Key operated cylinder valve in O-ring seal design for carbon dioxide

SKN-12/C

- Robust construction
- High performance and ease of maintenance
- Resistant to stress corrosion cracking

ISO 9001 and TPED certified valve manufacturer
Features and benefits for best-in-class performance

Series SKN-12/C

- Drain hole on gland nut to prevent water trapping
- Upper spindle is designed to shear from failure groove to avoid damage to the operating mechanism in case excessive torque is applied
- Metal to metal seal prevents leakage past gland nut threads. Gland nut O-ring arrests leakage in case the metallic sealing is compromised by external damage
- PA 66 / PCTFE soft seat provides long life and low torque operation
- Pressure relief device (PRD) uses corrosion resistant Nickel disc. Internal plug capsule design using copper gasket provides secure sealing with valve body and protects the PRD from loosening or damage in service
- Secondary O-ring prevents moisture / contamination ingress
- High durometer EPDM back-up ring prevents extrusion of primary O-ring
- Primary EPDM O-ring provides external tightness past upper spindle over entire operating and storage temperature and pressure range
- PA 66 thrust washer reduces friction and provides external tightness at high pressure
- SS-303 lower spindle provides high torque resistance and eliminates stress corrosion cracking associated with brass material in carbon dioxide service
- Available in different valve outlet and inlet connection (Refer valve selection guide)
- Tapped as per customer requirement for dip tube fitment

Dimensions are in mm
Dimensions shown are for 1” BS inlet and BS-8 outlet and 3/8-26 BSB dip tube thread

- a Depends upon inlet connection
- b Depends upon outlet connection

Design Specifications

- MIN life: 2000 cycles
- Operating and storage temperature range: -46 °C to +65 °C
- MIN closing torque: 8 Nm
- Gland nut installation torque: 65 Nm
- Failure torque: 70-80 Nm
- MAX test pressure (TP): 360 bar
- Lubricant: Krytox GPL 225
- Flow coefficient (Cv): 0.70
- MAX weight of cylinder package mass for which valve can be used without protection: 111 kg

Testing and certification

- Valve meets EN ISO 10297:2014, tested by BAM Berlin
- Production testing as per EN ISO 14246:2014
- Certified by BAM Berlin to European Transportable Pressure Equipment Directive (TPED) and available with ⚅ mark
Operating principle

Series SKN-12/C

Identifying features
SKN-12/C is key operated O-ring seal valve using two piece spindle construction. The robust design is mainly suitable for carbon dioxide and carbon dioxide mixtures but may also be used for inert gas application requiring high flow. The free floating upper spindle and the threaded lower spindle interface through a square drive. The design uses O-rings to create a seal around the upper spindle. Polyamide thrust washer makes contact with the collar of the upper spindle under pressure and acts as anti-friction ring during rotation of the upper spindle to open and close the valve. Leakage through the gland nut threads is protected by metallic sealing with secondary protection provided by an O-ring below the gland nut threads. Lower spindle is machined from SS-303 to eliminate the problem of stress corrosion of the spindle skirting associated with brass material in carbon dioxide service. PA 66 / PCTFE soft seat ensures low torque closure. SS-303 upper spindle has a designated failure groove to allow the operating mechanism to fail safely at a failure torque between 70-80 Nm without damaging the lower spindle and the valve internal threads. As the failure torque is nearly ten times more than the minimum closing torque of 8 Nm, the valve operating mechanism can withstand significantly high torques in the field than necessary to close the valve.

Recommended opening procedure
It is recommended that the valves always be opened gradually, with 9.5mm square spindle opening key, in anticlockwise direction until the required flow is achieved. Opening the valve fully causes the lower spindle to ride upwards on its threads until it contacts the upper spindle. Valves in the fully open position can be mistaken as closed by inexperienced or untrained operators. The operator should always check the position of the valve by attempting to close the valve, never by trying to open the valve.

Recommended closing procedure
Close the cylinder valve by rotating the upper spindle in the clockwise direction.

Valve installation
Valving procedure and torque guidelines should be as per EN ISO 13341.

- **CAUTION**
  1. NEVER use wrenches or other persuaders to operate the valve.
  2. Valving tools (e.g. sockets or jaws) used to screw the valve into the cylinder must only make contact with the flats provided in the valve body (and not touching any part of the valve outlet and/or PRD, if provided). The tools should fit the valve properly without causing damage.
  3. Over-torquing the valve into the cylinder must be avoided as they cause high stresses in the cylinder neck, leading to overload failures. Over-torquing also leads to irreparable damage to the valve stem.
  4. As upper spindle is non-rising, do not over torque the valve in open direction.
  5. Do not use PTFE tapes on gland nut threads to stop gland leakage.
  6. Do not replace soft seat in the bottom spindle.
  7. Repair and maintenance should only be carried out by trained personnel.
  8. Proper connectors should be used for filling and discharge ensuring contact only at the intended sealing surface.
Material of construction and assembly arrangement

Series SKN-12/C

1. Valve body: LT Brass / Brass as per IS 8737
2. Gland nut O-ring: EPDM
3. PRD assembly
4. Thrust washer: PA 66
5. Back-Up Ring: EPDM
6. Upper spindle: SS 303
7. Gland nut: Free cutting brass
8. O-ring X 2: EPDM
9. Lower spindle assembly: SS 303 with PA 66 / PCTFE seat insert
Disassembly, inspection and assembly instructions

Series SKN-12/C

**Disassembly of valve**

1. Place the valve assembly after removing from the cylinder in a vice or similar holding fixture. The holding fixture must securely grip the valve body (1) on the wrench flats so that there is no damage to the valve body plating, internal bores and inlet and outlet threads.

2. Using a 28 mm socket wrench or hex box wrench, unscrew the gland nut (8) in counter clockwise direction. The upper spindle assembly (7) with O-rings (5), back-up ring (6) and thrust washer (4) will remove with the gland nut. Remove the upper spindle assembly from the gland nut by pushing the upper spindle from the top. Be careful not to scratch the gland nut sealing surface.

3. Use the upper spindle to remove the lower spindle assembly (3) from the valve chamber, by rotating it counter clockwise.

4. Remove the PRD (9) (if necessary) using 12mm socket wrench or HEX box wrench by rotating in counter clockwise direction.

**Inspection of valve and components**

1. Valve body (1)
   a. Inspect the valve body chamber for dirt, debris or damage. Where possible, blow out the valve body chamber using clean, dry, compressed Air or Nitrogen to remove any foreign particles.
   b. Inspect the valve body for seat damage and thread wear.
   c. Inspect if gland nut O-ring (2) is in place inside the valve body groove.
   d. Do not attempt to repair the valve body if damaged.

2. Components
   a. Inspect all parts visually for wear, damage. Replace parts as necessary. In case of damage to upper spindle (7) and/or elastomers, replace with new upper spindle assembly.
   b. Inspect lower spindle (3) threads and soft seating for any sign of wear / damage. Inspect the thrust washer (4). Replace if necessary.
   c. Inspect PRD (9) if installed for any damage.

**Assembly of valve**

1. Check all parts visually for burrs, dent, damage and crack.

2. Lubricate parts as per GA drawing.
   NOTE Customer will receive parts / spare kits in lubricated condition.

3. Place thrust washer (4) to rest above the upper spindle (7) collar.

4. Use special tools to fit O-rings (5) and back-up ring (6) in upper spindle groove. Care should be taken to place the back-up ring above the O-ring in the lower groove and secondary O-ring in the upper groove.

5. Fit gland nut O-ring (2) inside the groove provided in the valve body (1) just below the gland nut threads.

6. Insert upper spindle subassembly inside gland nut (8) with a twisted motion to avoid damage to elastomers and insert till it rests on gland nut counter bore.

7. Place the lower spindle assembly (3) into the valve body. Position the upper spindle to engage with the lower spindle square and screw in gland nut into the valve body by rotating the upper spindle square. This will also drive the lower spindle assembly to rest with the valve body seat.

8. Clamp valve body in bench vice between nylon clamps. Tighten gland nut using 28 mm socket wrench or HEX box wrench at 65 Nm in clockwise direction.

9. Tighten PRD assembly (9), if applicable, using 12 mm socket wrench or HEX box wrench at 30-35 Nm in clockwise direction.

**NOTE** Refer “Material of construction and assembly arrangement” page to identify the part No. given in the bracket.
Series SKN-12/C

Valve item code matrix

**Valve series**
- SKN: SKN-12/C

**Body**
- LB: Low Tensile brass (CW 617N)
- FB: Brass to IS 8737

**Inlet A**
- 1BS: 1" to BS 341-1:1962
- 25E: 25E to ISO 11363-1
- 12N: 3/4-14 NGT to CGA V-1
- 32T: 31.75 (Type 4, Size 3 of IS:3224)
- 16N: 1-11.5 NGT

**Dip Tube A**
- b: M10X1.0
- h: M10X0.75
- E: 1/4" NGT
- s: 3/8" BSB
- X: Not required

**Specification**

**Inspection**
- P: "P" mark (in-house inspection service)

**Gas service**
- SC: As per list (refer next page)

**Miscellaneous**
- XX6: Seat insert PA 66
- XXE: Seat insert PCTFE

**Outlet A**
- AFC: AFNOR - Type C
- 320: CGA 320
- D06: DIN-6
- 507: IS-7/BS-8
- UN2: 2-UNI

**PRD type**
- 1: CG-1/Ni
- X: Not required

**PRD rating**
- 28: 186-207 bar
- 32: 208-232 bar
- 36: 230-250 bar
- CC: Customer requirement
- XX: Not required

**Test pressure B**
- 190: 190 bar
- 250: 250 bar
- 360: 360 bar

**Options**
- Seal nut and sealing gasket

A - Other inlet, outlet & dip tube connections are available as per customer requirement
B - Test pressure 190 bar corresponds to a filling ratio of 0.66 and 250 bar corresponds to a filling ratio of 0.75 for CO2 as per P 200 of ADR
## List of approved gases

### Series SKN-12/C

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<th>Sl. No.</th>
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<th>ASHRAE No.</th>
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* PRD not available
1) What are the advantages of soft seated two piece spindle valves in O-ring seal design over metal seated single spindle valves in packed design?
- The packed design valves have inherent limitation of particulate generation due to packing wear, gland leakages (requiring the need to tighten the gland nut) and increase in closing torque due to seizing / wear of the valve body threads after repeated use.

These limitations are addressed in SKN-12/C design as it provides reliable external and internal tightness under normal operating condition, high cycle life, safe failure in case excessive torque is applied to the operating device (without damaging the valve body internals) and ease of maintenance.

2) Why failure groove is provided in the upper spindle?
- The failure groove is provided to facilitate safe breakage of the upper spindle if torque exceeding 70 Nm is applied to the valve operating device. This protects the valve internal threads and lower spindle assembly from damage. The breakage of the top spindle acts as a fuse and allows the operator to replace the top spindle even when the cylinder is pressurized. The failure groove also ensures that there is no ejection (safe failure) of the gland nut if excessive torque is applied in the opening direction.

Caution - It is important to note that the upper spindle is non-rising and does not rise when the valve is opened.

3) How resistant is SKN-12/C to abuse in the field?
- a) SKN-12/C has been designed and tested for safe operation up to 60 Nm (factor of safety of 7.5 times over the minimum closing torque of 8 Nm). So the design can withstand very high torques without damage to the operating mechanism.

b) SKN-12/C has been endurance tested for 2000 cycles (TP-360 bar) at endurance torque of 20.3 Nm without increase in torque. This makes the valve design highly reliable in the field.

c) The valve body is very robust and tested to withstand impact strength of 400 J. So the valve is resistant to mishandling and allowed to be used on cylinders having total package mass of 111 kg without the use of protective cap.

4) Does the design allow safe cylinder recovery procedure in the event of breakage of spindle on pressurized cylinder?
- As the upper spindle is designed to fail first leaving lower spindle intact, this allows safe cylinder recovery procedure. The broken top spindle can be replaced by removing the gland nut (with the valve in closed position) even if the cylinder is pressurized, thereby also securing the contents of the cylinder.

5) What is the expected life of O-ring/back-up ring? Should the entire upper spindle subassembly be replaced in case of any damage to upper spindle or O-ring/back-up ring?
- Tekno uses peroxide cured O-ring/back-up ring from reputed suppliers for long service life. The O-ring is protected in service from extrusion by thrust washer and back-up ring. O-ring /back-up ring do not require to be replaced. If the upper spindle is required to be changed, we recommend replacing the upper spindle subassembly, i.e. factory fitted O-ring/back-up ring, duly lubricated.
6) How secure is the design to external leakage in service?
   - The leakage through the upper spindle is protected by thrust washer under high pressure while leakage at low pressure is arrested by spindle O-ring. Leakage through the gland nut threads is primarily taken care as the gland nut abuts with the valve body. The gland nut O-ring prevents leakage if the metallic sealing is compromised by external impact. Hence the design is well secured against external leakage.

7) Is it advisable to replace soft seat in case it is worn out?
   - The seat materials used in SKN-12/C have high cycle life and load bearing capacity. If worn out, the lower spindle assembly needs to be replaced as the soft seat is factory fitted to the lower spindle by crimping operation which cannot be replicated at user end.

8) What is the benefit of lubrication?
   - SKN-12/C design is assembled with high quality lubricant compatible with gases for which the valve is intended to be used to assist low torque operation and prevent seizing and galling in service.

Disclaimer
1. Proper use and maintenance would enhance life of the valve. The recommendations given in the FAQ are not meant to substitute existing plant procedures.
2. Repair and maintenance should only be carried out by trained personnel.