

## KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

### INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Before installation these instructions must be fully read and understood

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#### 1 SCOPE

This manual is provided to ensure proper installation, operation and maintenance for KTM Virgo Series trunnion ball valve, manufactured and supplied by Emerson. (Applicable to Soft / Metal seated, Cast / Forge, NL, NG, ML, MG subseries)

#### ⚠ WARNING

*Always use Personal Protective Equipment (PPE) when carrying out above activities.*

#### 2 RECEIPT, HANDLING AND STORAGE

- Identify the valve contained in the box using the packing list fixed on the box.
- While loading and unloading the box, check for handling instructions/symbols marked on the box and handle the box accordingly. Ensure lifting of valve box in upright position using fork lift as shown in Figure 1. Do not drag the box.
- Before removing the valve from the box, ensure valve is not fastened/fixed inside the box with wooden battens and bolts which are provided to prevent the valve from toppling or moving inside the box during transportation.
- Remove the valve from the box using proper D-Shackle or lifting hooks and straps. These must be sized depending upon the weight that must be lifted at lifting points (lifting lugs) provided on valve as shown in Figure 2. Do not use chains or hooks in contact with the machined or painted surfaces.

FIGURE 1

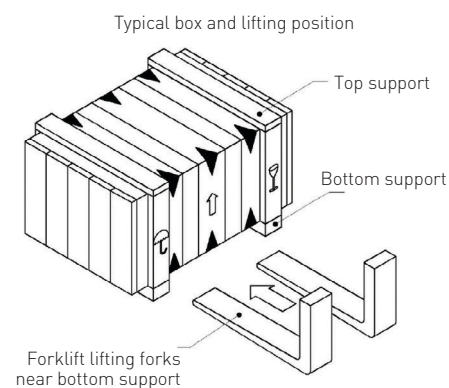
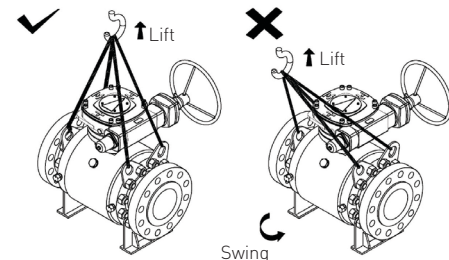


FIGURE 2



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

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- If lifting lugs are not provided on the valve, hold the valve with lifting strap around neck area and gently lift it as shown in Figure 3. Ensure the lifting strap is sized appropriately for the weight that must be lifted and is holding the neck area of valve firmly, to prevent damages.

### ⚠ WARNING

- If the valve is supplied with an operator (gear operator or actuator) do not use the operator or the operator lifting lugs to lift the valve assembly.
- For stem extension valve, use proper support as shown in Figure 4 to prevent toppling of valve.
- During handling, pay attention to prevent any damage to the flange faces, butt weld ends, operator, auxiliary fittings and piping (as applicable). Do not drag the valve during handling.
- The identification of the valve is given on the body or on the nameplate or both. (Figure 5).
- If a tag number is specified by the customer, identify the valve using tag number stamped on the name plate or tag plate affixed to the valve.
- After removing from box, always store the valve under roof and in a dry and clean atmosphere, protected from rain and storm.
- Always place the valve on 'soft' surface like rubber sheets or wooden planks free of dirt/debris/hardware like nails and moisture to avoid damage to the valve surfaces.
- Ensure that valve ends are covered with protective end caps. Do not remove any protection from the valve during storage period.
- In case of automated valve assembly, refer to actuator/accessory manufacturer instructions for handling and storage.
- Always keep the valve either in fully open or fully closed position. Full open position is preferred. The valve is normally shipped in the full open position (exception is valve with a 'fail close' spring return actuator arrangement)

FIGURE 3

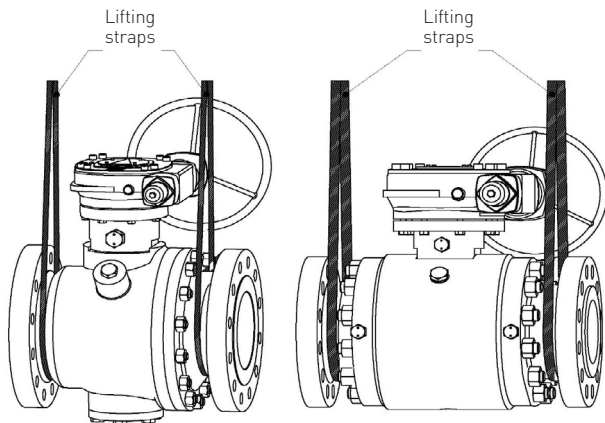


FIGURE 4

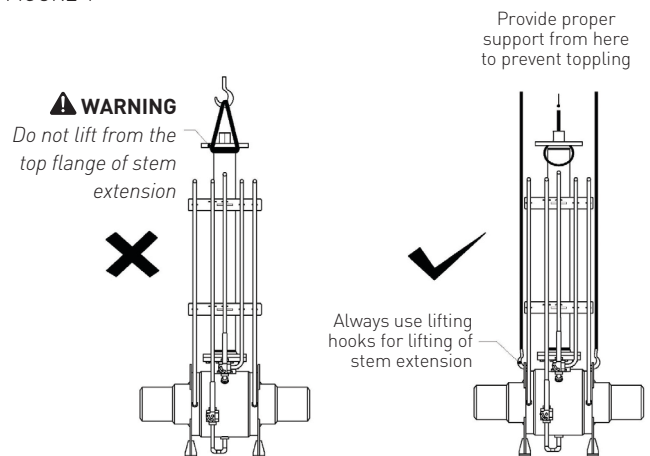
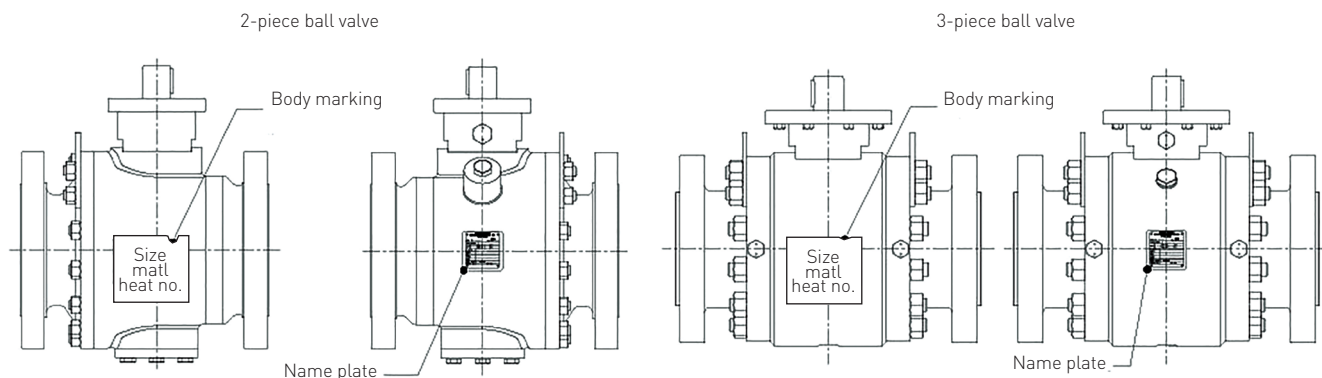


FIGURE 5



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 3 INSTALLATION

#### ⚠ WARNING

- To prevent personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given on name plate / tag plate of valve.
- Personal injury could result from packing leakage. The valve packing was tightened before shipment however; the packing might require some readjustment to meet specific service conditions.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- Before valve installation, ensure that the pipeline is free from dirt, debris, scale, weld-slag etc. to prevent damage to the internal trim parts and seals of the valve.
- Ensure that the valve end protectors are removed and the valve ends and bore are cleaned before installation.
- The mounting stand attached to the body to adapter joint shall not be removed while installing the valve on the pipeline (refer Figure 6).
- If mounting Stand or Support stand of valve is provided on end flange they shall be removed before installation on the pipeline (refer Figure 7).
- Mounting/support stand is only for handling and transportation and not for carrying piping loads. Hence Emerson recommends to give supports to the pipeline appropriately and shall not exceed following recommendations.
  - For sizes, up to DN 100 (NPS 4), support to be provided at a distance of '2D' to '3D' from both valve ends
  - For sizes, DN 150 (NPS 6) and higher, support to be provided at distance 'D' from both valve ends, where 'D' is the nominal diameter of pipeline.
- For removing mounting/support stand from valve assembly, lift the valve above ground level by using appropriate material handling/lifting equipment. Refer handling section of this IOM. Loosen and remove the nuts from respective mounting stand bolts/studs and remove the stands. Fasten the nuts and bolts/studs only to the mounting stand again and store the entire set appropriately to reuse whenever required for maintenance, storage etc.
- To reinstall the mounting/support stand from valve, position the valve above ground level by using appropriate material handling/lifting equipment. Refer handling section of this IOM. Loosen and remove the nuts and bolts/studs from mounting stand set. Position the stand aligning its holes with valve flange holes and retighten the nuts with bolts/studs as shown in Figure 7.
- Examples of valve support configurations are shown in Figure 8.
- The valve should preferably be in fully open condition during installation. Exception being the 'fail close' valves.
- Never install the Valve with the Actuator upside down on the pipeline, refer Figure 9.

FIGURE 6

Mounting stand attached to body flange

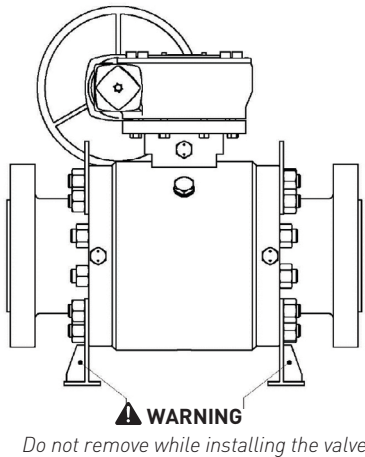


FIGURE 7

Mounting stand attached to end flange

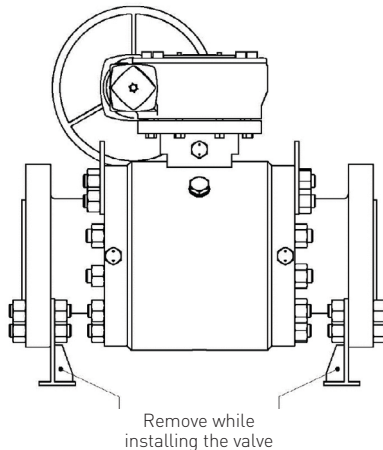
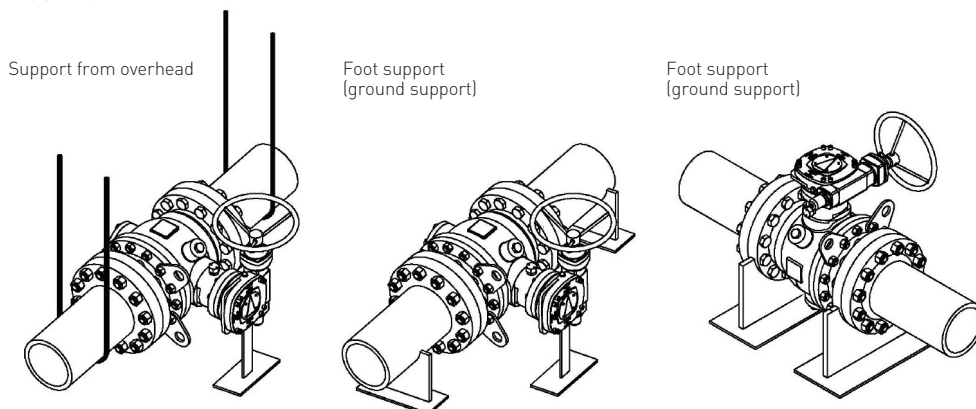


FIGURE 8



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### Installation of valve in vertical pipeline

- Place the valve with end flange resting on 'soft' surface like rubber sheets or wooden planks free of dirt/debris/hardware like nails and moisture.
- Hook the valve at end flange bolt holes as shown in Figure 10 and lift with the help of suitable crane.
- Alternately, valve can be lifted with the help of fork lift as shown in Figure 11.
- Mount the valve on the pipeline end flange with the flange gaskets appropriate for the application and assemble with suitable fasteners.
- Refer to tables in Section 14 of this IOM for recommended tightening torques.
- Do not allow valve body temperature in seat area to exceed 200 °F (94 °C) during welding of valve to the pipeline in case of butt weld end valves.

### 4 OPERATION

- For lever operated valve, the lever is either shipped loose or assembled with valve depending upon the size of the valve / lever. Rotation of lever in the clockwise direction closes the valve and counter clockwise rotation opens the valve.
- For gear operated valve, the gear operator open / close adjustment has been done prior to shipment and must not be changed. Rotation of hand wheel in the clockwise direction closes the valve and counter clockwise rotation opens the valve.
- It is recommended that the valve should be opened and closed slowly to prevent hammering effect on the valve and pipeline.
- If the valve is not operating to fully open or fully close position and/or leaking, do not apply excessive force to operate the valve. This can damage the valve internals and/or the operator parts.

- Do not apply extra force using inappropriate extensions to levers and handwheel like pipes or bars.  
**Note:** national standards typically restrict the input force on lever/handwheel rim to max. of 360N and the valves are designed accordingly.
- For valve with pneumatic and gas actuator, do not exceed the operating pressure of actuator.
- Always use dry, moisture free air while operating the valve with pneumatic actuator.

FIGURE 9

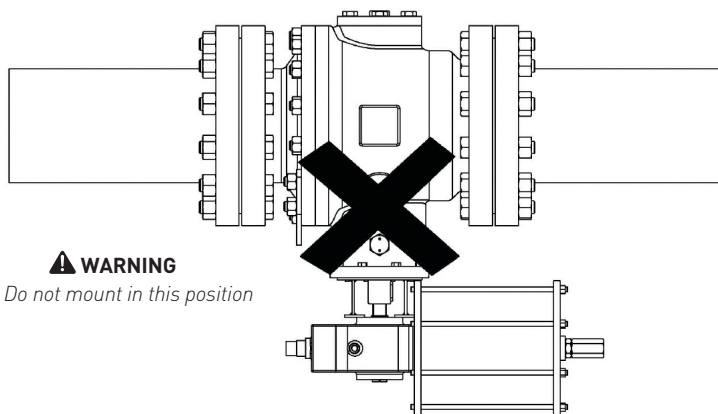


FIGURE 10

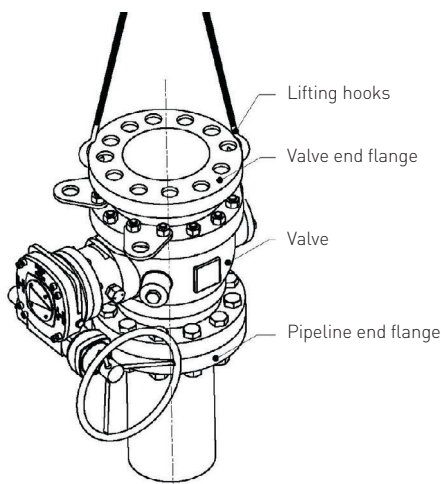
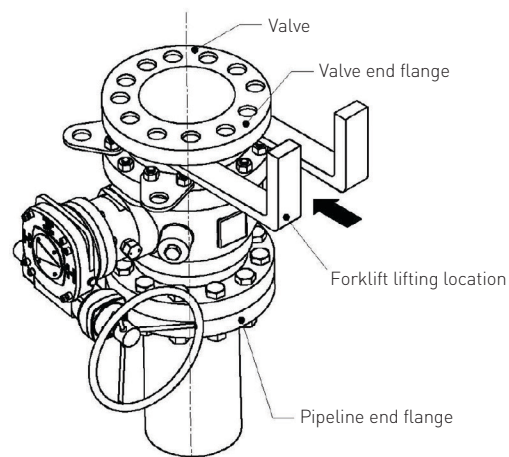


FIGURE 11



OR

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 5 GEAR OPERATOR INSTRUCTIONS

#### 5.1 Assembly of gear operator with bracket and coupling

- It is recommended that the valve should be kept in upright position (stem vertical).
- Valve shall be fully open.
- Place the bracket over valve top mounting flange and fasten it with suitable fasteners. Refer to tables in Section 14 of this IOM for recommended tightening torques.
- Fit the key in stem keyway slot and then mount coupling over stem.
- Fit the key in the coupling keyway slot and assemble the gear operator on the bracket with suitable fasteners ensuring that gear operator position indicator matches the open position of the valve.
- Gear operator setting should be done as given in Section 5.3.

#### 5.2 Assembly of gear operator without bracket and coupling

- It is recommended that the valve should be kept in upright position (stem vertical).
- Valve shall be fully open.
- Fit the key in the stem keyway slot and mount the gear operator on valve top mounting flange and fasten it with suitable fasteners ensuring that gear operator position indicator matches the open position of the valve. Refer to tables in Section 14 of this IOM for recommended tightening torques.
- Gear operator setting to be done as given in Section 5.3.

#### 5.3 Procedure for gear operator setting

##### CAUTION

*If the valve has been supplied by Emerson with the gear operator assembled on the valve - open / close adjustment has been done prior to shipment and must not be changed. In case of gear operator replacement or mounting of new gear operator on bare shaft valve, the steps below shall be followed.*

- Figure 14 shows the open and close positions of position indicator, adjustment bolts and lock nuts.
- Loosen the lock/check nut and unscrew both left and right side bolt by minimum one rotation.
- Match ball bore with valve bore. Fully tighten the right-side bolt and then tighten the lock nut.
- Rotate the ball by 90 degrees. Fully tighten the left-side bolt and then tighten the lock nut.

#### 5.4 Possible orientations of gear operator

Figure 15 below illustrates the two possible orientations for a gear operator when assembled together with the Virgo Series N trunnion mounted ball valve.

FIGURE 12

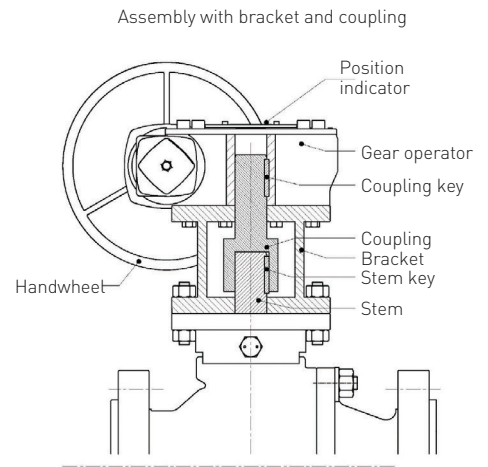


FIGURE 13

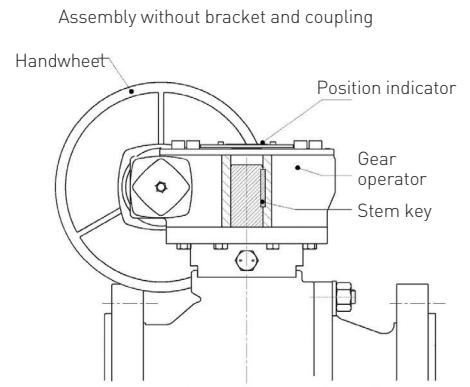


FIGURE 14

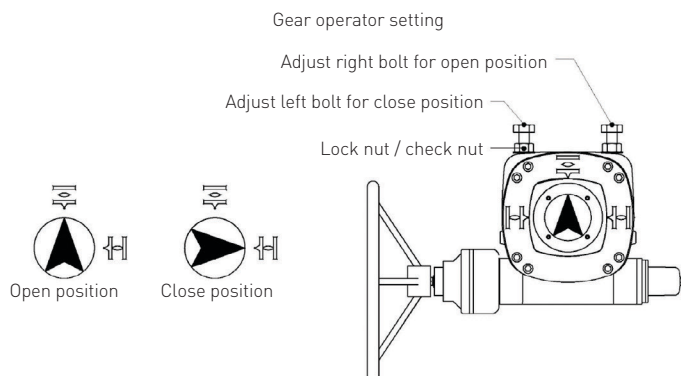
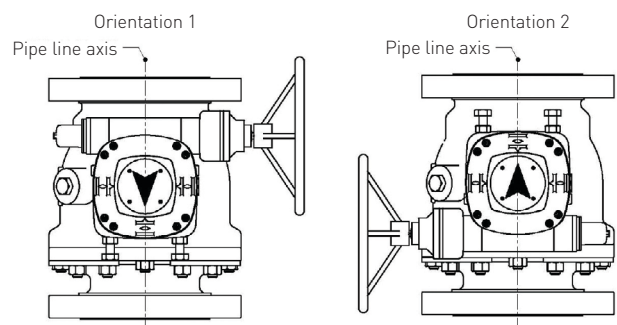


FIGURE 15



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 6 EMERGENCY SEALANT INJECTION SYSTEM

Typically provided on DN 150 (NPS 6) and larger valves

- Emergency Sealant injection system is provided on valve seat and/or stem packing area to temporarily reduce seat leakage when the valve is in the closed position or to reduce packing leakage.
- Typically, for valve size DN 350 (NPS 14) and above, 1 sealant injection fitting is provided for stem and 2 fittings for each seat. For valve sizes DN 300 (NPS 12) and below, 1 sealant injection fitting is provided for stem and 1 fitting for each seat.
- This emergency sealant injection system is to be used only when valve is not able to achieve the desired shutoff due to damage / wear and tear on the seats and seals and it is not possible to take the valve off the line for repair and maintenance.
- Always flush the sealant port with suitable cleaner/solution, before injecting sealant. Sealant / cleaning agents shall be selected based on service fluid / condition. References can be drawn from manufacturers like Climax Lubricants and Equipment Co®, Sealweld® etc.

#### Sealant injection fitting - Type A (standard supply)

See Figure 16

##### Seat sealant injection

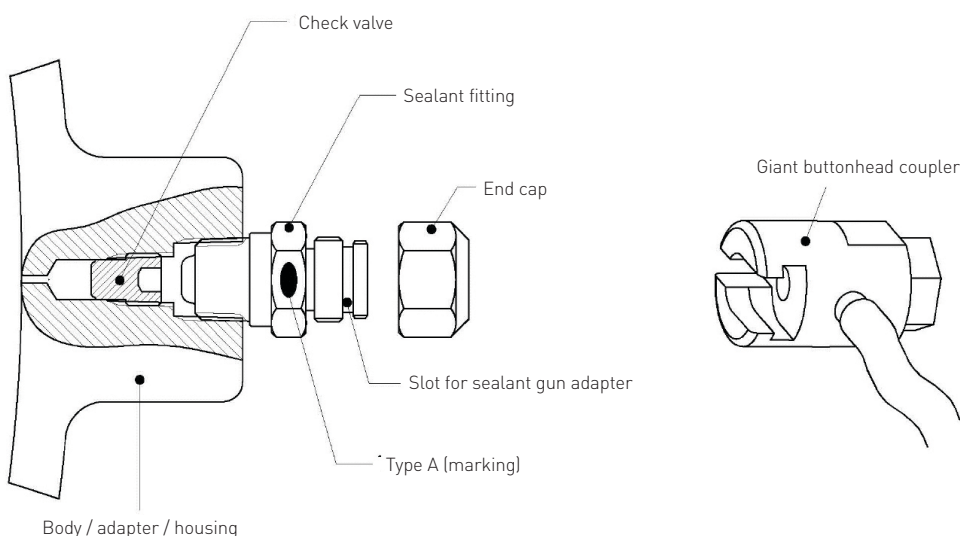
- Fully close the valve.
- Remove the fitting end cap and slide giant buttonhead coupler (Climax® model 1699/1700) on sealant fitting. Inject sealant into each of the sealant fitting. Injection pressure shall be more than pipeline pressure but shall not exceed 1.5 times the pipeline pressure at operating temperature.
- Fully open the valve. Inject sealant into each of the sealant fitting.
- Again, close the valve to uniformly distribute the sealant over the ball surface.
- Repeat above steps multiple times until desired sealing is achieved. Ensure last injection is always made with valve in close position.

##### Stem sealant injection

- Remove the fitting end cap and slide giant buttonhead coupler on sealant fitting. Inject sealant into the sealant fitting. Injection pressure shall be more than pipeline pressure but shall not exceed 1.5 times the pipeline pressure at operating temperature.
- Cycle valve once to uniformly distribute the sealant around the stem.

FIGURE 16

Sealant injection fitting - Type A (standard supply)





# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 7 PREVENTIVE / PERIODIC MAINTENANCE

Preventive / periodic maintenance is essential as the failure to do so may result in inadequate performance of the valve or also failures like seat leakage, environmental leakage, increased torque, jerky operation etc.

All valves in operation should be periodically inspected thoroughly to evaluate the condition of ball, seats and seals as these parts are subject to normal wear and tear. The frequency of inspection depends upon the severity of service conditions and location of the valve and should be conducted during partial or total shutdown.

Special attention is to be paid to inspect for damage and / or wear due to corrosion or erosion.

Periodic inspection of valve typically includes following activities:

- Inspection for any visible defect or failure such as packing or body joint leakage
- Tightening of bolts/nuts to recommended torques
- Valve stroking to prevent jamming and corrosion every six months

Section 11 describes the procedure for disassembly and reassembly of the valve.

Once a valve is refurbished / repaired it should undergo a complete set of tests to make sure that the valve is fit to use for the intended working conditions. Hydrostatic or Pneumatic tests should be carried out as per the specifications relevant to the valve.

Gear operators are packed with grease.

It is recommended that the grease should be changed after approximately 5-7 years if operated frequently or after 10-12 years if operated infrequently. Contact factory for appropriate grease grades if grease needs to be changed.

### 8 POSSIBLE MISUSE OF BALL VALVE

Sr. no.	Possible misuse	Actions to prevent misuse
1	Exceeding the pressure and / or temperature limits of the valve.	Do not exceed pressure and / or temperature limits mentioned on name plate affixed to the valve.
2	Valve material not suitable for service fluid.	Check Tag number (as applicable) and ensure correct valve is used as per process diagram. Verify valve material mentioned on Name plate is suitable with service fluid.
3	Use for control application.	These ball valves are designed for on/off application and should not be used for control / throttling.
4	Mounting of valve upside down.	Follow 'Installation' section of this document.
5	Wrong installation in case of uni-directional valve.	Verify flow direction on valve body or on additional plate affixed to valve.
6	Use of improper actuator when customer automates valve on site.	Contact factory for correct sizing of actuator.
7	Opening/closing of valve by using inappropriate extensions like pipes/bars etc.	Operate valve only with levers, gear operator, hand wheel or actuator provided / recommended by Emerson.
8	Any modification by customer in valve e.g. drilling, tapping, change of valve ends etc.	Unauthorized modifications are not allowed. Modification voids warranty. Contact factory if any such case arises.
9	Testing the valve with water without corrosion inhibitor.	Corrosion inhibitor shall be used to prevent corrosion of valve components. Requirements of international standards such as API 6D, API 598, BS EN 12266 etc. should be followed.
10	Inadequate draining and drying of valve after hydro test.	When valves are hydro tested onsite, they shall be drained and dried completely before installing on pipeline to prevent corrosion of parts and contamination of service fluid.
11	Not using lock open/close feature.	Ensure to use this provision (as applicable) based on process requirement.
12	Improper long term storage.	For long term storage and preservation of valves at site refer Emerson procedure QAC/KM-028. Contact Factory.
13	Damage to valve fittings during handling.	Follow handling instructions.

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 9 TROUBLESHOOTING

Problem	Possible cause	Remedy
Leakage across closed valve	<ol style="list-style-type: none"> <li>1. Damaged ball surface.</li> <li>2. Damaged seats / seat seals.</li> <li>3. Ball not closed fully.</li> <li>4. Seat not moving freely resulting in inadequate contact between ball and seat.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refurbish or replace the ball.</li> <li>2. Refurbish or replace seats. Replace seat seals.</li> <li>3. Check and reset ball. Open/close settings.</li> <li>4. Open valve, check for accumulation of dirt, debris, corrosion between seat and body, clean and re-assemble.</li> </ol>
Valve too hard to operate / valve torque too high / stick-slip operation	<ol style="list-style-type: none"> <li>1. Damaged seats / seat seals / ball.</li> <li>2. Seat not moving freely due to accumulation of dirt, debris, corrosion between seat and body or seat and ball.</li> <li>3. Operator not sized properly, damaged operator parts.</li> <li>4. Actuator not sized properly, damaged actuator parts, insufficient input air/gas pressure to actuator, restriction/clogging of actuator vent.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refurbish or replace the seats /seat seals / ball.</li> <li>2. Open valve, clean and reassemble.</li> <li>3. Select correct operator and replace.</li> <li>4. Select correct actuator and replace. Check input air supply, clean actuator vent.</li> </ol>
Leakage through stem	<ol style="list-style-type: none"> <li>1. Loose gland fasteners.</li> <li>2. Damaged stem, stem sealing surface.</li> <li>3. Damaged stem seal.</li> <li>4. Accumulation of dirt, debris, corrosion between stem and housing.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten the fasteners.</li> <li>2. Refurbish or replace the stem.</li> <li>3. Replace the stem seal.</li> <li>4. Open valve, clean and reassemble.</li> </ol>
Leakage through body to adapter joint; body to housing joint	<ol style="list-style-type: none"> <li>1. Damaged seal/gasket.</li> <li>2. Relaxation of joint fasteners.</li> <li>3. Accumulation of dirt, debris, corrosion between body and adapter.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace seal/ gasket.</li> <li>2. Retighten the fasteners evenly in criss-cross manner.</li> <li>3. Open valve, clean and reassemble.</li> </ol>
Leakage through drain, vent and sealant fittings.	<ol style="list-style-type: none"> <li>1. Loosening of fittings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Retighten. If leakage persists may require fresh thread sealant or replacement of fitting. WARNING: Do not remove fittings when valve / body cavity is under pressure.</li> </ol>

### 10 ORDERING SPARES

When ordering spares, please furnish the following information.

Size	Available on name plate or body of the valve
Class	Available on name plate or body of the valve
Batch number / serial number	Available on name plate or body of the valve
Manufacturing date	Available on name plate or body of the valve
Part number	Available on general arrangement drawing
Part name	Available on general arrangement drawing
Purchase order number	Available on general arrangement drawing



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### 11 DISASSEMBLY AND RE-ASSEMBLY

#### Sections

- 11.1 Warnings
- 11.2 Notes
- 11.3 **Series N & M trunnion mounted ball valve with gland**
  - Construction: Two-Piece
  - Type: External trunnion
  - 11.3.1 Disassembly procedure
  - 11.3.2 Re-assembly procedure
  - 11.3.3 Exploded view
- 11.4 **Series N & M trunnion mounted ball valve with gland**
  - Construction: Two-Piece
  - Type: Support plate
  - 11.4.1 Disassembly procedure
  - 11.4.2 Re-assembly procedure
  - 11.4.3 Exploded view
- 11.5 **Series N & M trunnion mounted ball valve without gland**
  - Construction: Two-Piece
  - Type: External trunnion
  - 11.5.1 Disassembly procedure
  - 11.5.2 Re-assembly procedure
  - 11.5.3 Exploded view
- 11.6 **Series N & M trunnion mounted ball valve without gland**
  - Construction: Two-Piece
  - Type: Support plate
  - 11.6.1 Disassembly procedure
  - 11.6.2 Re-assembly procedure
  - 11.6.3 Exploded view
- 11.7 **Series N & M trunnion mounted ball valve without gland**
  - Construction: Three-Piece
  - Type: Support plate
  - 11.7.1 Disassembly procedure
  - 11.7.2 Re-assembly procedure
  - 11.7.3 Exploded view

#### 11.1 Warnings

*For removal of valve from pipeline, disassembly, re-assembly*

- Pay attention to prevent personal injury or equipment damage from sudden release of process pressure or uncontrolled movement of parts.
- Always wear PPE like protective gloves, safety shoes, helmet, clothing, eyewear and other PPE as mandated by site/project when performing any maintenance operations to prevent personal injury.
- Do not remove the operator from the valve while the valve is still pressurized.
- In case of an actuated valve, before removal of actuator, disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot accidentally open or close the valve.
- In case of spring return actuators ensure that the spring is at its uncompressed position.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Double block and bleed valves can retain pressure and process fluid even after process pressure has been removed from both sides of the valve. Relieve this pressure before disassembling or removing the valve from the line. Take additional care if the process fluid is hot, flammable, caustic, or hazardous.
- Carefully secure the valve in an upright position. The roundness of the flanges and valve body allow it to easily roll from side-to-side. The combined weight of the valve and actuator assembly could cause injury or property damage when falling to the side.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Exercise caution when working on the valve stem packing as it may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Prevent injury by keeping hands, tools and other objects away from the ball while stroking the valve.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

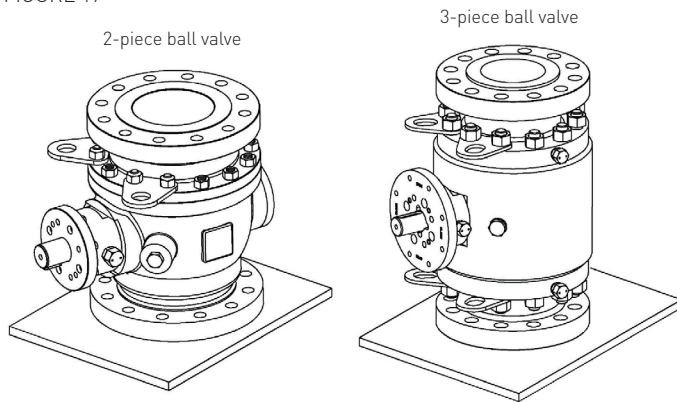
## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 11.2 Notes

- Ensure clean environment during disassembly and re-assembly of valve.
- Use appropriate material handling / lifting equipment. Refer handling section of this IOM.
- Prior to disassembly, it is recommended to mark mating parts like body and adapter, body and housing, body and trunnion, gear operator or actuator and ISO pad or housing to ensure same orientation during re-assembly.
- Before disassembly, it is recommended to keep the ball in fully closed position and then remove the operator from valve assembly.
- Valve shall be positioned on clean and flat surface with adapter end flange on top as shown in Figure 17.
- It is recommended to use original spares.
- Graphite gaskets shall be replaced.
- Elastomer and plastomer seals can be re-used, however it is recommended to replace them to maximize valve service life.
- Protect every sealing surface from nicks, dents and damages.
- Lubricate the O-ring and seals and lip seals before re-assembly.
- During re-assembly, refer to tables in Section 14 of this IOM for recommended tightening torques.
- Assembly drawing shows the standard configuration for valve with O-ring seals but can be considered as a reference for lip-seal configuration also.

FIGURE 17



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 11.3 Series N & M trunnion mounted ball valve with gland

Construction: Two-piece

Type: External trunnion

Refer section 11.3.3 for exploded view and location of parts.

#### 11.3.1 Disassembly procedure

1. Position the valve vertically by resting body side end flange as shown in Figure 17.
2. Slowly remove the vent / drain plug (20) to relieve any residual pressure from the body cavity.
3. Remove nuts (22) and housing (06) from body (01). Remove fasteners (08), gland (07) and packing (12) from housing. Remove O-ring (13) and gasket (14) from housing.
4. Remove key (18 and 19). Remove the stem (04) from the housing. Remove O-ring (11) from housing. Remove bearing (23) from housing, if it requires replacement due to wear / tear / damage. Remove thrust washer (24) from stem.
5. Remove trunnion (28) from body by removing fasteners (33). Remove O-ring (31) and gasket (32) from trunnion.
6. Disassemble the adapter (02) by removing nuts (17). Where threaded "Puller Holes" are provided on adapter flange, appropriate fasteners can be used to gradually separate the adapter from the body before lifting. This can be done by screwing the fasteners in the puller holes until they touch the body face and thereby pulling adapter away from the body. The size of the puller hole threading is same as that of the fastener (21) size of body to housing joint. Remove 'O'-ring (09) and gasket (10) from adapter.
7. Remove seat (05) from adapter. Remove O-ring (15) from seat. Remove seat springs (25) from adapter or seat.
8. Remove ball (03) and seat (05) from body. Remove O-ring (15) from seat. Remove seat springs (25) from body or seat. Remove bearing (29) from ball, if it requires replacement due to wear / tear / damage. Remove Thrust washer (30) from ball.
9. Where applicable, the sealant injection fittings (26) may be removed for cleaning.

#### 11.3.2 Re-assembly procedure

1. Ensure all parts are clean prior to assembly of the valve.
2. Pay attention to references marked during disassembly.
3. Position the body (01) vertically by resting on end flange. Insert springs (25) in body or seat (05). Mount O-rings / lip seals (15) as applicable on seat and insert seat in body.
4. Assemble bearing (29) and thrust washer (30) in ball pocket and place the ball (03) on body side seat such that ball is in closed position.
5. Insert springs (25) in adapter (02) or seat (05). Mount O-rings / lip seals (15) as applicable on seat and insert seat in adapter.
6. Place gasket (10) and O-ring (09) on adapter. Place the adapter assembly on body. Assemble lifting hooks (27) as applicable. Tighten the nuts (17) in criss-cross pattern.
7. Assemble the trunnion (28) along with O-ring / lip seal (31) and gasket (32) as applicable on body with fasteners (33).
8. Place O-rings / lip seal (11), packing (12) and bearing (23) on housing (06). Assemble gland (07) with fasteners (08).
9. Insert stem (04) along with thrust washer (24) in housing.
10. Assemble housing along with stem on body using gasket (14), O-ring (13) and dowel (34). Tighten the nuts (22) in criss-cross pattern.
11. Assemble key (18 and 19) on stem.
12. Assemble drain / vent plug (20) as applicable.
13. Assemble sealant injection fittings (26) as applicable.

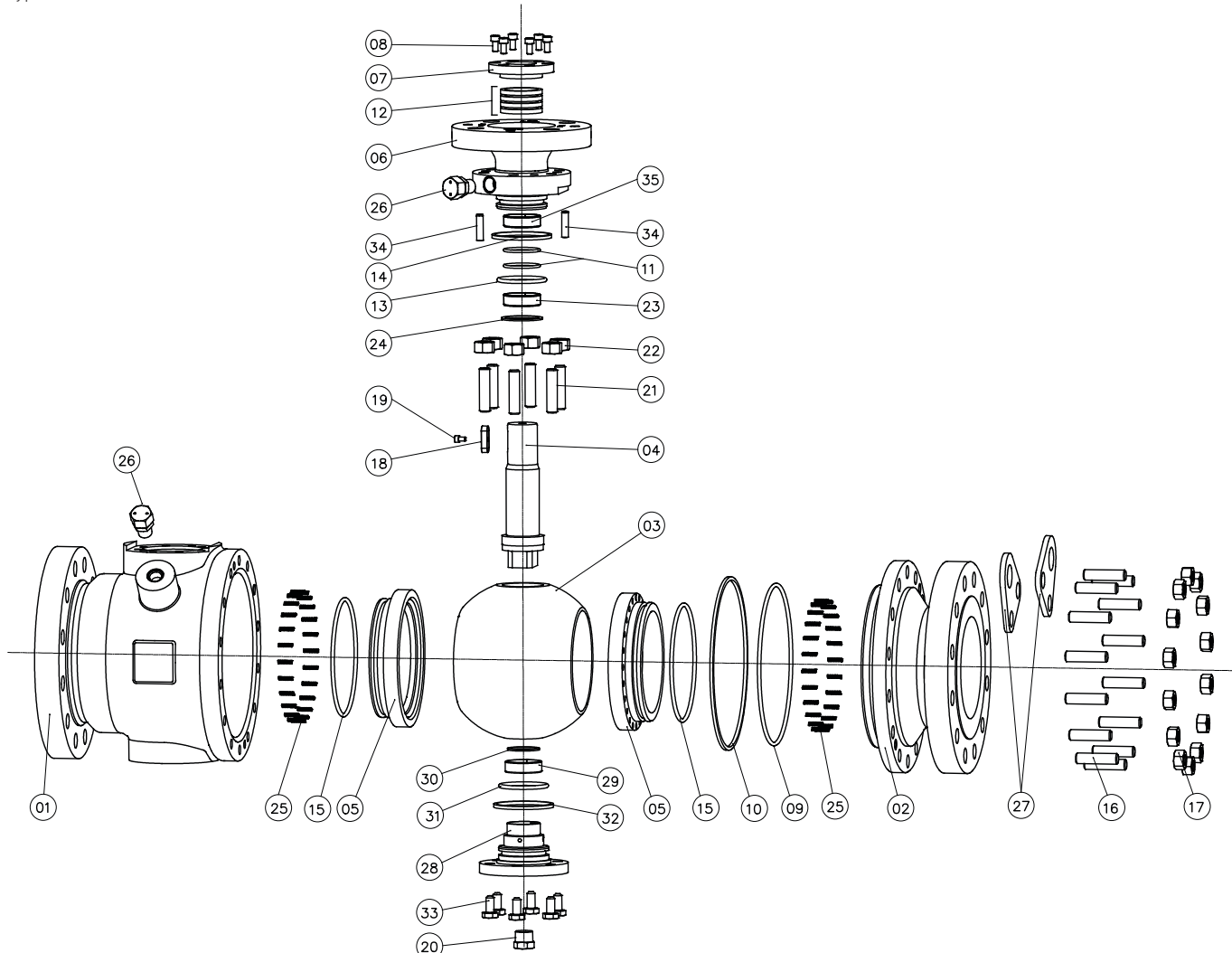
## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 11.3.3 Exploded view

### Series N & M trunnion mounted ball valve with gland

Construction: Two-piece

Type: External trunnion



## PARTLIST

Item No.	Part name	Item No.	Part name
1	Body	19	Cap screw (key-stem)
2	Adapter	20	Drain plug
3	Ball	21	Stud (body-housing)
4	Stem	22	Nut (body-housing)
5	Seat	23	Bearing (stem)
6	Housing	24	Thrust washer (stem)
7	Gland	25	Seat spring
8	Cap screw (gland-housing)	26	Sealant fitting for DN 150 (NPS 6) (for seat thru body cavity)
9	O-ring (body seal)	27	Lifting hook for DN 150 (NPS 6)
10	Gasket (body seal)	28	Trunnion
11	O-ring (stem seal)	29	Bearing (trunnion)
12	Packing (stem seal)	30	Thrust washer (trunnion)
13	O-ring (housing seal)	31	O-ring (trunnion seal)
14	Gasket (housing seal)	32	Gasket (trunnion seal)
15	O-ring (seat seal)	33	Hex screw (trunnion)
16	Stud (body-adapter)	34	Dowels (body-housing)
17	Nut (body-adapter)	35	Bush (stem)
18	Key		

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 11.4 Series N & M trunnion mounted ball valve with gland

Construction: Two-piece

Type: Support plate

Refer Section 11.4.3 for exploded view and location of parts.

#### 11.4.1 Disassembly procedure

1. Position the valve vertically by resting body side end flange as shown in Figure 17.
2. Slowly remove the vent / drain plug (21) to relieve any residual pressure from the body cavity.
3. Remove nuts (23) and housing (06) from body. Remove fasteners (08), gland (07) and packing (12) from housing. Remove O-ring (13) and gasket (14) from housing.
4. Remove key (19 and 20). Remove the stem (04) from the housing. Remove O-ring (11) from housing. Remove bearing (24) from housing, if it requires replacement due to wear / tear / damage. Remove thrust washer (25) from stem.
5. Remove nuts (18) and adapter (02). Where threaded "Puller Holes" are provided on adapter flange, appropriate fasteners can be used to gradually separate the adapter from the body before lifting. This can be done by screwing the fasteners in the puller holes until they touch the body face and thereby pulling adapter away from the body. The size of the puller hole threading is same as that of the fastener (22) size of body to housing joint. Remove O-ring (09) and gasket (10) from adapter.
6. Remove lock washers (34) and seat (05) from adapter. Remove O-ring (15) from seat. Remove seat springs (26) from adapter or seat.
7. Remove ball (03) along with support plates (29) from body. Remove support plate from ball.  
Remove bearings (30) from support plates, if it requires replacement due to wear / tear / damage. Remove thrust washer (31) from ball.
8. Remove seat (05) from body. Remove O-ring (15) from seat. Remove seat springs (26) from body or seat.
9. Where applicable, the sealant injection fittings (27) may be removed for cleaning.

#### 11.4.2 Re-assembly procedure

1. Ensure all parts are clean prior to assembly of the valve.
2. Pay attention to references marked during disassembly.
3. Position the body (01) vertically by resting on end flange. Insert springs (26) in body or seat (05). Mount O-rings / lip seals (15) as applicable on seat and insert seat in body.
4. Assemble dowel pins (33) and bearing (30) in support plates (29) and place them on ball (03) along with thrust washers (31).
5. Place the ball along with support plates in the body such that ball is in closed position.
6. Insert springs (26) in adapter (02) or seat (05). Mount O-rings / lip seals (15) as applicable on seat and insert seat in adapter. Assemble lock washers (34) to lock the seat in adapter.
7. Place gasket (10) and O-ring (09) on adapter (02). Place the adapter assembly on body such that dowel pins (33) take guide of dowel pin hole on adapter. Assemble lifting hooks (28) as applicable. Tighten the nuts (18) in criss-cross pattern.
8. Place O-rings / lip seal (11), packing (12) and bearing (24) in housing (06). Assemble gland (07) with fasteners (08).
9. Insert stem (04) along with thrust washer (25) in housing.
10. Assemble housing along with stem on body using gasket (14), O-ring (13) and dowel (32). Tighten the nuts (23) in criss-cross pattern.
11. Assemble key (19 and 20) on stem.
12. Assemble drain / vent plug (21) as applicable.
13. Assemble sealant injection fittings (27) as applicable.

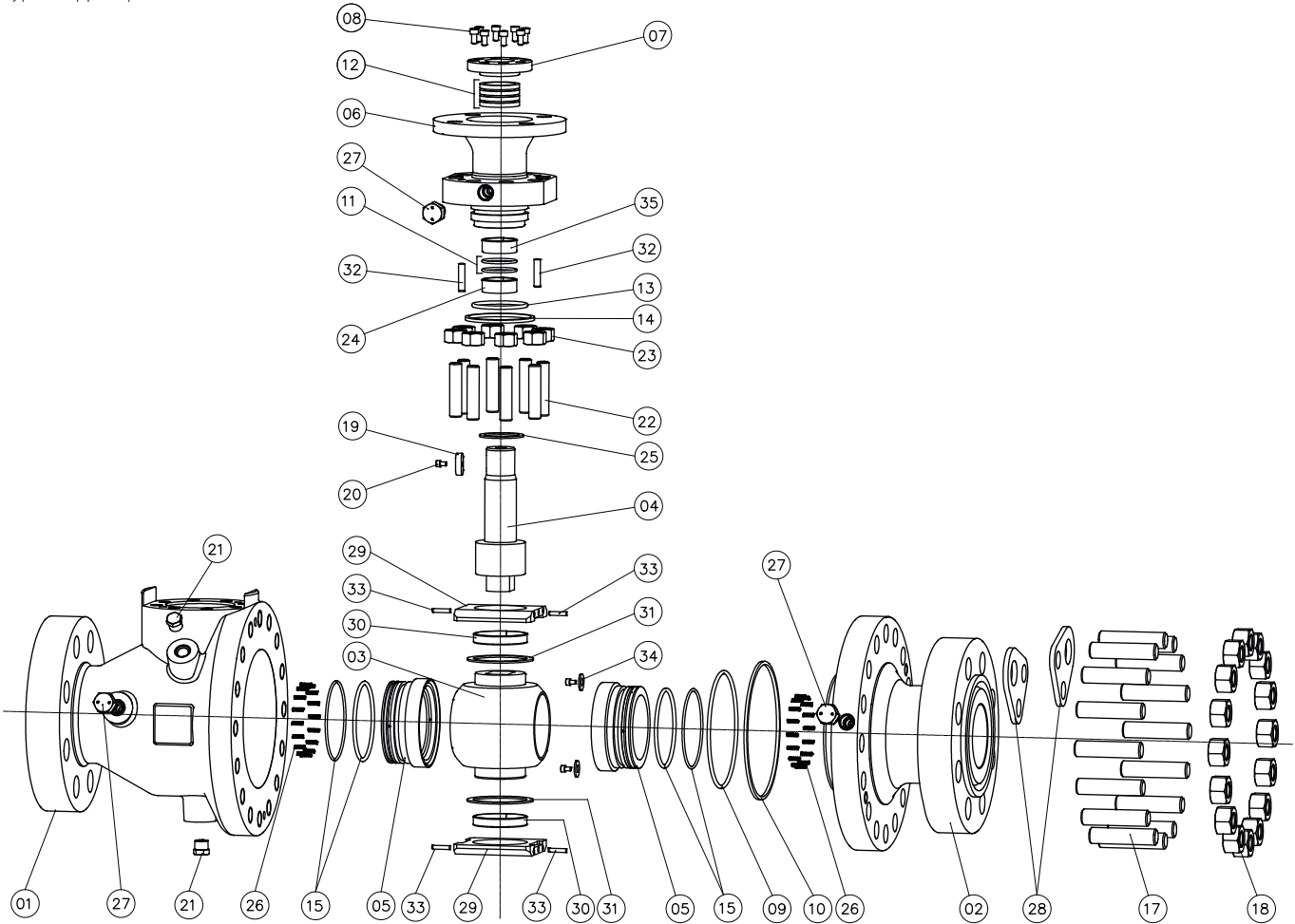
**KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES**  
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

11.4.3 Exploded view

**Series N & M trunnion mounted ball valve with gland**

Construction: Two-piece

Type: Support plate



**PARTS LIST**

Item No.	Part name	Item No.	Part name
1	Body	20	Cap screw (key-stem)
2	Adapter	21	Drain plug for all sizes. Vent plug for DN 100 (NPS 4) Class 600 and above
3	Ball	22	Stud (body-housing)
4	Stem	23	Nut (body-housing)
5	Seat	24	Bearing (stem)
6	Housing	25	Thrust washer (stem)
7	Gland	26	Seat spring
8	Cap screw (gland-housing)	27	Sealant fitting for DN 100 (NPS 4) Class 600 and above
9	O-ring (body seal)	28	Lifting hook for DN 80 (NPS 3) Class 1500 and above
10	Gasket (body seal)	29	Support plate
11	O-ring (stem seal)	30	Bearing (support plate)
12	Packing (stem seal)	31	Thrust washer (support plate)
13	O-ring (housing seal)	32	Dowels (body-housing)
14	Gasket (housing seal)	33	Dowels (support plate-body/adapter)
15	O-ring (seat seal)	34	Lock washer with screw
17	Stud (body-adapter)	35	Bush (stem)
18	Nut (body-adapter)		
19	Key		

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 11.5 Series N & M trunnion mounted ball valve without gland

Construction: Two-piece

Type: External trunnion

Refer Section 11.5.3 for exploded view and location of parts.

#### 11.5.1 Disassembly procedure

1. Position the valve vertically by resting body side end flange as shown in Figure 17.
2. Slowly remove the vent / drain plug (21) to relieve any residual pressure from the body cavity.
3. Remove fasteners (09) and ISO pad (07). Remove fasteners (08) and housing (06). Remove O-ring (14) and gasket (13 and 15) from housing.
4. Remove key (19 and 20). Remove the stem (04) from the housing. Remove O-ring from housing. Remove bearing (22) from housing, if it requires replacement due to wear / tear / damage. Remove thrust washer (23) from stem.
5. Remove trunnion (27) from body by removing fasteners (32). Remove O-ring (30) and gasket (31) from trunnion.
6. Disassemble the adapter (02) by removing nuts (18). Where threaded "Puller Holes" are provided on adapter flange, appropriate fasteners can be used to gradually separate the adapter from the body before lifting. This can be done by screwing the fasteners in the puller holes until they touch the body face and thereby pulling adapter away from the body. The size of the puller hole threading is same as that of the fastener (09) size of body to housing joint. Remove 'O'-ring (10) and gasket (11) from adapter. Use puller holes provided on adapter for easy removal.
7. Remove the seat (05) from adapter. Remove O-ring (16) from seat. Remove seat springs (24) from adapter or seat.
8. Remove ball (03) and seat (05) from body. Remove O-ring (16) from seat. Remove seat springs (24) from body or seat. Remove thrust washer (29) from ball. Remove bearing (28) from ball, if it requires replacement due to wear / tear / damage.
9. Where applicable, the sealant injection fittings (25) may be removed for cleaning.

#### 11.5.2 Re-assembly procedure

1. Ensure all parts are clean prior to assembly of the valve.
2. Pay attention to references marked during disassembly.
3. Position the body (01) vertically by resting on end flange. Insert springs (24) in body or seat (05). Mount O-rings / lip seals (16) as applicable on seat and insert seat in body.
4. Assemble bearing (28) and thrust washer (29) in ball pocket and place the ball (03) on body side seat such that ball is in closed position.
5. Insert springs (24) in adapter (02) or seat (05). Mount O-rings / lip seals (16) as applicable on seat and insert seat in adapter.
6. Place gasket (11) and O-ring (10) on adapter. Place the adapter assembly on body. Assemble lifting hooks (26) as applicable. Tighten the nuts (18) in criss-cross pattern.
7. Assemble the trunnion (27) along with O-ring / lip seal (30) and gasket (31) as applicable on body with fasteners (32).
8. Place O-rings (12) and bearing (22) in housing (06).
9. Insert stem (04) along with thrust washer (23) in housing.
10. Assemble housing along with stem on body using gasket (15), O-ring (14), fasteners (08) and dowel (33).
11. Place gasket (13) between ISO pad (07) and housing and assemble ISO pad using fasteners (09) and dowel pins (34).
12. Assemble key (19 and 20) on stem.
13. Assemble drain / vent plug (21) as applicable.
14. Assemble sealant injection fittings (25) as applicable.



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

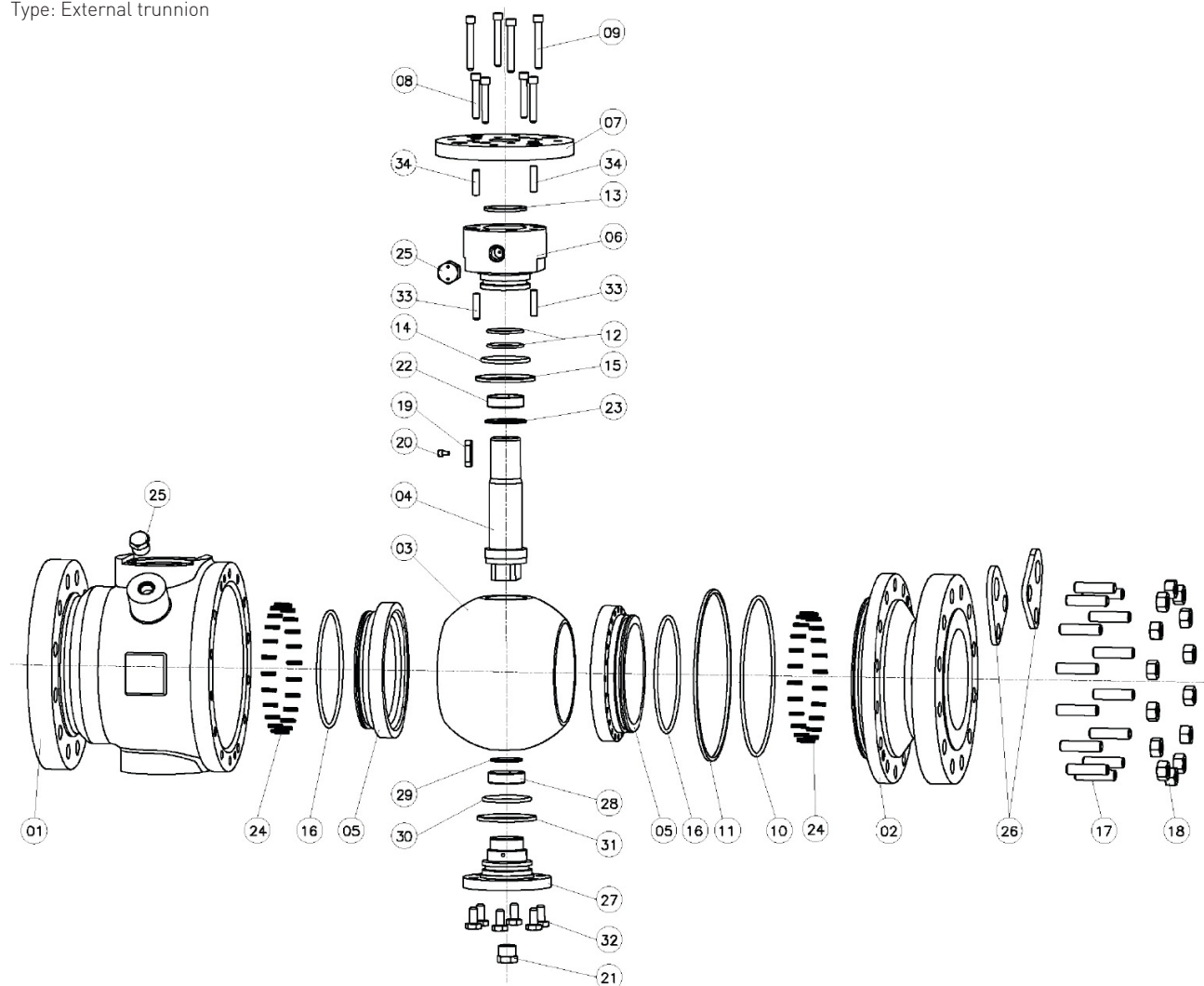
## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 11.5.3 Exploded view

#### Series N & M trunnion mounted ball valve without gland

Construction: Two-piece

Type: External trunnion



#### PARTS LIST

Item No.	Part name	Item No.	Part name
1	Body	19	Key
2	Adapter	20	Cap screw (key-stem)
3	Ball	21	Drain plug
4	Stem	22	Bearing (stem)
5	Seat	23	Thrust washer (stem)
6	Housing	24	Seat spring
7	ISO pad	25	Sealant fitting for DN 150 (NPS 6) (for seat thru body cavity)
8	Fastener (ISO pad-housing)	26	Lifting hook for DN 150 (NPS 6)
9	Fastener (housing-body)	27	Trunnion
10	O-ring (body seal)	28	Bearing (trunnion)
11	Gasket (body seal)	29	Thrust washer (trunnion)
12	O-ring (stem seal)	30	O-ring (trunnion seal)
13	Gasket (stem seal)	31	Gasket (trunnion seal)
14	O-ring (housing seal)	32	Hex screw (trunnion)
15	Gasket (housing seal)	33	Dowels (body-housing)
16	O-ring (seat seal)	34	Dowels (ISO pad-housing)
17	Stud (body-adapter)		
18	Nut (body-adapter)		

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 11.6 Series N & M trunnion mounted ball valve without gland

Construction: Two-piece

Type: Support plate

Refer Section 11.6.3 for exploded view and location of parts.

#### 11.6.1 Disassembly procedure

1. Position the valve vertically by resting body side end flange as shown in Figure 17.
2. Slowly remove the vent / drain plug (22) to relieve any residual pressure from the body cavity.
3. Remove fasteners (09) and ISO pad (07). Remove fasteners (08) and housing (06). Remove O-ring (14) and gasket (15) from housing.
4. Remove key (20 and 21). Remove the stem (04) from the housing. Remove O-ring (13) from housing. Remove bearing (23) from housing, if it requires replacement due to wear / tear / damage. Remove thrust washer (24) from stem.
5. Remove nuts (19) and adapter (02). Where threaded "Puller Holes" are provided on adapter flange, appropriate fasteners can be used to gradually separate the adapter from the body before lifting. This can be done by screwing the fasteners in the puller holes until they touch the body face and thereby pulling adapter away from the body. The size of the puller hole threading is same as that of the fastener (09) size of body to housing joint. Remove O-ring (10) and gasket (11) from adapter.
6. Remove lock washer (34) and seat (05) from adapter. Remove O-ring (13) from seat. Remove seat springs (25) from adapter or seat.
7. Remove ball (03) along with support plates (28) from body. Remove support plate from ball. Remove bearings (29) from support plates, if it requires replacement due to wear / tear / damage. Remove thrust washer from ball.
8. Remove seat (05) from body. Remove O-ring (13) from seat. Remove seat springs (25) from body or seat.
9. Where applicable, the sealant injection fittings (26) may be removed for cleaning.

#### 11.6.2 Re-assembly procedure

1. Ensure all parts are clean prior to assembly of the valve.
2. Pay attention to references marked during disassembly.
3. Position the body (01) vertically by resting on end flange. Insert springs (25) in body or seat (05). Mount O-rings / lip seals (16) as applicable on seat and insert seat in body.
4. Assemble dowel pins (32) and bearing (29) in support plates (28) and place them on ball (03) along with thrust washers (30).
5. Place the ball along with support plates in the body such that ball is in closed position.
6. Insert springs (25) in adapter (02) or seat (05). Mount O-rings / lip seals (16) as applicable on seat and insert seat in adapter. Assemble lock washer (34) to lock the seat in adapter.
7. Place gasket (11) and O-ring (10) on adapter. Place the adapter assembly on body such that dowel pins (32) take guide of dowel pin hole on adapter. Assemble lifting hooks (27) as applicable. Tighten the nuts (19) in criss-cross pattern.
8. Place O-rings (12) and bearing (23) in housing (06).
9. Insert stem (04) along with thrust washer (24) in housing.
10. Assemble housing along with stem on body using gasket (15), O-ring (14), fasteners (08) and dowel (31).
11. Place gasket (13) between ISO pad (07) and housing and assemble ISO pad using fasteners (09) and dowel pins (33).
12. Assemble key (19 and 20) on stem.
13. Assemble drain / vent plug (22) as applicable.
14. Assemble sealant injection fittings (26) as applicable.

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

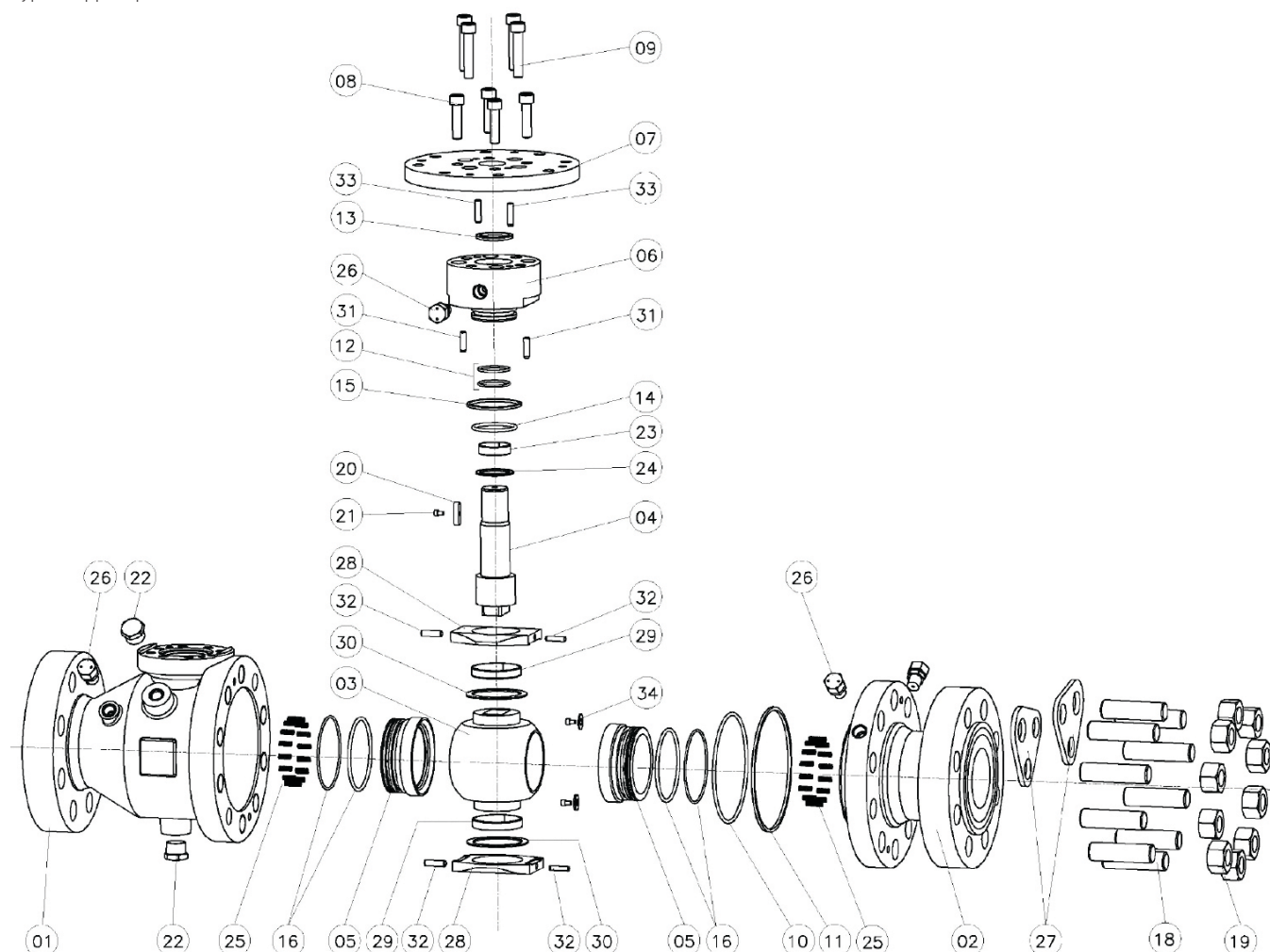
## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 11.6.3 Exploded view

#### Series N & M trunnion mounted ball valve without gland

Construction: Two-piece

Type: Support plate



#### PARTS LIST

Item no.	Part name	Item No.	Part name
1	Body	20	Key
2	Adapter	21	Cap screw (key-stem)
3	Ball	22	Drain plug for all sizes. Vent plug for DN 100 (NPS 4) Class 600 and above
4	Stem	23	Bearing (stem)
5	Seat	24	Thrust washer (stem)
6	Housing	25	Seat spring
7	ISO pad	26	Sealant fitting for DN 100 (NPS 4) Class 600 and above
8	Fastener (ISO pad-housing)	27	Lifting hook for DN 80 (NPS 3) Class 1500 and above
9	Fastener (housing-body)	28	Support plate
10	O-ring (body seal)	29	Bearing (support plate)
11	Gasket (body seal)	30	Thrust washer (support plate)
12	O-ring (stem seal)	31	Dowels (body-housing)
13	Gasket (stem seal)	32	Dowels (support plate-body/adapter)
14	O-ring (housing seal)	33	Dowels (ISO pad-housing)
15	Gasket (housing seal)	34	Lock washer with screw
16	O-ring (seat seal)		
18	Stud (body-adapter)		
19	Nut (body-adapter)		

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 11.7 Series N & M trunnion mounted ball valve without gland

Construction: Two-piece or three-piece

Type: Support plate

Refer Section 11.7.3 for exploded view and location of parts.

#### 11.7.1 Disassembly procedure

1. Position the valve vertically on side end flange as shown in Figure 17.
2. Slowly remove the vent / drain plug (22) to relieve any residual pressure from the body cavity.
3. Remove fasteners (08) and ISO pad (07). Remove fasteners (09) and housing (06). Remove O-ring (14) and gasket (15) from housing.
4. Remove key (20 and 21). Remove the stem (04) from housing. Remove O-ring (13) from housing. Remove bearing (23) from housing, if it requires replacement due to wear / tear / damage. Remove thrust washer (24) from stem.
5. Remove nuts (19) and 2<sup>nd</sup> or top adapter (02). Remove O-ring (10) and gasket (11) from 2<sup>nd</sup> or top adapter.
6. Remove lock washer (35) and seat (05) from 2<sup>nd</sup> or top adapter. Remove O-ring (16) from seat. Remove seat springs (25) from adapter or seat.
7. Remove ball (03) along with support plates (28). Remove support plates from ball. Remove bearings (29) from support plates, if it requires replacement due to wear / tear / damage. Remove thrust washer (30) from ball.
8. Remove nuts (19) and body (01) from 1<sup>st</sup> or bottom adapter (02). Lifting lugs (27) can be fastened at 180° apart using body top side studs and nuts for lifting and removing the body. Remove O-ring (10) and gasket (11) from 1<sup>st</sup> or bottom adapter.
9. Remove lock washer (35) and seat (05) from 1<sup>st</sup> or bottom adapter. Remove O-ring (16) from seat. Remove seat springs (25) from adapter or seat.
10. Where applicable, the sealant injection fittings (26) may be removed for cleaning.

#### 11.7.2 Re-assembly procedure

1. Ensure all parts are clean prior to assembly of the valve.
2. Pay attention to references marked during disassembly.
3. Position the 1<sup>st</sup> or bottom adapter (02) vertically by resting on end flange. Insert springs (25) in 1<sup>st</sup> or bottom adapter or seat (05). Mount O-rings / lip seals (16) as applicable on seat and insert seat in 1<sup>st</sup> or bottom adapter. Assemble lock washer (35) to lock the seat in 1<sup>st</sup> or bottom adapter.
4. Place gasket (11) and O-ring (10) on 1<sup>st</sup> or bottom adapter. Assemble the body (01) such that dowel pins on body take guide of dowel pin holes on 1<sup>st</sup> or bottom adapter. Assemble lifting hooks (27) as applicable. Tighten the nuts (19) in criss-cross pattern.
5. Assemble dowel pins (32) and bearing (29) in support plates (28) and place them on ball (03) along with thrust washers (30).
6. Place the ball along with support plates on 1<sup>st</sup> or bottom adapter seat such that ball is in closed position.
7. Insert seat springs (25) in 2<sup>nd</sup> or top adapter or seat (05). Mount O-rings / lip seals (16) as applicable on seat and insert seat in 2<sup>nd</sup> or top adapter. Assemble lock washer (35) to lock the seat in 2<sup>nd</sup> or top adapter.
8. Place gasket (11) and O-ring (10) on 2<sup>nd</sup> or top adapter. Assemble 2<sup>nd</sup> adapter such that dowel pins on body take guide of dowel pin holes on 2<sup>nd</sup> or top adapter. Assemble lifting hooks (27) as applicable. Tighten the nuts (19) in criss-cross pattern.
9. Place O-rings / lip seals (12) and bearing (23) in housing (06).
10. Insert the stem (04) along with thrust washer (24) in housing.
11. Assemble housing along with stem on body using gasket (15), O-ring (14), fasteners (09) and dowel (31).
12. Place gasket (13) between ISO pad (07) and housing and assemble ISO pad using fasteners (08) and dowel pins (33).
13. Assemble key (20 and 21) on stem.
14. Assemble drain / vent plug (22) as applicable.
15. Assemble sealant injection fittings (26) as applicable.

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

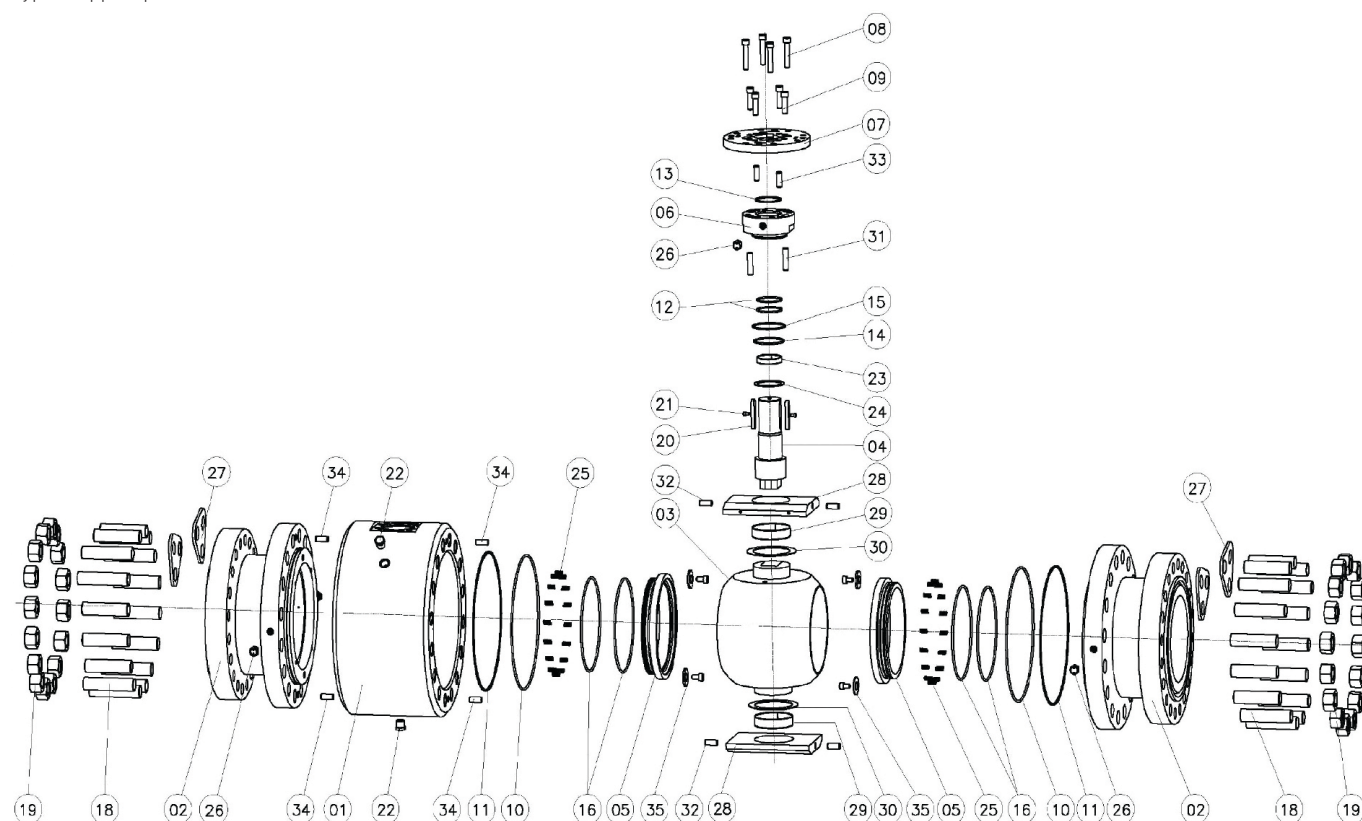
## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 11.7.3 Exploded view

#### Series N & M trunnion mounted ball valve without gland

Construction: Three-piece

Type: Support plate



#### PARTS LIST

Item No.	Part name	Item No.	Part name
1	Body	20	Key
2	Adapter	21	Cap screw (key-stem)
3	Ball	22	Drain plug / vent plug
4	Stem	23	Bearing (stem)
5	Seat	24	Thrust washer (stem)
6	Housing	25	Seat spring
7	ISO pad	26	Sealant fitting for DN 100 (NPS 4) Class 600 and above
8	Fastener (ISO pad-housing)	27	Lifting hook for DN 80 (NPS 3) Class 1500 and above
9	Fastener (housing-body)	28	Support plate
10	O-ring (body seal)	29	Bearing (support plate)
11	Gasket (body seal)	30	Thrust washer (support plate)
12	O-ring (stem seal)	31	Dowels (body-housing)
13	Gasket (stem seal)	32	Dowels (support plate-body/adapter)
14	O-ring (housing seal)	33	Dowels (ISO pad-housing)
15	Gasket (housing seal)	34	Dowels (body-adapter)
16	O-ring (seat seal)	35	Lock washer with screw
18	Stud (body-adapter)		
19	Nut (body-adapter)		

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 12 BODY CAVITY RELIEF OPERATION

#### Single piston effect (SPE) - self relieving seats

When seats are under pressure in pipeline, both upstream and downstream, the resultant thrust from pressure pushes the seat rings towards the ball.

At the same time, pressure in the body cavity creates a thrust that pushes the seat rings away from the ball.

The single piston effect (SPE) permits the automatic release of overpressure in the body cavity when the valve is in the fully open or closed position. In single piston effect design, seat rings are thus "self-relieving".

#### Double piston effect (DPE)

When seats are under pressure in pipeline, upstream and downstream both, the resultant thrust from pressure pushes the seat rings towards the ball.

Also, pressure in the body cavity creates a thrust that pushes the seat rings towards the ball.

When the valve is designed with double piston effect (DPE), self-relieving does not occur and hence pressure relief (PR) valve is mandatory with pre-setting to avoid over-pressure building in the cavity.

### 13 GLAND PACKING ASSEMBLY PROCEDURE

1. In case of packing contain braided graphite, it shall be placed at bottom and top. Position of packing arrangement such that the oblique cut of these braided graphite is 180° apart. Refer Figure below for appropriate arrangement for die molded (Figure 19) and for VEE type packing (Figure 20).
2. Place the gland into the housing and disk spring (for VEE type packing) and the cap screw / hex bolt.
3. Hand tighten cap screw / hex bolt in crisscross pattern.
4. Tighten gland cap screws / hex bolt in crisscross pattern by using 25% torque as specified in Section-14 against mentioned fasteners material.
5. Ensure no bottoming up of gland or otherwise one ring needs to be added in packing set.
6. Verify that the gland top surface is at equal depth from top face of housing.

#### NOTE

Full tightening of screws shall be done during performance testing depending on Leakage observed.

FIGURE 18

Square/rectangular type stem packing arrangement

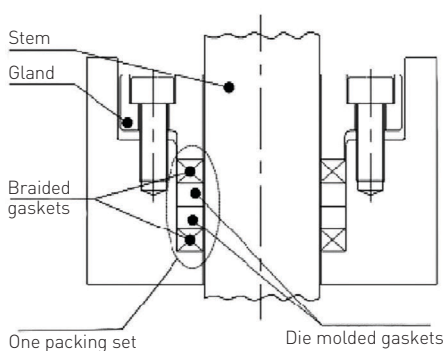
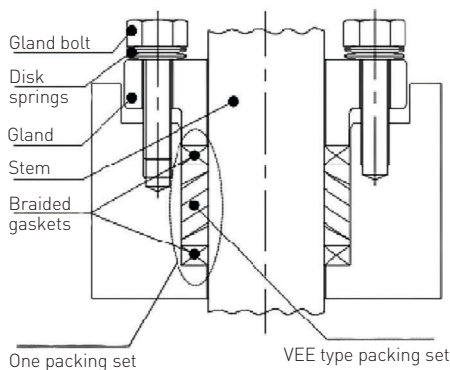


FIGURE 19

VEE type stem packing arrangement



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 14 RECOMMENDED TIGHTENING TORQUES FOR FASTENERS AND PLUGS

#### NOTES

1. Ensure that all the nuts/bolts are tightened to the torque values as specified in below Tables.
2. Torque values for carbon and low alloy steel material are for dry and non-lubricated fasteners.
3. Torque values for austenitic stainless steel material are with anti-seize lubricant.
4. Apply pipe thread sealant to the threads of the drain and vent plugs.
5. 1 Nm = 0.737 ft-lb

#### FOR METRIC SERIES (Nm)

Thread size (Metric) Pitch		Non-coated bolts / nuts					Coated bolts / nuts				
		Low resistance bolt / stud material			High resistance bolt / stud material		Low resistance bolt / stud material grade			High resistance bolt / stud material	
		L7M, B7M	B8M Class 1	B8M Class 2	L7, B7	Gr 660	L7M, B7M	B8M Class 1	B8M Class 2	L7, B7	Gr 660
M8	1.25	15	6	18	20	16	9	3	11	12	10
M10	1.50	30	11	36	40	32	18	7	21	24	19
M12	1.75	52	19	62	69	55	31	12	37	40	33
M14	2.00	83	31	99	108	88	49	18	58	64	52
M16	2.00	126	47	150	165	134	74	28	88	97	79
M18	2.50	174	65	207	228	185	103	38	123	135	110
M20	2.50	243	91	289	318	258	143	53	143	187	152
M22	2.50	327	122	327	428	348	191	71	191	250	203
M24	3.00	415	155	415	544	441	245	91	200	320	261
M27	3.00	601	224	492	787	639	351	131	287	459	373
M30	3.50	814	303	511	1066	866	477	178	299	625	507
M33	3.50	1097	409	688	1436	1167	639	238	401	836	680
M36	4.00	1410	526	884	1845	1500	824	307	517	1078	876
M39	4.00	1810	675	1135	2370	1925	1052	392	660	1377	1119
M42	4.50	2241	835	1406	2934	2384	1306	487	819	1710	1389
M45	4.50	2780	1036	1744	3639	2957	1613	601	1012	2112	1716
M48	5.00	3348	1248	2100	4383	3561	1948	726	1222	2571	2072
M52	5.00	4298	1602	2696	5626	4572	2488	927	1561	3257	2646
M56	5.50	5343	1991	3352	6995	5683	3098	1155	1943	4056	3295
M60	5.50	6624	2469	4155	8671	7046	3824	1425	2399	5006	4067



# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### FOR IMPERIAL SERIES (Nm)

Thread size (Inch) TPI		Non-coated bolts / nuts					Coated bolts / nuts				
		Low resistance bolt / stud material			High resistance bolt / stud material		Low resistance bolt / stud material grade			High resistance bolt / stud material	
		L7M, B7M	B8M Class 1	B8M Class 2	L7, B7	Gr 660	L7M, B7M	B8M Class 1	B8M Class 2	L7, B7	Gr 660
5/16"	18	15	6	18	20	16	10	4	12	12	11
3/8"	16	26	10	22	34	28	15	6	18	20	16
1/2"	13	61	23	73	80	65	37	14	44	47	39
5/8"	11	118	44	141	155	126	71	26	85	92	76
3/4"	10	206	77	245	270	219	122	45	145	160	130
7/8"	9	328	122	328	429	349	194	72	194	255	206
1"	8	488	182	488	639	519	289	108	289	378	307
1 1/8"	8	706	263	578	925	751	414	154	339	544	440
1 1/4"	8	981	366	803	1285	1043	571	213	467	750	607
1 3/8"	8	1320	492	933	1727	1404	763	284	479	1002	812
1 1/2"	8	1727	644	1083	2261	1837	994	370	624	1305	1057
1 5/8"	8	2211	824	1387	2894	2352	1266	472	794	1527	1347
1 3/4"	8	2777	1035	1742	3636	2954	1585	591	994	2080	1686
1 7/8"	8	3433	1280	2153	4493	3651	1952	728	1224	2563	2076
2"	8	4183	1559	2624	5476	4449	2373	884	1489	3114	2524
2 1/4"	8	5997	2235	3762	7851	6379	3375	1258	2117	4418	3590
2 1/2"	8	8271	3083	5188	10828	8797	4635	1728	2907	6068	4930
2 3/4"	8	11117	4144	6973	14591	11824	6208	2314	3894	8148	6603
3"	8	14481	5397	9084	19007	15403	8064	3006	5058	10583	8577
3 1/4"	8	18462	6881	11581	24232	19637	10256	3823	6433	13461	10909
3 1/2"	8	23114	8615	14499	30336	24585	12812	4775	8037	16817	13627
3 3/4"	8	28485	10617	17868	37388	30298	15762	5875	9887	20688	16765

### FOR NPT PLUG THREADS

Plug size	Thread per inch	Approx. torque (Nm)
3/8" NPT	18	61
1/2" NPT	14	68
3/4" NPT	14	75
1" NPT	11 1/2	88

### NOTES

1. Torque values given for NPT threads are only for reference, it may change depending upon accuracy of thread profile, sealing requirement, nature of the sealant used etc.
2. As a general guideline, after hand-tight engagement, tighten 1-3 full turns so that you get 'leak proof' joint.

### 15 SERVICE OF VALVES WITH API MONOGRAM

In case of repair and service of "API monogram" valve, service engineer shall consult Head- QA for any further actions.

### 16 INFORMATION FOR PED 2014/68/EU COMPLIANT VALVE

The year of manufacture	Refer name plate affixed to the valve
Essential maximum / minimum allowable limits	Refer name plate affixed to the valve
The normal size for piping DN	Refer name plate affixed to the valve
Test pressure applied in bar and date	Refer tag plate affixed to the valve
Tare mass in kg	Refer tag plate affixed to the valve
The fluid group	Refer tag plate affixed to the valve

# KTM VIRGO SERIES N & M TRUNNION MOUNTED BALL VALVES

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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### 17 WARRANTY

Our liability in respect of any defect in or failure of the goods supplied or for any loss, injury or damage attributable thereto is limited to making good by replacement or repair defects which under proper use appear therein and arise solely from faulty materials and workmanship within a period of 18 calendar months after the original goods shall have been first dispatched or 12 calendar months from the date of commissioning, whichever is earlier provided that such defective parts are returned free to our works for examination. The undertaking shall exclude any and every other obligation.

### CAUTION

*Emerson does not assume responsibilities for any liabilities/damages arriving out of wrong application of its valve, or imprudent operations carried out by inexperienced operators, or which does not comply with this manual, or instructions provided by Emerson.*

*The valve shall be appropriately used for the purpose they are built, or applications they are supplied. Use of standard valve for special applications is not recommended unless it has been communicated and agreed to by Emerson. Valve shall be operated and maintained strictly in accordance with the procedures. Operation or maintenance outside these procedures constitutes abuse of the product and voids all warranty and claims.*

### 18 FACTORY ADDRESS FOR CORRESPONDENCE

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