White Paper

Criteria to consider to ensure your rotary valves are long-lasting and reliable

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Criteria to consider to ensure your rotary valves are long-lasting and reliable.

In the past, selecting a rotary valve was mainly a matter of matching a valve feeding capacity based on the product bulk density to your required process or pneumatic conveyor capacity. Today, this is only the beginning. The use of a materials testing laboratory, computer-aided design engineering, advanced casting technology, certified fabrication procedures and modern manufacturing processes produces the modern day rotary valve that is unlike rotary valves of the past.

Your rotary valves must be engineered to match your application. Your valve supplier must first evaluate your needs and process requirements. Then, using this information to select the valve and it's features to insure you get a rotary valve that is problem free.

Your plant up time will increase because of proper application engineering

It may seem a basic, yet there are many applications where the identification of what is required for a rotary valve is not as straight forward as one might think. A rotary valve manufacture should be knowable in the design of bulk materials handling systems including mechanical conveyor as well as both dilute and dense phase pneumatic conveyors. As an example, a rotary valve used as an airlock feeder in a positive pressure dilute phase pneumatic conveying system needs different features than a valve used in a vacuum conveying system. A positive pressure system rotary valve is sized with different fill efficiencies as compared to a rotary valve used in a vacuum system. A vendor's pneumatic conveying experience can be a big factor in the proper sizing and application of rotary valves.

Your rotary valve vendor should have a test lab so they can learn the exact characteristics of the material that is to be handled in the valve. You should send the material sample to the vendor before they select the valve and its features. The sample of the material must be identical to the material that is being handled at the same point in the process. For example, if you are handling nylon pellets and the valve is located in the process at a point before the fines are remove from the product, the sample should also include these fines. Sending a sample of material that has been further process and has different physical characteristics may cause you continuous problems during the service life of the process.

Design engineering reduces your cost of ownership.

Company by company the process industry has recognized that many small improvements in the equipment they purchase can add up to a big increase in production up time. Advances in technology like automated design engineering CAD systems and proprietary software help ensure that rotary valves furnished are state-of-the-art and comply with your specifications, plant codes and standards. Also, Design Engineers can apply their engineering and design skills more efficiently using 3D solid modeling programs. These programs diagnose component assemblies, analysis material stresses and can show safety and environmental issues. The 3D design tools help shorten design cycle times, improve valve quality, reduce errors and lower the overall cost.

You get longer service life using high quality raw materials.

Long service life of a rotary valve is depended on the quality of raw materials. Cast rotary valve components should be made of state of the art casting methods. The newest casting technology provides greater design freedoms, with the opportunity to design for optimum service performance with less constraint imposed by older methods. Modern valves use high tolerance castings with excellent surface finish, free of defect and inclusions.

Whether the rotary valve components are cast or fabricated, all raw materials should be traceable to standard specifications for materials. The American Society for Testing Materials (ASTM) is the most use specification. You will know exactly what you are getting as far as material quality by referencing these specifications. The durability of fabricated rotary valves and valve components is dependent on the strength of the welds. Likewise, cast valves use fabricated rotors and supports. The durability of these components also depends on having sound full penetration welds. To ensure high quality welding, all welders, welding procedures and processes used in producing any fabricated part should follow procedures established by the ASME Code.

By using the most modern manufacturing process, you lower operating and maintenance cost.

Accurate machining of the rotary valve components will lower your operating cost, maintenance cost and increase the valve's service life. Valve suppliers that use the most modern CNC machines to produce the components have several advantages. Because of the precision and close tolerance of the CNC machining in the manufacture valve parts, the valves are made with

closer tip tolerances --resulting in less air leakage. Also, the precision layout of each component by the machining center result in easier disassembly, assembly, maintenance, parts replacement and valve installation.

You get lower operating cost because of less air leakage with precision bearing and improved shaft seals

All rotary valves should have out board mounted bearings and compression packing seals in order to have a long service life. The outboard mounting of the bearings isolates them from the product. This prevents contamination of the bearing lubricant with the material that is being handled in the valve.

The bearings should be high tolerance premium ball bearings. These bearings should be self-aligning, ABEC class 1 with wide inner and outer races, deep groove, zone hardened inter race and land riding metal retainer. Bearings should be secured to the rotor shaft with squeeze type locking collar. This bearing-to-shaft locking system eliminates any shifting of the rotor and provides a near-perfect concentricity of the rotor in the rotary valve housing. Valves that run concentric do not jam because of product wedging in the valve tip radial clearances. Using high tolerance premium ball bearings in the rotary valve allows it to be manufacture to a minimum rotor to housing clearance thus reducing air leakage.

Compression packing is the sealing material of choice for rotary valves. Over the last 10 years, choices in packing materials have changed dramatically. The standard packing material for rotary valves is multi-service lattice braided aramid filament with PTFE dispersion lubrication.

However, your valve supplier should analyze your requirements and determine the right packing for your application.

Your rotary valve vendor should offer several styles of valves including drop-thru, side entry, blow-thru, high pressure and easy clean designs in order to be able to offer the right valve for your application. They also should offer a wide range of optional features and optional accessories plus custom designs. Optional rotary valve features offered may include the following:

- Rotors with partially fill pockets, adjustable tips, inlaid tip, beveled tips and shrouds.
- Materials of construction: cast iron, cast steel, cast stainless steel, cast aluminum, fabricate carbon steel, fabricate stainless steel, Hastelloy, Inconel, Incoloy, Titanium, Stellite and engineered plastics.
- High temperature designs up to 1600 degrees Fahrenheit
- High pressure housing designs up to 350 PSIG
- Differential pressure designs up to 60 PSIG
- Air purge packing seals and mechanical seals
- Adjustable speed drives, direct drives and special drive arrangements
- Housing vent connections
- End seals
- Inspection doors
- Interior coatings and plating
- Motion switches
- Inlet baffles
- End plate purge and end plate "O" ring seals

In the chemical, food and pharmaceutical industries, reliable equipment is defined as equipment operating with 100% up time, 24 hours per day, seven days per week – unattended service. Plant operators and maintenance personnel should not need to adjust or fix the piece of equipment while it is running in the process. The only time the valve is not operational is when it is shut down for preventative maintenance. With good preventative maintenance, these rotary valves will operate 30 to 40 years.

Attached is a copy of "Technical Equipment Specification - Rotary Valves". This specification covers the minimum requirements for a rotary valve that is reliable and long lasting. This specification is based on the above information. By purchasing a rotary valve using this specification, you will have a rotary valve that will reliably handle your material under your process conditions.

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TECHNICAL EQUIPMENT SPECIFICATION
ROTARY VALVES

1. GENERAL

1.1 Scope

This specification covers the minimum requirements for rotary valves. The Vendor shall submit their proposal in accordance with this specification.

1.2 Industry Standards

The following documents are referenced herein and form part of the Order. Current editions of the industry standards including all mandatory addenda in effect at the time of the order shall apply unless otherwise indicated.

1.2.1 The American Society of Mechanical Engineers (ASME)

1.2.1.1 ASME Boiler & Pressure Vessel Code Section IX - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

1.2.1.2 ASME B16.5 - Pipe Flanges and Flanges Fittings

1.2.1.3 ASME B29.1M - Precision Power Transmission Roller Chains, Attachments and Sprockets.

1.2.2 American Bearing Manufactures Association (ABMA)

1.2.2.1 ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings

1.2.3 American Gear Manufacture's Association (AGMA)

1.2.3.1 AGMA 2000 - Gear Classification and Inspection Handbook-Tolerances and Measuring Methods for Unassembled Spur and Helical Gears.

1.2.3.2 AGMA 6010 – Standards for Spur, Helical, Herringbone and Bevel Enclosed Drive

1.2.4 National Electrical Manufacturers Association (NEMA)

NEMA MG1 – Part 31 – Definite Purpose Inverter-fed Motors

1.2.5 National Fire Protection Association (NFPA)

NFPA 70 – National Electrical Code, Section 500,501 and 502
Area Classification (Wiring Requirements)

1.2.6 Occupational Safety and Health Administration (OSHA)

OSHA 1910.212 – General Requirements for all Machines
OSHA 1910.219 – Mechanical Power Transmission Apparatus
OSHA 1910.1200 and 1926.59 – Hazardous Communication Regulations

2.0 PERFORMANCE DATA

2.1 Service

2.1.1	Differential Design Pressure	-	15 PSIG
2.1.2	Internal Design Pressure	-	15 PSIG
2.1.3	Design Vacuum	-	14" HG
2.1.4	Design Temperature	-	250° F
2.1.5	Duty	-	Continuous
2.1.6	Location	-	Outdoors

2.2 Application

2.2.1	Material Handled:	-	(See Data Sheet)
2.2.2	Material Temperature	-	(See Data Sheet)
2.2.3	Material Particle Sizes	-	(See Data Sheet)
2.2.3	Material Flow Characteristics	-	(See Data Sheet)
2.2..4	Abrasive	-	(See Data Sheet)
2.2.4	Material Bulk Density	-	(See Data Sheet)
2.2.5	Material Throughput Capacity	-	(See Data Sheet)
2.2.6	Service	-	Metering or Airlock

2.3 The vender shall test the materials that will be handled the valve to determine and verify the handling characteristics.

3.0 DESIGN DATA

3.1 General

3.1.0 Valves shall be furnished fully assembled complete with all components and accessories.

3.1.1 Welded components in contact with the product shall be seal welded.

3.1.2 The maximum allowable sound pressure level is 85 dBA as measured three (3) feet from the source.

3.1.3 Cast iron raw materials shall be specified using the appropriate ASTM Specification and Class number. Minimum standard grade of gray cast iron is ASTM A278 Class 30, which has a minimum tensile strength of 30,000 psi.

Example: ASTM A278 CL30

3.1.4 All Non-Ferrous alloy raw materials shall be specified using the appropriate ASTM Specification and alloy number.

3.1.5 All carbon and stainless steel raw materials for non-ASME Code applications shall be specified by the appropriate AISI Type Number or by ASTM number.

Examples: 304 S/S, 316L S/S, A351 Grade CF8

3.2 Housing design

3.2.0 The design shall eliminate all possible causes of product holdup or accumulation by proper design.

3.2.1 The housing shall be cast iron, cast steel, cast Aluminum or cast stainless steel or fabricated of steel or stainless steel with all welding procedures and operators in accordance to Section IX of the ASME Code

3.2.2 The housing shall be reinforced with heavy end flanges and ribs.

3.2.3 Valve housing shall have flanges machined to a 125 microinch finish and bore machined to a 63 microinch finish.

3.2.4 Rotor and housing shall be machined and assembled concentrically

3.2.5 Valve end plates shall have a minimum ½" pilot length.

3.2.6 The housing, end plates and bearing support shall be sized to maintain alignment and clearance under maximum design conditions.

3.2.7 Bearing mounts shall provide an open area between the bearing and the shaft seal that is open to the atmosphere with a minimum 1/2" gap.

3.2.8 Round flanges shall have standard ANSI 150 lb. drilling pattern.

3.2.9 All bolts shall be class SAE J429 Grade 5 or ASTM A449 TYPE 1 and zinc plated..

3.2.10 Threaded jacking holes shall be provide to aid removal of end plates

3.2.11 Valve shall have grounding and bonding lugs for electrical grounding/bonding in accordance with the National Electrical Code per NFPA 77 and 70.

3.3 Rotor Design

3.3.1 The rotor shall be fabricated of steel or stainless steel with all welding procedures and operators in accordance to Section IX of the ASME Code

3.3.2 The rotor shall have wrenching stub on the tail end of rotor shaft.

3.3.3 Max Speed allowed is 38 RPM

3.3.4 Packing area shall have a maximum 32 microinch finish.

3.3.5 The valve rotor, rotor shaft, bearings and bearing support shall be sized to maintain alignment and clearance under maximum design conditions.

3.3.6 The rotor shall be designed to provide at least two blades sealing between inlet and outlet to minimize leakage at any given time.

3.4 Packing Design

3.4.1 The minimum clearance between the end plate packing housing and the end of the packing follower shall be equal to three rings packing or one lantern ring and two rings of packing .

3.4.2 Packing shall be a minimum of four (4) rings or three rings plus lantern ring for air purge design.

3.4.3 Shaft seal shall be square packing of braided aramid filament impregnated with PTFE.

3.4.4 Unit shall be furnished with compression packing that can be replaced without removing the end plate or rotor shaft bearing .

3.5 Bearing Design

3.5.1 Bearing shall be outboard mounted

3.5.2 Bearings shall be special low tolerance , 00 fit, premium ball bearings. Bearings shall be self aligning, ABEC class 1 with wide inner and outer races, deep groove, zone hardened inner race and land riding metal retainer. Each bearing shall be secured to the rotor shaft with squeeze locking collar to eliminate any shifting of the rotor and provide near-perfect concentricity in the rotary valve.

3.5.3 Bearings shall be anti-friction type designed for a minimum L-10 life of 50,000 hours at maximum design conditions in accordance with ABMA Standards 9 and 11, and shall be lubricated before shipment.

3.5.4 Bearings shall be cartridge units designed for press fitting into the bearing support housing on the valve end plate.

3.6 Drive Design

3.6.1 The gearmotor and drive shall be designed to start valve under full load.

3.6.2 The roller chain drive reduction ratio shall not exceed 4:1.

3.6.3 The roller chain drive components shall be size based on a 1.4 minimum safety factor based on motor nameplate horsepower.

3.6.4 The gear reducer shall be size based on a AGMA Class II gearing..

3.6.5 Chains shall be standard roller type, cotter pinned or riveted, with one pinned master link per chain

3.6.6 Single strand chains shall be No. 50 minimum

3.6.7 Sprockets shall be Type B (hub on one side). A taper-lock hub with full-depth key way shall be used.

3.6.8 Gear reducers shall be designed with oil-tight and dust-tight gear enclosures with fill port/breather cap, and low point drain.

3.6.9 All exposed power transmission equipment shall be furnished with guards regardless of location or position.

3.6.10 Guards shall be constructed and positioned so that they do not interfere with equipment installation, maintenance and adjustments.

3.6.11 Guards shall be fastened to the valve in a sturdy, vibration-free manner with a minimum number of fastening devices.

3.6.12 Guards and mounting shall be capable of supporting a 180 lb. load in the vertical or horizontal direction.

3.6.13 Guards shall be properly ventilated when necessary to prevent excessive heat build up

3.6.14 Motors and electrical components shall be designed as per NFPA 70 for the electrical area classification.

4.0 CONSTRUCTION DATA

4.1 All Welding shall be performed by welders certified to Section IX of the ASME Code

4.2 Rotor and housing shall be machined and assembled concentrically

4.3 Welding – no weld splatter or slag permitted on interior and exterior surfaces

4.4 Cleanup of all interior and exterior surfaces with all rust, mill scale, dirt, oitl grease and chemical contamination removed by washing or wiping with appropriate cleaner per SSPC-SP1

4.5 All interior and exterior welds to be continuous with intermittent weld permissible on exterior attachments.

4.6 Mill test reports shall be used to identify all material used to manufacture the valve.

4.7 The valve shall be thoroughly cleaned before shipping including components, and subassemblies so that they are free of all water, sand, grit, weld spatter, grease, oil and other foreign material.

4.8 A stainless steel nameplate showing at least the following information shall be permanently attached to the valve.

Manufacture’s Name
Valve Serial Number
Valve Size, Type and Model Number
Job Number
Customers P.O. Number.

4.9 The direction of rotation shall be clearly and permanently marked on valve.

4.10 All sharp projections, edges, corners, and purrs shall be removed.

4.11 All carbon steel parts are to be painted as follows:

4.9.1 Surface Preparation

Remove all rust scale, weld slag, weld spatter, mill scale, dirt and chemical contamination. Refer to the order specifications if special surface preparations such as grinding are necessary.

Remove all grease and oil residues by washing or spraying Toluene base thinner. (Sherwin-Williams 154-2364 or equal)

Remove all moisture and dirt from cracks, crevices and the entire surface using compressed air or vacuum. This operation is to be carried out before applying prime coat and before applying each succeeding coating of the system.

4.9.2 Prime Coat

Prime coat shall be applied the same day the surface to be coated has been prepared as listed above. Do not permit any prepared surfaces to stand overnight before applying primer.

Prime coat shall be a single application of Sherwin-Williams Metal Primer, Gray No. E61 A 45 applied at a rate of 1.5 mils minimum dry film thickness.

4.9.3 Top Coat

Top Coat shall be applied the same day the surface to be coated has been prepared as listed above. Do not permit any prepared surfaces to stand overnight before applying top coat.

Top coat shall be a single application of Sherwin-Williams Alkyd B54 Series Industrial Enamel, Harbor Blue No. B54 W102 MC88 applied at a rate of 1.5 mils minimum dry film thickness.

4.9.4 Finished Coating Thickness

Total minimum dry film thickness of this coating system shall be 3 mils.

5.0 INSPECTION AND TESTING

5.1 The equipment shall be inspected to assure conformance to this specification and the codes and standards specified in section 1.2 of this specification.

5.2 The valve is to be operated in the shop before shipment.

5.2.1 Visual inspection shall be performed no the following items. The inspection shall be documented and provided with shipment.

Verify: Location. & compliance of other dimensions with the specification requirements including:

Welds

Surface finishes

Alignments

Tolerances

Materials of construction

Proper motor sizing and alignments

6.0 PACKAGING

6.1 The equipment shall be securely pack to ensure its undamaged arrival. The valve shall be crated to ensure that all pieces are securely fixed so that movement within the crate does not occur.

7.0 DOCUMENTATION REQUIREMENTS

7.1	Approval Drawings	-	Three copies of approval drawings.
7.2	Final Drawings	-	Three copies of final drawings
7.3	IOM Manuals	-	Three copies of Installation, Operation and Maintenance Manuals

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