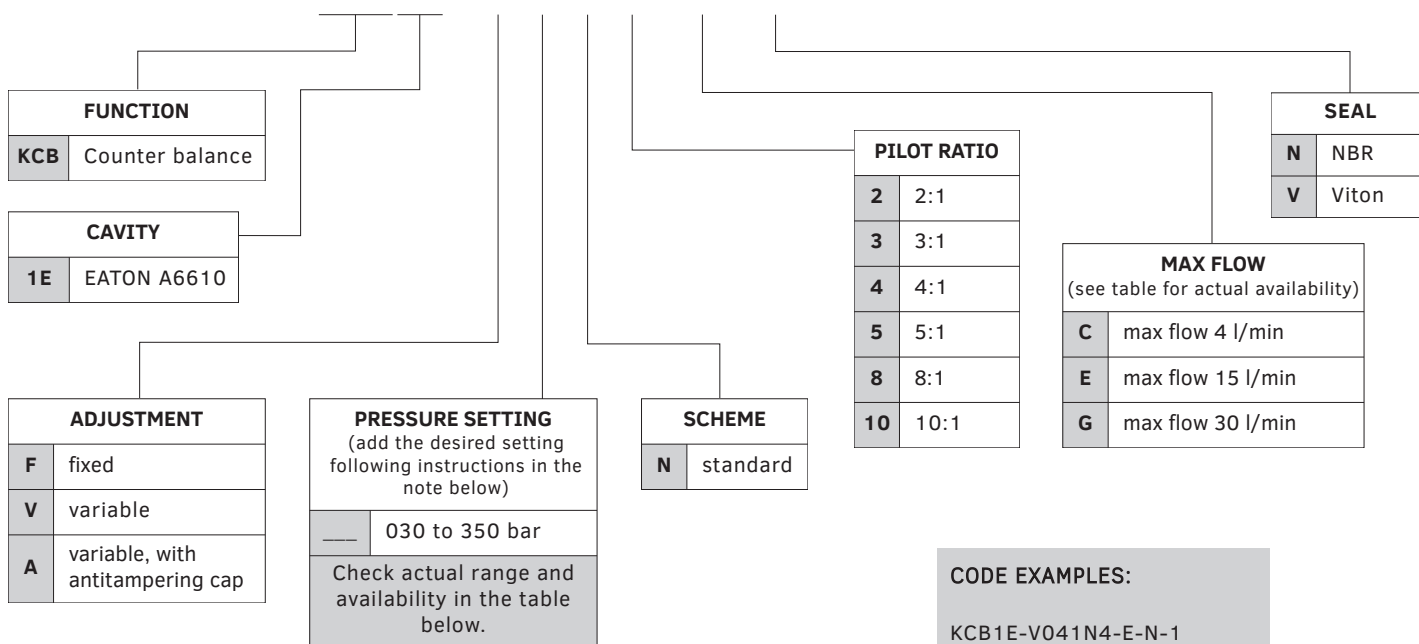


1 = piloted open  
2 = free flow



CARTRIDGES FOR EATON A6610 CAVITY

**KCB1E - ■ ■ N ■ - ■ - ■ -1** ————— design mark



**CODE EXAMPLES:**

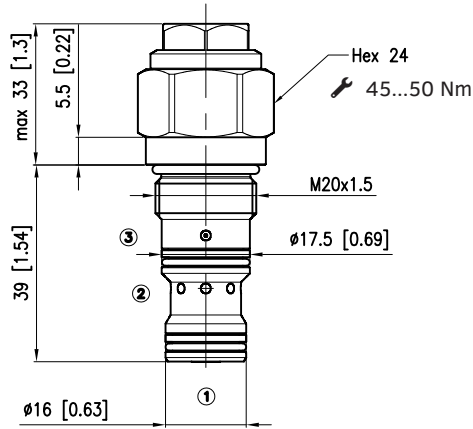
KCB1E-V041N4-E-N-1  
KCB1E-F345N10-G-N-1

AVAILABILITY TABLE							
ADJUSTMENT	SCHEME	PRESSURE RANGE	PILOT RATIO	MAX FLOW (l/min)			SEAL
				C (4)	E (15)	G (30)	
F / V / A	N	30 ÷ 350	2	■	■	■	N / V
			3	■	■	■	
			4	■	■	■	
			5			■	
			8			■	
			10			■	

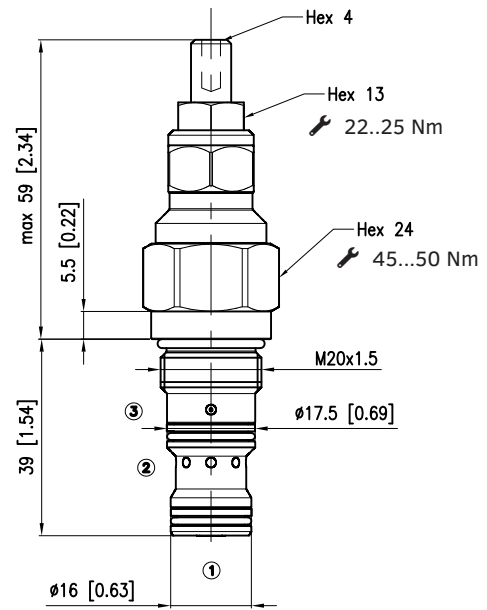
**AVAILABLE SETTINGS**

- Adjustments types **V** and **A**: choose the desired pressure value within the pressure range indicated in the availability table (e.g. 080 bar, 081 bar, etc)
- Adjustment type **F**: choose the desired pressure value within the pressure range, 5 bar step, indicated in the availability table (e.g. 080 bar, 085 bar, etc).

KCB1E-F - FIXED ADJUSTMENT

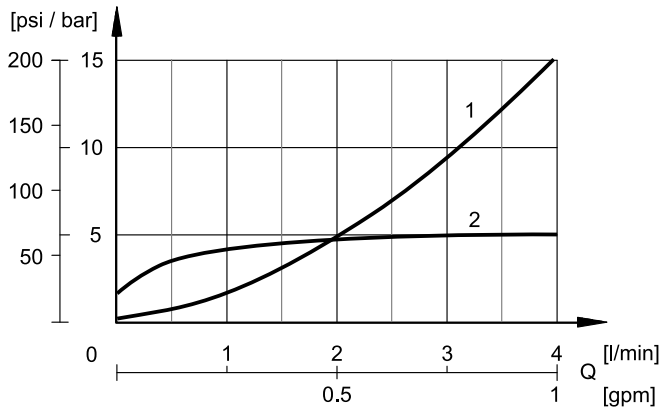


KCB1E-V - VARIABLE ADJUSTMENT

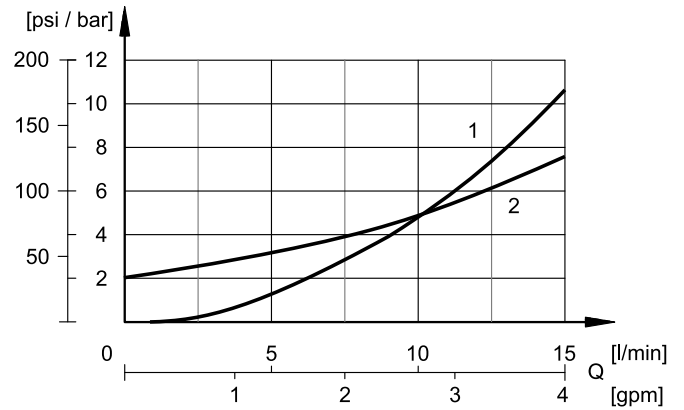


dimensions in mm [inch]

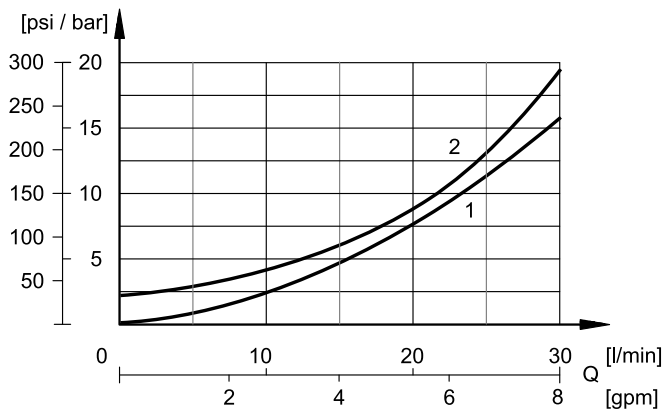
KCB1E-\*\*\*\*-C-\*-1



KCB1E-\*\*\*\*-E-\*-1

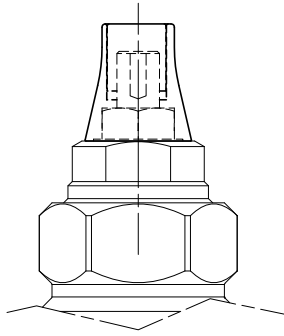


KCB1E-\*\*\*4-G-\*-1



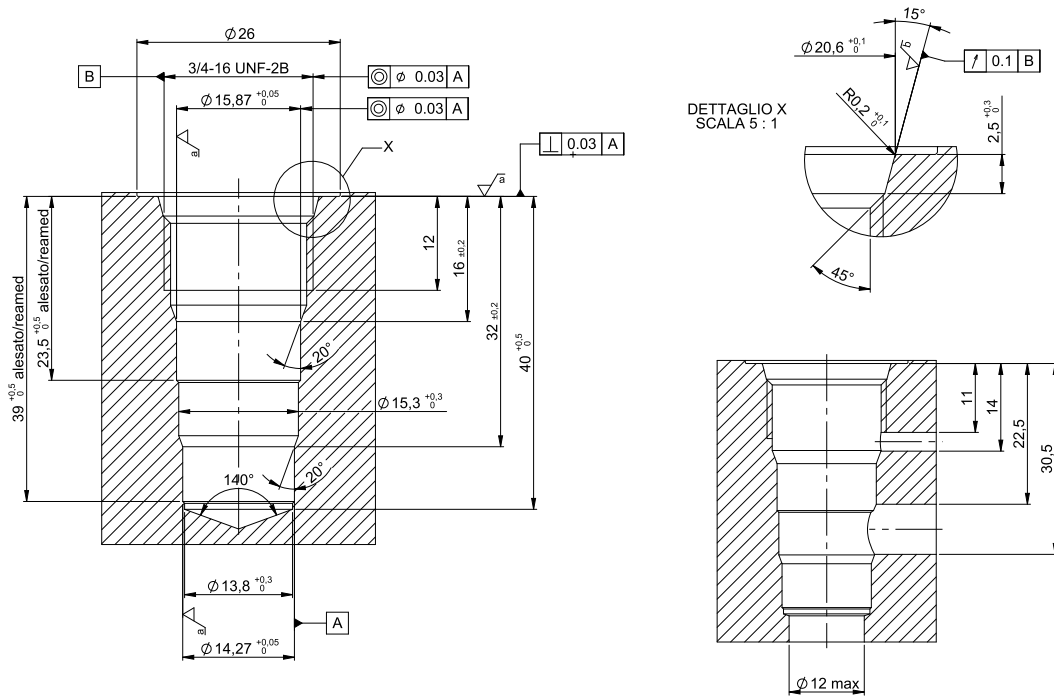
1 = piloted open  
2 = free flow

**ANTI-TAMPERING CAP**



All KCB\*\* -A valves are supplied with a plastic cap that prevents unintentional tampering of the adjustment screw. The adjustment screw can only be reached by breaking the cap.

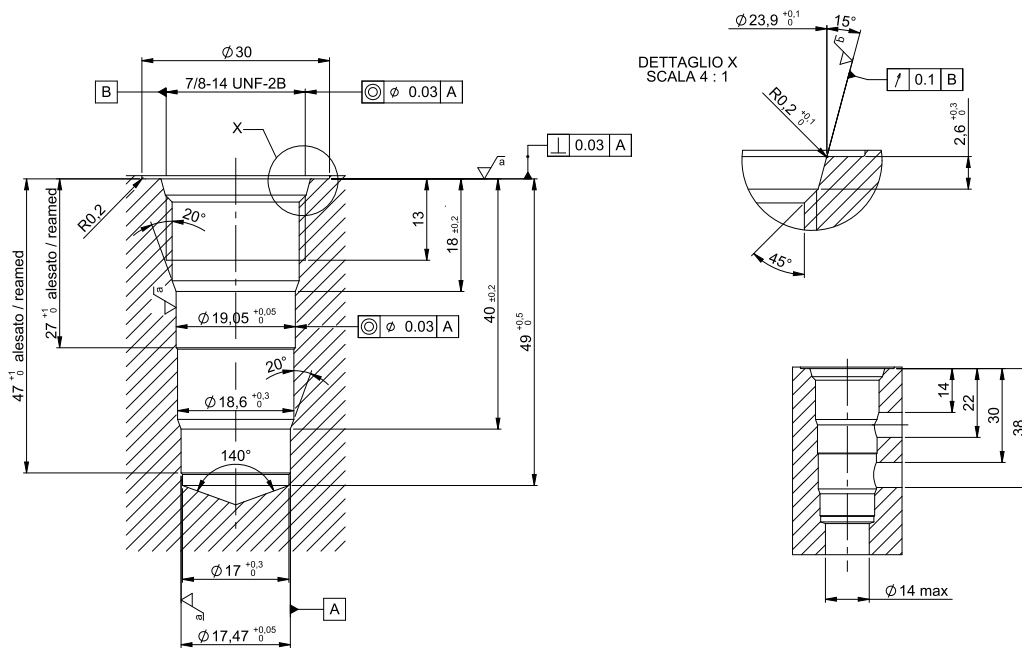
SAE 08



$\sqrt{a}$	$= \sqrt{R_{max} 1.6}$
$\sqrt{b}$	$= \sqrt{R_{max} 1.2}$
$\sqrt{c}$	$= \sqrt{R_{max} 1.2}$

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS mm ANGLE PROJECTION  
TOLERANCES ACCORDING TO (ISO2768-mk)  
BASE SHAFT (h13)  
BASE HOLE (H15)  
LINEAR DIMENSIONS TLL (0.5 +/- 0.05)  
ANGULAR DIMENSIONS TLL (0.5 +/- 0.05)  
FILLETS AND CHAMFERS TLL (0.5 +/- 0.05)  
DEBUR AND BREAK SHARP EDGES (0.1 +/- 0.05)

SAE 10

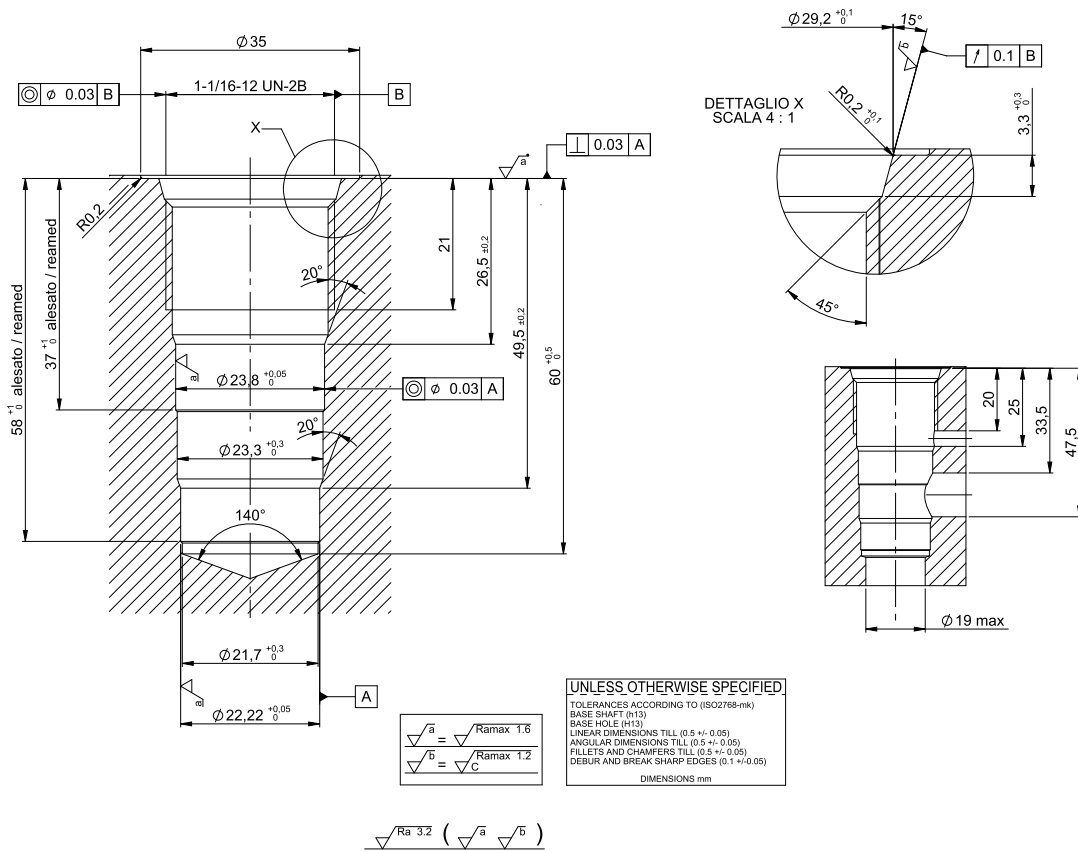


$\sqrt{a}$	$= \sqrt{R_{max} 1.6}$
$\sqrt{b}$	$= \sqrt{R_{max} 1.2}$
$\sqrt{c}$	$= \sqrt{R_{max} 1.2}$

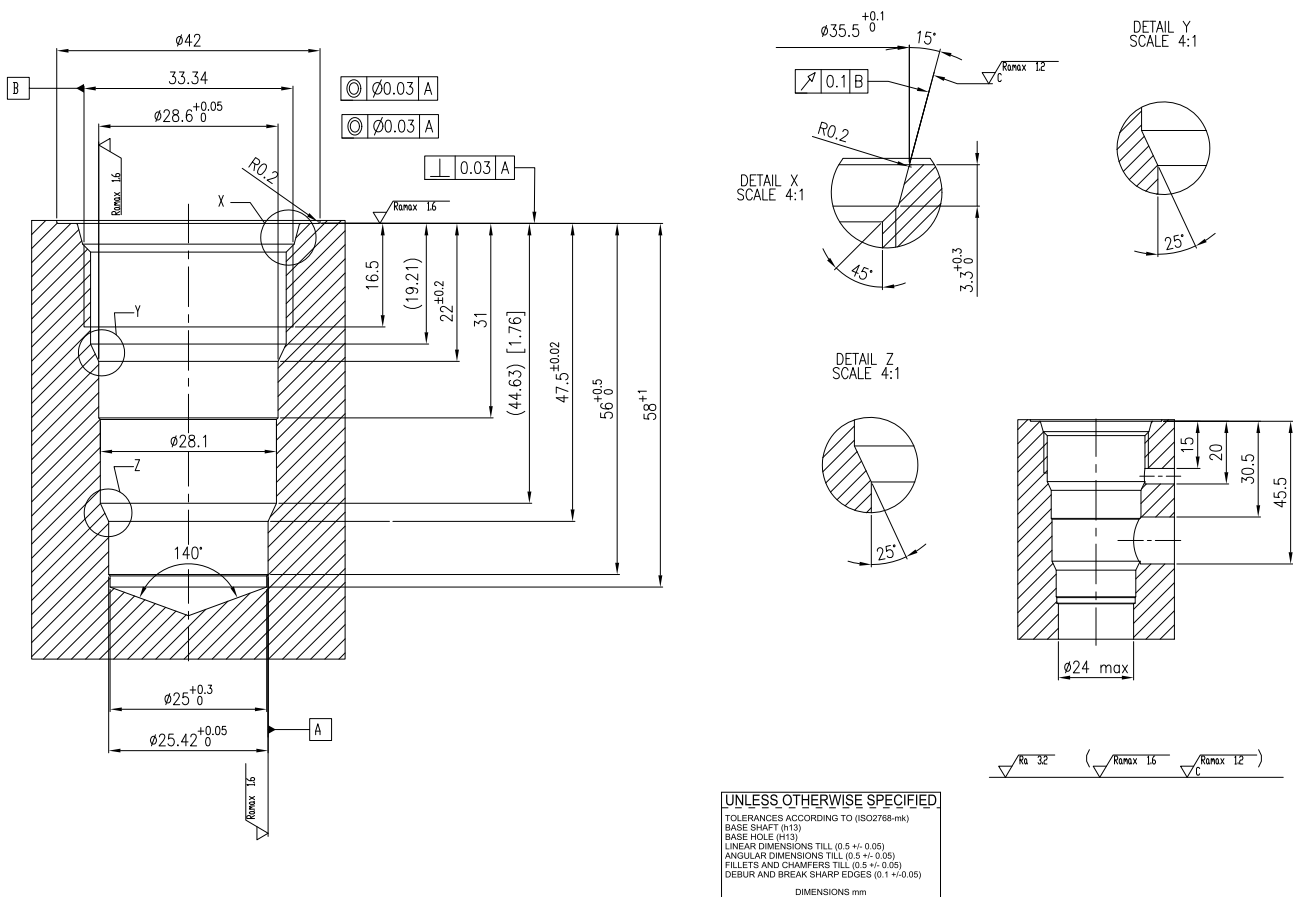
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS mm ANGLE PROJECTION  
TOLERANCES ACCORDING TO (ISO2768-mk)  
BASE SHAFT (h13)  
BASE HOLE (H15)  
LINEAR DIMENSIONS TLL (0.5 +/- 0.05)  
ANGULAR DIMENSIONS TLL (0.5 +/- 0.05)  
FILLETS AND CHAMFERS TLL (0.5 +/- 0.05)  
DEBUR AND BREAK SHARP EDGES (0.1 +/- 0.05)

$$\sqrt{Ra} 3.2 \left( \sqrt{a} \sqrt{b} \right)$$

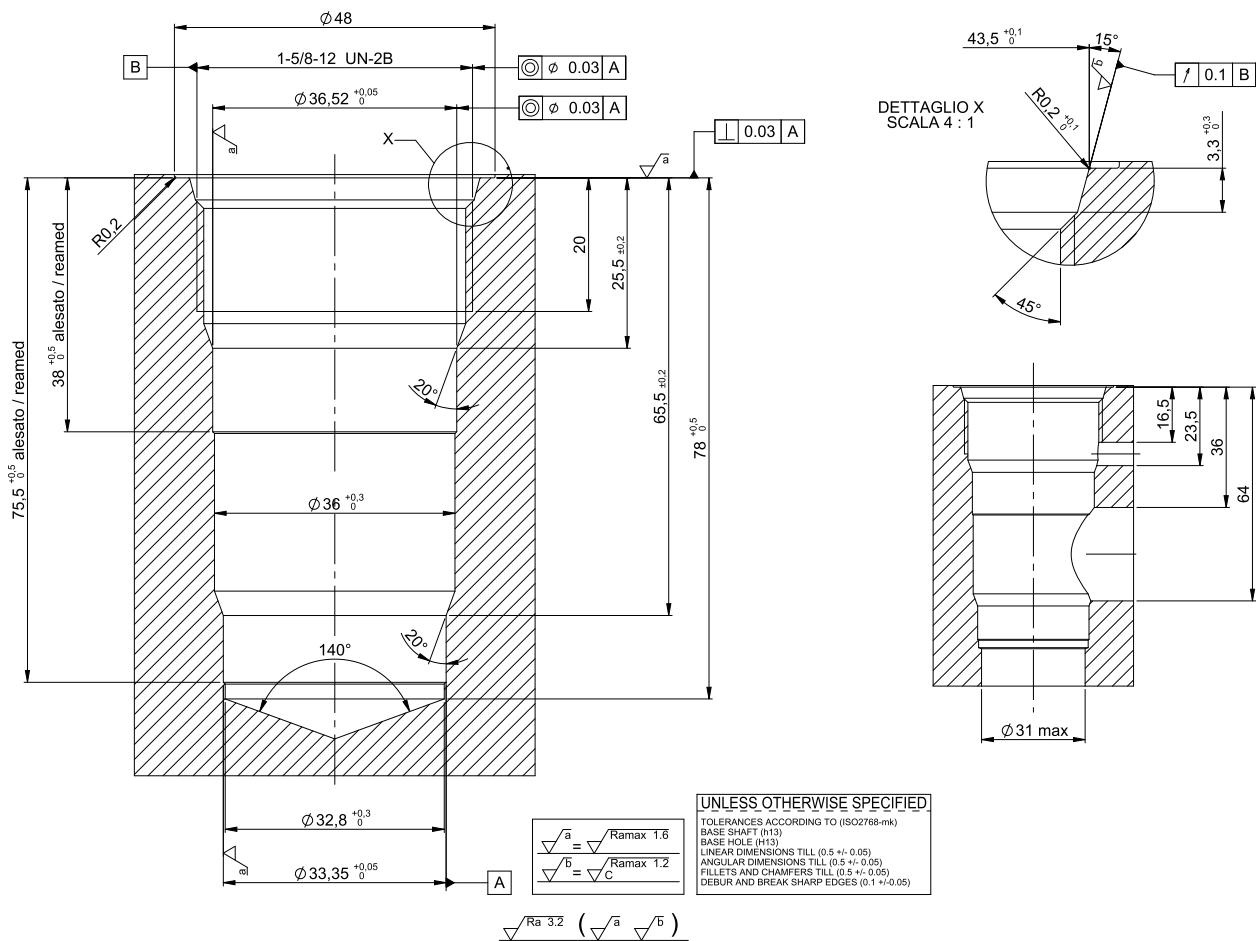
SAE 12



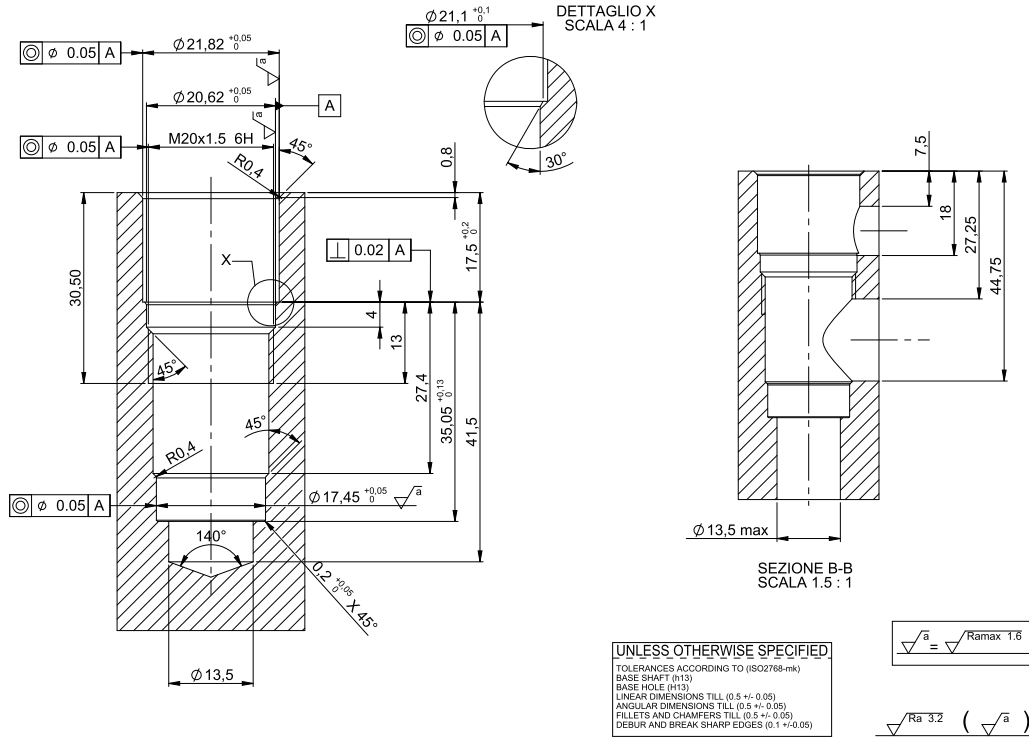
SAE 16



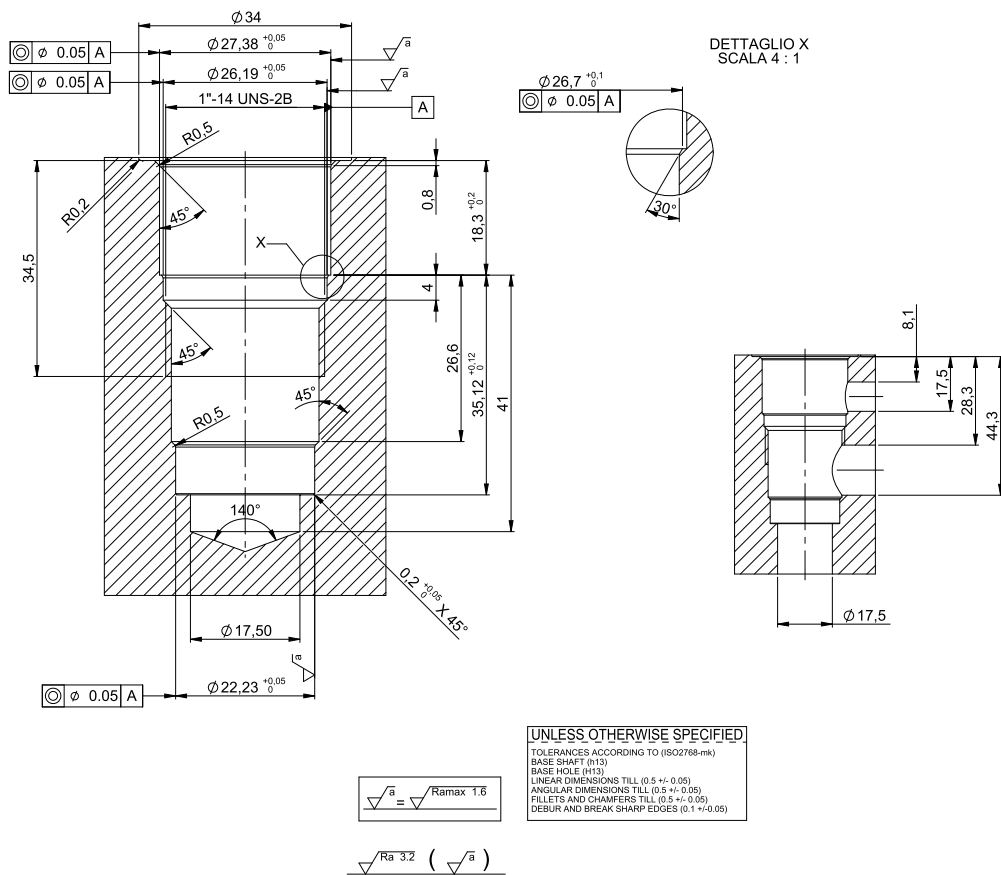
SAE 20



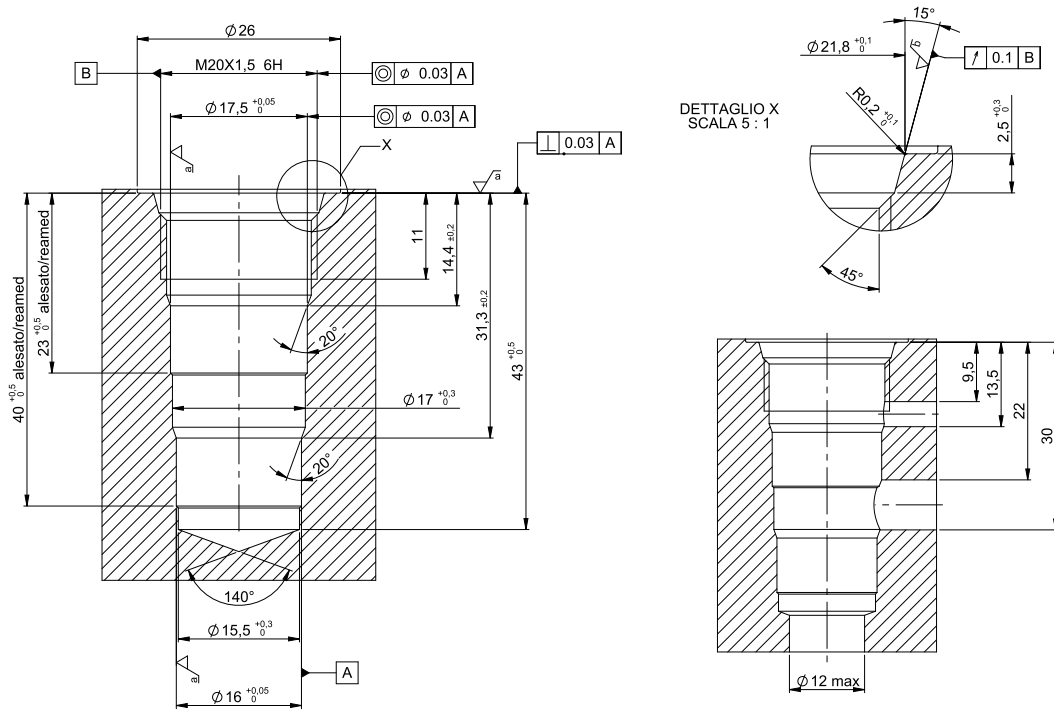
SUN T11A



SUN T2A



EATON A6610



$\sqrt{a}$	$= \sqrt{R_{\text{max}} 1.6}$
$\sqrt{b}$	$= \sqrt{R_{\text{max}} 1.2}$
$\sqrt{c}$	$= \sqrt{C}$

**UNLESS OTHERWISE SPECIFIED**  
 DIMENSIONS mm  
 ANGLE PROJECTION  
 TOLERANCES ACCORDING TO (ISO2768-mk)  
 BASE SHAFT (H13)  
 BASE HOLE (h13)  
 LINEAR DIMENSIONS TILL (0.5 +/- 0.05)  
 ANGULAR DIMENSIONS TILL (0.5 +/- 0.05)  
 FILLETS AND CHAMFERS TILL (0.5 +/- 0.05)  
 DEBUR AND BREAK SHARP EDGES (0.1 +/- 0.05)



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