



120713-P1  
Rev A, 1/99  
Instruction Manual

# MKS Type 656A Throttling Poppet Valve



## WARRANTY

### Type 656A Equipment

MKS Instruments, Inc. (**MKS**) warrants that the equipment described above (the "equipment") manufactured by **MKS** shall be free from defects in materials and workmanship for a period of one year from date of shipment and will for a period of two years from the date of shipment, correctly perform all date-related operations, including without limitation accepting data entry, sequencing, sorting, comparing, and reporting, regardless of the date the operation is performed or the date involved in the operation, provided that, if the equipment exchanges data or is otherwise used with equipment, software, or other products of others, such products of others themselves correctly perform all date-related operations and store and transmit dates and date-related data in a format compatible with **MKS** equipment. THIS WARRANTY IS **MKS'** SOLE WARRANTY CONCERNING DATE-RELATED OPERATIONS.

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# **MKS Type 656A Throttling Poppet Valve**

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## Valve Safety Information

### Symbols Used in This Instruction Manual

Definitions of WARNING, CAUTION, and NOTE messages used throughout the manual.

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**Warning**

The **WARNING** sign denotes a hazard to personnel. It calls attention to a procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in injury to personnel.

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**Caution**

The **CAUTION** sign denotes a hazard to equipment. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of all or part of the product.

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**Note**

The **NOTE** sign denotes important information. It calls attention to a procedure, practice, condition, or the like, which is essential to highlight.

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## Symbols Found on the Unit

The following table describes symbols that may be found on the unit.















Definition of Symbols Found on the Unit			
			
On (Supply) IEC 417, No.5007	Off (Supply) IEC 417, No.5008	Earth (ground) IEC 417, No.5017	Protective earth (ground) IEC 417, No.5019
			
Frame or chassis IEC 417, No.5020	Equipotentiality IEC 417, No.5021	Direct current IEC 417, No.5031	Alternating current IEC 417, No.5032
			
Both direct and alternating current IEC 417, No.5033-a	Class II equipment IEC 417, No.5172-a	Three phase alternating current IEC 617-2 No.020206	
			
Caution, refer to accompanying documents ISO 3864, No.B.3.1	Caution, risk of electric shock ISO 3864, No.B.3.6	Caution, hot surface IEC 417, No.5041	

Table 1: Definition of Symbols Found on the Unit

## **Safety Procedures and Precautions**

Observe the following general safety precautions during all phases of valve operation. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of intended use of the valve and may impair the protection provided by the equipment. MKS Instruments, Inc. assumes no liability for the customer's failure to comply with these requirements.

### **Warning**



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Moving parts in the valve create a risk of personal injury until the valve is securely incorporated into a system. To avoid injury, keep all bodily parts away from any valve opening.

1. Do not insert objects into openings where contact with moving parts is possible.
  2. Isolate the valve from any electrical or pneumatic power supply before handling the valve.
- 

### **DO NOT SUBSTITUTE PARTS OR MODIFY VALVE**

Do not install substitute parts or perform any unauthorized modification to the valve. Return the valve to an MKS Calibration and Service Center for service and repair to ensure that all safety features are maintained.

### **SERVICE BY QUALIFIED PERSONNEL ONLY**

Operating personnel must not attempt component replacement and internal adjustments. Any service must be performed by qualified service personnel only.

### **USE CAUTION WHEN OPERATING WITH HAZARDOUS MATERIALS**

If hazardous materials are used, observe the proper safety precautions, completely purge the valve when necessary, and ensure that the material used is compatible with the wetted materials in this product, including any sealing materials.

### **PURGE THE VALVE**

After installing the unit, or before removing it from a system, purge the unit completely with a clean, dry gas to eliminate all traces of the previously used flow material.

### **USE PROPER PROCEDURES WHEN PURGING**

This valve must be purged under a ventilation hood, and gloves must be worn for protection.

**DO NOT OPERATE IN AN EXPLOSIVE ENVIRONMENT**

To avoid explosion, do not operate this product in an explosive environment unless it has been specifically certified for such operation.

**USE PROPER FITTINGS AND TIGHTENING PROCEDURES**

All valve fittings must be consistent with valve specifications, and compatible with the intended use of the valve. Assemble and tighten fittings according to manufacturer's directions.

**CHECK FOR LEAK-TIGHT FITTINGS**

Carefully check all vacuum component connections to ensure leak-tight installation.

**OPERATE AT SAFE INLET PRESSURES**

Never operate the valve at pressures higher than the rated maximum pressure (refer to the product specifications for the maximum allowable pressure).

**INSTALL A SUITABLE BURST DISC**

When operating from a pressurized gas source, install a suitable burst disc in the vacuum system to prevent system explosion should the system pressure rise.

**KEEP THE UNIT FREE OF CONTAMINANTS**

Do not allow contaminants to enter the unit before or during use. Contamination such as dust, dirt, lint, glass chips, and metal chips may permanently damage the unit or contaminate the process.

**KEEP AWAY FROM VALVE OPENING**

Keep fingers, other body parts, and other materials away from the valve opening when the valve is in operation.

## Sicherheitshinweise für das Ventil

### In dieser Betriebsanleitung vorkommende Symbole

Bedeutung der mit WARNUNG!, VORSICHT! und HINWEIS gekennzeichneten Absätze in dieser Betriebsanleitung.

**Warnung!**



---

Das Symbol **WARNUNG!** weist auf eine Gefahr für das Bedienpersonal hin. Es macht auf einen Arbeitsablauf, eine Arbeitsweise, einen Zustand oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu Verletzungen führen kann.

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**Vorsicht!**



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Das Symbol **VORSICHT!** weist auf eine Gefahr für das Gerät hin. Es macht auf einen Bedienungsablauf, eine Arbeitsweise oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu einer Beschädigung oder Zerstörung des Gerätes oder von Teilen des Gerätes führen kann.

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**Hinweis**



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Das Symbol **HINWEIS** macht auf wichtige Informationen bezüglich eines Arbeitsablaufs, einer Arbeitsweise, eines Zustands oder einer sonstige Gegebenheit aufmerksam.

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## Erklärung der am Gerät angebrachten Symbole

Nachstehender Tabelle sind die Bedeutungen der Symbole zu entnehmen, die am Gerät angebracht sein können.















Bedeutung der am Gerät angebrachten Symbole			
			
Ein (Energie) IEC 417, No.5007	Aus (Energie) IEC 417, No.5008	Erdanschluß IEC 417, No.5017	Schutzleiteranschluß IEC 417, No.5019
			
Masseanschluß IEC 417, No.5020	Equipotential- anschluß IEC 417, No.5021	Gleichstrom IEC 417, No.5031	Wechselstrom IEC 417, No.5032
			
Gleich- oder Wechselstrom IEC 417, No.5033	Durchgängige doppelte oder verstärkte Isolierung IEC 417, No.5172	Dreileiter- Wechselstrom (Drehstrom) IEC 617-2, No.02-02-06	
			
Warnung vor einer Gefahrenstelle (Achtung, Dokumen- tation beachten) ISO 3864, No.B.3.1	Warnung vor gefährlicher elektrischer Spannung ISO 3864, No.B.3.6	Höhere Temperatur an leicht zugänglichen Teilen IEC 417, No.5041	

Tabelle 2: Bedeutung der am Gerät angebrachten Symbole

## **Sicherheitsvorschriften und Vorsichtsmaßnahmen**

**Folgende allgemeine Sicherheitsvorschriften sind während allen Betriebsphasen dieses Ventils zu befolgen. Eine Mißachtung der Sicherheitsvorschriften und sonstiger Warnhinweise in dieser Betriebsanleitung verletzt die für dieses Ventil und seine Bedienung geltenden Sicherheitsstandards, und kann die eingebauten Schutzvorrichtungen wirkungslos machen. MKS Instruments, Inc. haftet nicht für Mißachtung dieser Sicherheitsvorschriften seitens des Kunden.**

**Warnung!**



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**Solange das Ventil nicht fest in ein System eingebaut ist, besteht Verletzungsgefahr aufgrund von beweglichen Teilen. Daher Finger und andere Körperteile unbedingt von allen Ventilöffnungen fernhalten**

- 1. Niemals Fremdkörper in Öffnungen einführen, in denen ein Kontakt mit beweglichen Teilen möglich ist.**
  - 2. Das Ventil vor dem Hantieren stets von allen elektrischen und pneumatischen Kraftquellen trennen.**
- 

### **Niemals Teile austauschen oder Änderungen am Ventil vornehmen!**

Ersetzen Sie keine Teile mit baugleichen oder ähnlichen Teilen, und nehmen Sie keine eigenmächtigen Änderungen am Ventil vor. Schicken Sie das Ventil zwecks Wartung und Reparatur an den MKS-Kalibrierungs- und -Kundendienst ein. Nur so wird sichergestellt, daß alle Schutzvorrichtungen voll funktionsfähig bleiben.

### **Wartung nur durch qualifizierte Fachleute!**

Das Auswechseln von Komponenten und das Vornehmen von internen Einstellungen darf nur von qualifizierten Fachleuten durchgeführt werden, niemals vom Bedienpersonal.

### **Vorsicht beim Arbeiten mit gefährlichen Stoffen!**

Wenn gefährliche Stoffe verwendet werden, muß der Bediener die entsprechenden Sicherheitsvorschriften genauestens einhalten, das Ventil, falls erforderlich, vollständig spülen, sowie sicherstellen, daß der Gefahrstoff die von ihm benetzten, im Ventil verwendeten Materialien, insbesondere Dichtungen, nicht angreift.

**Spülen des Ventils mit Gas!**

Nach dem Installieren oder vor dem Ausbau aus einem System muß das Ventil unter Einsatz eines reinen Trockengases vollständig gespült werden, um alle Rückstände des Vorgängermediums zu entfernen.

**Anweisungen zum Spülen des Ventils!**

Das Ventil darf nur unter einer Ablufthaube gespült werden. Schutzhandschuhe sind zu tragen.

**Nicht zusammen mit explosiven Stoffen, Gasen oder Dämpfen benutzen!**

Um der Gefahr einer Explosion vorzubeugen, darf dieses Produkt niemals zusammen mit explosiven Stoffe aller Art eingesetzt werden, sofern es nicht ausdrücklich für diesen Zweck zugelassen ist.

**Anweisungen zum Installieren der Armaturen!**

Alle Ventilanschlußstücke und Armaturenteile müssen mit den Ventilspezifikationen übereinstimmen, und mit dem geplanten Einsatz des Ventils kompatibel sein. Der Einbau, insbesondere das Anziehen und Abdichten, muß gemäß den Anweisungen des Herstellers vorgenommen werden.

**Ventil auf Undichtigkeiten prüfen!**

Überprüfen Sie sorgfältig alle Verbindungen auf undichte Stellen.

**Nur unter zulässigen Anschlußdrücken betreiben!**

Betreiben Sie das Ventil niemals unter Drücken, die den maximal zulässigen Druck (siehe Produktspezifikationen) übersteigen.

**Geeignete Berstscheibe installieren!**

Wenn mit einer unter Druck stehenden Gasquelle gearbeitet wird, sollte eine geeignete Berstscheibe in das Vakuumsystem installiert werden, um eine Explosionsgefahr aufgrund von steigendem Systemdruck zu vermeiden.

**Verunreinigungen vermeiden!**

Stellen Sie sicher, daß Verunreinigungen jeglicher Art weder vor dem Einsatz noch während des Betriebs in das Innere gelangen können. Staub- und Schmutzpartikel, Glassplitter oder Metallspäne können das Produkt dauerhaft beschädigen oder Prozeß und Meßwerte verfälschen.

**Hände weg von der Ventilöffnung!**

Körperteile, insbesondere Finger, sowie Fremdobjekte während des Betriebes von der Ventilöffnung fernhalten.

## Informations relatives à la sécurité pour la valve

### Symboles utilisés dans ce manuel d'utilisation

Définitions des indications AVERTISSEMENT, ATTENTION, et REMARQUE utilisées dans ce manuel.

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#### Avertissement



L'indication **AVERTISSEMENT** signale un danger pour le personnel. Elle attire l'attention sur une procédure, une pratique, une condition, ou toute autre situation présentant un risque d'accident pour le personnel, en cas d'exécution incorrecte ou de non respect des consignes.

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#### Attention



L'indication **ATTENTION** signale un danger pour l'appareil. Elle attire l'attention sur une procédure d'exploitation, une pratique, ou toute autre situation, présentant un risque d'endommagement ou de destruction d'une partie ou de la totalité de l'appareil, en cas d'exécution incorrecte ou de non respect des consignes.

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#### Remarque



L'indication **REMARQUE** signale une information importante. Elle attire l'attention sur une procédure, une pratique, une condition, ou toute autre situation, présentant un intérêt particulier.

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## Symboles apparaissant sur l'unité

Le tableau suivant décrit les symboles pouvant apparaître sur l'unité.















Définition des symboles apparaissant sur l'unité			
			
Marche (sous tension) IEC 417, No.5007	Arrêt (hors tension) IEC 417, No.5008	Terre (masse) IEC 417, No.5017	Terre de protection (masse) IEC 417, No.5019
			
Masse IEC 417, No.5020	Equipotentialité IEC 417, No.5021	Courant continu IEC 417, No.5031	Courant alternatif IEC 417, No.5032
			
Courant continu et alternatif IEC 417, No.5033-a	Matériel de classe II IEC 417, No.5172-a	Courant alternatif triphase IEC 617-2, No.020206	
			
Attention : se reporter à la documentation ISO 3864, No.B.3.1	Attention : risque de choc électrique ISO 3864, No.B.3.6	Attention : surface brûlante IEC 417, No.5041	

Tableau 3: Définition des symboles apparaissant sur l'unité

## **Mesures de sécurité et précautions**

Prendre les précautions générales de sécurité suivantes pendant toutes les phases d'exploitation de la valve. Le non respect des ces précautions ou des avertissements contenus dans ce manuel constitue une violation des normes de sécurité relatives à l'utilisation de la valve et peut diminuer la protection fournie par l'appareil. MKS Instruments, Inc. n'assume aucune responsabilité concernant le non respect des consignes par les clients.

### **Avertissement**



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**Les pièces mobiles de la valve peuvent être une cause d'accident tant que la valve n'est pas solidement incorporée dans un système. Pour éviter tout accident, tenir toute partie du corps à distance de toute ouverture de la valve.**

- 1. Ne pas insérer des objets dans les ouvertures où le contact avec des pièces mobiles est possible.**
  - 2. Isoler la valve de toute source d'alimentation électrique ou pneumatique pendant la manipulation de la valve.**
- 

### **PAS DE SUBSTITUTION DE PIÈCES OU DE MODIFICATION DE LA VALVE**

Ne pas installer des pièces de substitution ou effectuer des modifications non autorisées sur la valve. Renvoyer la valve à un centre de service et de calibrage MKS pour tout dépannage ou réparation afin de garantir le l'intégrité des dispositifs de sécurité.

### **DÉPANNAGE UNIQUEMENT PAR DU PERSONNEL QUALIFIÉ**

Le personnel d'exploitation ne doit pas essayer de remplacer des composants ou de faire des réglages internes. Tout dépannage doit être uniquement effectué par du personnel qualifié.

### **PRÉCAUTION EN CAS D'UTILISATION AVEC DES PRODUITS DANGEREUX**

Si des produits dangereux sont utilisés, prendre les mesures de précaution appropriées, purger complètement la valve quand cela est nécessaire, et s'assurer que les produits utilisés sont compatibles avec les composants liquides de l'appareil, y compris les matériaux d'étanchéité.

### **PURGE DE LA VALVE**

Après l'installation de l'unité, ou avant son enlèvement d'un système, purger l'unité complètement avec un gaz propre et sec afin d'éliminer toute trace du produit de flux utilisé précédemment.

### **UTILISATION DES PROCÉDURES APPROPRIÉES POUR LA PURGE**

Cette valve doit être purgée sous une hotte de ventilation, et il faut porter des gants de protection.

### **PAS D'EXPLOITATION DANS UN ENVIRONNEMENT EXPLOSIF**

Pour éviter toute explosion, ne pas utiliser cet appareil dans un environnement explosif, sauf en cas d'homologation spécifique pour une telle exploitation.

### **UTILISATION D'ÉQUIPEMENTS APPROPRIÉS ET PROCÉDURES DE SERRAGE**

Tous les équipements de la valve doivent être cohérents avec ses spécifications, et compatibles avec l'utilisation prévue de la valve. Assembler et serrer les équipements conformément aux directives du fabricant.

### **VÉRIFICATION DE L'ÉTANCHÉITÉ DES CONNEXIONS**

Vérifier attentivement toutes les connexions des composants pour le vide afin de garantir l'étanchéité de l'installation.

### **EXPLOITATION AVEC DES PRESSIONS D'ENTRÉE NON DANGEREUSES**

Ne jamais utiliser la valve avec des pressions supérieures à la pression nominale maximum (se reporter aux spécifications de l'unité pour la pression maximum admissible).

### **INSTALLATION D'UN DISQUE D'ÉCHAPPEMENT ADAPTÉ**

En cas d'exploitation avec une source de gaz pressurisé, installer un disque d'échappement adapté dans le système à vide afin d'éviter une explosion du système en cas d'augmentation de la pression.

### **MAINTIEN DE L'UNITÉ À L'ABRI DES CONTAMINATIONS**

Ne pas laisser des produits contaminants pénétrer dans l'unité avant ou pendant l'utilisation. Des produits contaminants tels que des poussières et des fragments de tissu, de glace et de métal peuvent endommager l'unité d'une manière permanente ou contaminer le processus.

### **PRÉCAUTION AVEC L'OUVERTURE DE LA VALVE**

Éviter tout contact des mains, toute autre partie du corps, ou tout autre matériel avec l'ouverture de la valve quand celle-ci est en fonctionnement.

## Medidas de seguridad de la válvula

### Símbolos usados en este manual de instrucciones

Definiciones de los mensajes de advertencia, precaución y de las notas usados en el manual.

#### Advertencia



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El símbolo de advertencia indica la posibilidad de que se produzcan daños personales. Pone de relieve un procedimiento, práctica, estado, etc. que en caso de no realizarse u observarse correctamente puede causar daños personales.

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#### Precaución



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El símbolo de precaución indica la posibilidad de producir daños al equipo. Pone de relieve un procedimiento operativo, práctica, estado, etc. que en caso de no realizarse u observarse correctamente puede causar daños o la destrucción total o parcial del equipo.

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#### Nota



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El símbolo de notas indica información de importancia. Este símbolo pone de relieve un procedimiento, práctica o condición cuyo conocimiento es esencial destacar.

---

## Símbolos hallados en la unidad

La tabla siguiente contiene los símbolos que puede hallar en la unidad.















Definición de los símbolos hallados en la unidad			
			
Encendido (alimentación eléctrica) IEC 417, N° 5007	Apagado (alimentación eléctrica) IEC 417, N° 5008	Puesta a tierra IEC 417, N° 5017	Protección a tierra IEC 417, N° 5019
			
Caja o chasis IEC 417, N° 5020	Equipotencialidad IEC 417, N° 5021	Corriente continua IEC 417, N° 5031	Corriente alterna IEC 417, N° 5032
			
Corriente continua y alterna IEC 417, N° 5033-a	Equipo de clase II IEC 417, N° 5172-a	Corriente alterna trifásica IEC 617-2, N° 020206	
			
Precaución. Consulte los documentos adjuntos ISO 3864, N° B.3.1	Precaución. Riesgo de descarga eléctrica ISO 3864, N° B.3.6	Precaución. Superficie caliente IEC 417, N° 5041	

Tabla 4: Definición de los símbolos hallados en la unidad

## **Procedimientos y precauciones de seguridad**

Las precauciones generales de seguridad descritas a continuación deben observarse durante todas las etapas de funcionamiento de la válvula. La falta de cumplimiento de dichas precauciones o de las advertencias específicas a las que se hace referencia en el manual, constituye una violación de las normas de seguridad establecidas para el uso previsto de la válvula y podría anular la protección proporcionada por el equipo. Si el cliente no cumple dichas precauciones y advertencias, MKS Instruments, Inc. no asume responsabilidad legal alguna.

### **Advertencia**



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Hasta que la válvula sea incorporada en forma segura al sistema, las piezas en movimiento presentes en la misma pueden causar daños personales. Para evitarlo, mantenga todo el cuerpo alejado de la abertura de válvula.

1. **No introduzca por las aberturas objetos que puedan entrar en contacto con piezas en movimiento.**
  2. **Antes de tocar la válvula, aíslala de toda fuente de alimentación neumática o eléctrica.**
- 

### **NO UTILICE PIEZAS NO ORIGINALES O MODIFIQUE LA VÁLVULA**

No instale piezas que no sean originales o modifique la válvula sin autorización. Para asegurar el correcto funcionamiento de todos los dispositivos de seguridad, envíe la válvula al Centro de servicio y calibración de MKS toda vez que sea necesario efectuar reparaciones o tareas de mantenimiento.

### **LAS REPARACIONES DEBEN SER EFECTUADAS ÚNICAMENTE POR TÉCNICOS AUTORIZADOS**

Los operarios no deben intentar reemplazar los componentes o realizar tareas de ajuste en el interior. Las tareas de mantenimiento o reparación deben ser realizadas únicamente por personal autorizado.

### **TENGA CUIDADO CUANDO TRABAJE CON MATERIALES TÓXICOS**

Cuando se utilicen materiales tóxicos, los operarios deberán cumplir las medidas de seguridad correspondientes, purgar totalmente la válvula cuando sea necesario y comprobar que el material utilizado sea compatible con los materiales humedecidos del instrumento e inclusive, con los materiales de sellado.

### **PURGUE LA VÁLVULA**

Una vez instalada la unidad o antes de retirarla del sistema, purgue completamente la unidad con gas limpio y seco para eliminar todo resto de la sustancia líquida empleada anteriormente.

**USE PROCEDIMIENTOS ADECUADOS PARA REALIZAR LA PURGA**

La válvula debe purgarse debajo de una campana de ventilación y deben utilizarse guantes protectores.

**NO HAGA FUNCIONAR LA VÁLVULA EN UN AMBIENTE CON RIESGO DE EXPLOSIONES**

Para evitar que se produzcan explosiones, no haga funcionar este producto en un ambiente con riesgo de explosiones, excepto cuando el mismo haya sido certificado específicamente para tal uso.

**USE ACCESORIOS ADECUADOS Y REALICE CORRECTAMENTE LOS PROCEDIMIENTOS DE AJUSTE**

Todos los accesorios de la válvula deben cumplir las especificaciones de la misma y ser compatibles con el uso que se debe dar a la válvula. Arme y ajuste los accesorios de acuerdo con las instrucciones del fabricante.

**COMPRUEBE QUE LAS CONEXIONES SEAN A PRUEBA DE FUGAS**

Inspeccione cuidadosamente las conexiones de los componentes de vacío para comprobar que hayan sido instalados a prueba de fugas.

**HAGA FUNCIONAR LA VÁLVULA CON PRESIONES DE ENTRADA SEGURAS**

No haga funcionar nunca la válvula con presiones superiores a la máxima presión nominal (en las especificaciones del instrumento hallará la presión máxima permitida).

**INSTALE UNA CÁPSULA DE SEGURIDAD ADECUADA**

Cuando el instrumento funcione con una fuente de gas presurizado, instale una cápsula de seguridad adecuada en el sistema de vacío para evitar que se produzcan explosiones cuando suba la presión del sistema.

**MANTENGA LA UNIDAD LIBRE DE CONTAMINANTES**

No permita el ingreso de contaminantes en la unidad antes o durante su uso. Los productos contaminantes tales como polvo, suciedad, pelusa, lascas de vidrio o virutas de metal pueden dañar irreparablemente la unidad o contaminar el proceso.

**MANTÉNGASE ALEJADO DE LA ABERTURA DE LA VÁLVULA**

Cuando la válvula esté funcionando, mantenga los dedos, otras partes del cuerpo y otros materiales alejados de la abertura.

## Chapter One: General Information

### Introduction

The MKS Type 656A Throttling Poppet Valve performs the functions of a positive shutoff valve, a fast and accurate closed-loop pressure control valve, and a softstart valve. The valve eliminates the need for a separate isolation valve. It provides superior softstart function through use of a cylindrical plug and seat arrangement. The design is less susceptible to contamination on the seal than sealing butterfly valves.

Used in conjunction with the MKS Type 655 Self-Tuning Pressure Controller, the 656 valve provides reliable and repeatable control of small throughputs, and excellent control at low pressures. Slow pumpdowns from atmosphere are possible, eliminating the need for a separate softstart bypass valve to minimize turbulence and to reduce particulate disruption.

The 656 valve is available in four sizes: 40 mm, 50 mm, 80 mm, and 100 mm. All four sizes are offered in two styles; angle and in-line. This selection ensures that the 656 valve will fit into your system conveniently. An optional heated version, operating at 150° C, is available to reduce condensation of process byproducts and, thereby, extend uptime.

The 656 valve uses an opto-interrupt switch to positively indicate when the valve is fully closed. The valve bellows are designed to provide long life. There are no frictional moving parts exposed to vacuum, which minimizes particulate generation. Only 304 and 321 stainless steel, and O-rings, of either Viton®, Kalrez®, Chemraz®, or silicone are exposed to the process. The leak integrity for both internal to external leakage, and across a closed valve is  $<10^{-9}$  scc/sec He.

#### *Note to Type 654 Users*

The 656 valve is intended to replace obsolete 654 valves. The 656 valve is backwards compatible with the 654 valve, with the following exceptions:

- Interface cable – refer to *Interface Cables*, page 20, for details
- Dimensions – refer to *Dimensions*, page 24, for information
- Setup for the Type 655 controller – refer to *How To Configure the Type 655 Controller*, page 32, for information
- Action upon power loss – refer to *How the 656 Valve Reacts to Power Loss*, page 29, for details
- Close adjust feature – refer to *How To Adjust the Valve Closed Position*, page 33, for information

## How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 656 unit.

**Before installing your Type 656 unit in a system and/or operating it, carefully read and familiarize yourself with all precautionary notes in the *Safety Messages and Procedures* section at the front of this manual. In addition, observe and obey all WARNING and CAUTION notes provided throughout the manual.**

Chapter One, *General Information*, (this chapter) introduces the product and describes the organization of the manual.

Chapter Two, *Installation*, explains the environmental requirements and describes how to mount the instrument in your system.

Chapter Three, *Overview*, gives a brief description of the instrument and its functionality.

Chapter Four, *Operation*, describes how to use the instrument and explains all the functions and features.

Chapter Five, *Maintenance*, lists any maintenance required to keep the instrument in good working condition.

Chapter Six, *Troubleshooting*, provides a checklist for reference should the instrument malfunction.

Appendix A, *Product Specifications*, lists the specifications of the instrument.

Appendix B, *Model Code Explanation*, describes the model code.

## Customer Support

Standard maintenance and repair services are available at all of our regional MKS Calibration and Service Centers, listed on the back cover. In addition, MKS accepts the instruments of other manufacturers for recalibration using the Primary and Transfer Standard calibration equipment located at all of our regional service centers. Should any difficulties arise in the use of your Type 656 instrument, or to obtain information about companion products MKS offers, contact any authorized MKS Calibration and Service Center. If it is necessary to return the instrument to MKS, please obtain an ERA Number (Equipment Return Authorization Number) from the MKS Calibration and Service Center before shipping. The ERA Number expedites handling and ensures proper servicing of your instrument.

Please refer to the inside of the back cover of this manual for a list of MKS Calibration and Service Centers.

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### Warning



**All returns to MKS Instruments must be free of harmful, corrosive, radioactive, or toxic materials.**

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## Chapter Two: Installation

### How To Unpack the Type 656 Unit

MKS has carefully packed the Type 656 unit so that it will reach you in perfect operating order. Upon receiving the unit, however, you should check for defects, cracks, broken connectors, etc., to be certain that damage has not occurred during shipment.

---

**Note**

Do *not* discard any packing materials until you have completed your inspection and are sure the unit arrived safely.

---

If you find any damage, notify your carrier and MKS immediately. If it is necessary to return the unit to MKS, obtain an ERA Number (Equipment Return Authorization Number) from the MKS Service Center before shipping. Please refer to the inside of the back cover of this manual for a list of MKS Calibration and Service Centers.

#### **Unpacking Checklist**

##### *Standard Equipment:*

- Type 656A Unit
- Type 656A Instruction Manual (this book)

##### *Required Equipment:*

- Type MKS 655 Self-Tuning Pressure Controller (necessary to operate the valve)

##### *Optional Equipment:*

- Interface cable, refer to *Interface Cables*, page 20, for details
- Electrical Connector Accessories Kit, part number 656A-K1, contains a mating Type “D” connector

## Interface Cables

*As of January 1, 1996, most products shipped to the European Community must comply with the EMC Directive 89/336/EEC, which covers radio frequency emissions and immunity tests. In addition, as of January 1, 1997, some products shipped to the European Community must also comply with the Product Safety Directive 92/59/EEC and Low Voltage Directive 73/23/EEC, which cover general safety practices for design and workmanship. MKS products that meet these requirements are identified by application of the CE Mark.*

### Note



When the 656 valve has the heater option installed, an **HPS Series 45 heater must be used** to ensure compliance with CE Mark requirements. Failure to use a Series 45 heater with a heated version of the 656 valve will void the CE compliance.

To ensure compliance with EMC Directive 89/336/EEC, an overall metal braided shielded cable, properly grounded at both ends, is required during use. No additional installation requirements are necessary to ensure compliance with Directives 92/59/EEC and 73/23/EEC.

### Caution



**If you are replacing a Type 654 valve, you should order a new cable. Although the pinouts are the same, the connectors are different. The 654 interface cable has standoffs that DO NOT FIT the 656 valve.**

### Note



The “S” after the cable type designation indicates an overall metal braided shielded cable. For example to order a standard cable to connect the 656 valve to a 655 controller, use part number CB656-1-xx; for a metal braided shielded cable, use part number CB656S-1-xx (where x = length in feet).

Interface Cables	
Cable Description	Cable Number
Standard cable	CB656-1-xx
Overall metal braided shielded cable	CB656S-1-xx
<i>Nominal length 10 feet; additional lengths are available up to 50 feet, contact MKS for details</i>	

Table 5: Interface Cables

### Generic Shielded Cable Description

MKS offers a full line of cables for all MKS equipment. Should you choose to manufacture your own cables, follow the guidelines listed below:

1. The cable must have an overall metal *braided* shield, covering all wires. Neither aluminum foil nor spiral shielding will be as effective; using either may nullify regulatory compliance.
2. The connectors must have a metal case which has direct contact to the cable's shield on the whole circumference of the cable. The inductance of a flying lead or wire from the shield to the connector will seriously degrade the shield's effectiveness. The shield should be grounded to the connector before its internal wires exit.
3. With very few exceptions, the connector(s) must make good contact to the device's case (ground). "Good contact" is about 0.01 ohms; and the ground should surround all wires. Contact to ground at just one point may not suffice.
4. For shielded cables with flying leads at one or both ends; it is important at each such end, to ground the shield *before* the wires exit. Make this ground with absolute minimum length. (A ¼ inch piece of #22 wire may be undesirably long since it has approximately 5 nH of inductance, equivalent to 31 ohms at 1000 MHz). After picking up the braid's ground, keep wires and braid flat against the case. With very few exceptions, grounded metal covers are not required over terminal strips. If one is required, it will be stated in the Declaration of Conformity or in the instruction manual.
5. In selecting the appropriate type and wire size for cables, consider:
  - A. The voltage ratings.
  - B. The cumulative  $I^2R$  heating of all the conductors (keep them safely cool).
  - C. The IR drop of the conductors, so that adequate power or signal voltage gets to the device.
  - D. The capacitance and inductance of cables which are handling fast signals, (such as data lines or stepper motor drive cables).
  - E. That some cables may need internal shielding from specific wires to others; please see the instruction manual for details regarding this matter.

## Product Location and Requirements

### Operating Environmental Requirements

- Ambient Operating Temperature: 15° to 40° C (59° to 104° F)
- Maximum internal pressure: 35 psig (50 psid)
- Motor winding power requirement: a constant current, bipolar driven, at 2 Amp minimum peak
- Opto-interrupt switch power requirement: +5 VDC limited to 50 mA

### Controller Requirements

The controller must be able to monitor and recognize the full open and full close valve output signals. The output signals are low TTL signals which do not exceed 0.4 Volts when sinking 12.8 mA. Refer to Table 8, page 26, for the connector pinout.

The recommended supply circuitry is shown in Figure 1.

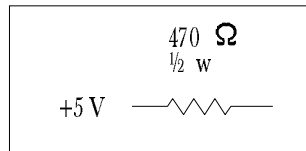


Figure 1: Recommended Supply Circuitry

The MKS Type 655 Pressure Controller meets the above criteria and is completely compatible with the 656 valve.

## **Set Up**

### **General**

When installing the 656 valve, observe the usual clean techniques customary in vacuum practice.

#### **Caution**



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**Handle the valve cautiously to avoid damaging the flanges. If a flange is damaged the valve may require a new body or rework at the factory.**

**Leave the protective plastic caps on the valve until it is installed in your system. Replace the caps if the valve is removed from the system.**

---

Be especially careful not to damage the flanges, when handling, installing, or removing the valve. Since the flanges are integral with the body, a defective flange would, most likely, require a new body or rework at the factory. To help protect the flanges, leave the plastic snap-on caps supplied with the valve on until installation, and replace them when the valve is removed from a system.

When installing the valve, allow adequate clearance between adjacent components to prevent the seal surfaces from sliding against each other. Flanges that have been assembled for some time may have a tendency to stick together. Gently separate the units. Also, do not set the valve down on the flange seal surfaces unless they are protected.

Vacuum components must be kept free of both particulate contamination and of all foreign materials which would have a significant vapor pressure. Before starting the repair of a vacuum valve, it is necessary to prepare a clean work station in a dust-free area. Tools should be clean, degreased, and devoted to precision assembly.

### **Mounting**

The Type 656 valve may be mounted in any orientation by clamping or bolting its flanges to a pair of mating flanges. Be sure to provide proper clearance for valve and valve sub-assembly removal as cleaning may be necessary due to buildup of process contaminants.

## Dimensions

### Note



All dimensions are listed in inches with millimeters referenced in parentheses.

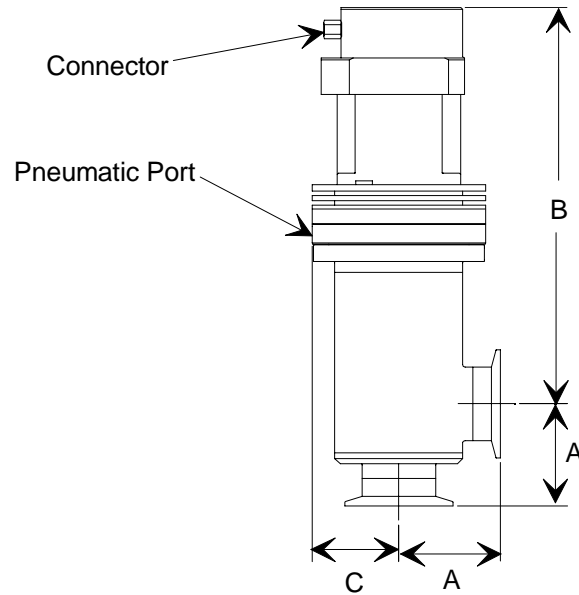


Figure 2: Angle Valves

### Note



All valves have identical measurements for Dimension A. This allows the valve to be mounted in either orientation.

Angle Valves			
Valve Size	ISO Flange (A)	(B)	(C)
40 mm	2.57 (65)	10.82 (275)	2.00 (51)
50 mm	2.77 (70)	10.82 (275)	2.35 (60)
80 mm	3.86 (98)	12.39 (315)	2.93 (74)
100 mm	4.25 (108)	12.39 (315)	3.72 (94)

Table 6: Angle Valves

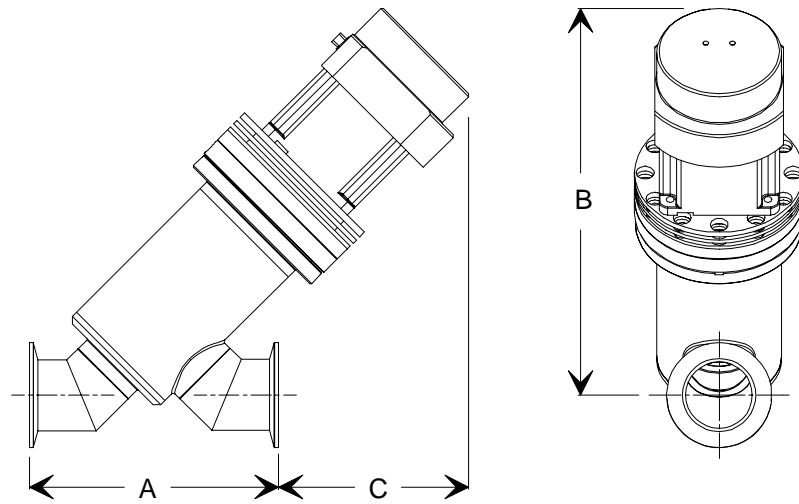


Figure 3: In-line Valves

<b>In-Line Valves</b>			
<b>Valve Size</b>	<b>ISO Flange (A)</b>	<b>All Flanges (B)</b>	<b>ISO Flange (C)</b>
40 mm	5.12 (130)	10.64 (270)	6.28 (160)
50 mm	7.00 (178)	10.88 (276)	5.35 (136)
80 mm	10.55 (268)	13.50 (343)	4.69 (119)
100 mm	13.58 (345)	14.02 (356)	3.18 (81)

Table 7: In-Line Valves

### Piping Considerations

The 656 valve has a very rugged design. However, if unusual stress or torque in the piping is expected, such as from extreme thermal expansion or a long length of pipe extended from a fixed junction, you should include additional stress relief. One approach is to introduce a short bellows, and to support the attached piping.

## Electrical Information

The 656 valve has a 15-pin Type “D” male connector for connection to a controller. The pinout of the connector is listed in Table 8.

<b>Connector Pinout</b>	
<b>Pin Number</b>	<b>Assignment</b>
1	Motor Winding A Feed
2	Motor Winding A Return
3	No Connection
4	No Connection
5	No Connection
6	Open Limit Switch
7	Closed Limit Switch
8	Digital Ground
9	No Connection
10	No Connection
11	No Connection
12	Motor Winding B Feed
13	Motor Winding B Return
14	+5 Volt Opto Voltage
15	No Pin

Table 8: Connector Pinout

### Note



The “No Connection” pin assignment refers to a pin with no internal connection. The “Reserved” pin assignment refers to a pin with an internal connection that may be assigned a function in the future.

## Chapter Three: Overview

### General Information

#### **Maximum Internal Pressure/Blow By**

The maximum internal bellows pressure rating of the 656 valve is 35 psig. If an increasing pressure is applied to the nosepiece port while the side port is under vacuum, at some pressure, approximately 22 psid, depending upon the valve size and tolerances), the nosepiece will lift and allow gas to blow by. This causes no harm to the valve but could be important to other elements of the system.

If similar pressure is applied to the side port while the nosepiece port is under vacuum, the leak tight seal will be maintained up to 50 psid. The thin material of the bellows could be permanently damaged at higher pressures.

#### **Opening with a Pressure Differential**

The 656 valve may be opened with a pressure differential of 15 psid in either sense without harm.

#### **Note**



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When operating the 656 valve with high vacuum diffusion pumps, it is important to make certain the pressure above the oil vapor jet does not exceed 0.5 milliTorr, as this leads to unstable pump performance. This unstable (oscillating) pump characteristic manifests itself as a seemingly unstable control loop and no amount of adjustment of the lead and gain will correct the situation. The only solution is to lower flow rates so that the diffusion pump may operate in its correct pressure range.

---

## **Theory of Operation**

The 656 valve is designed to provide a positive shutoff of gas flow, soft pump capabilities, and closed-loop pressure control. The top of the valve is the motor housing. It includes an opto-interrupt switch assembly attached to a stepper motor assembly. The valve body contains a bellows which hermetically seals a resilient linkage assembly and patented constant force spring assembly. The two valve ports (side port and nosepiece port) are arranged in an angled or in-line design to accommodate different system requirements.

A pressure controller, for example the MKS Type 655 pressure controller, provides power to the stepper motor assembly in the 656 valve. The stepper motor actuates a threaded shaft via a drive nut. The lower end of the threaded shaft is connected to a patented constant force spring assembly and a resilient linkage assembly which has the valve nosepiece at its lower end. As the lower end of the threaded shaft moves up and down, the linkage assembly and thus the valve nosepiece moves up and down. In its lowest position, the nosepiece is inserted in the valve seat and the valve is positively sealed via the O-ring in the nosepiece.

## How the 656 Valve Reacts to Power Loss

The Type 655 controller must be equipped with the optional battery back-up module to ensure that the valve will close upon power loss. In addition, to hold the valve in the closed position, up to 35 psig internal pressure must be applied through a normally open solenoid valve. These two requirements must be met to ensure a fail safe close operation in case of a power failure.

### Caution



**DO NOT apply more than 35 psig pressure to the bellows. Higher pressure may rupture the bellows.**

**DO NOT operate the valve with pressure applied to the bellows.**

In no case should the bellows be pressurized higher than 35 psig. Higher pressure (up to 150 psig) will not immediately rupture the bellows but will stress it so that very early failure will result. If an emergency condition requires using pressure above 50 psid to close the valve, the Bellows Assembly *must be replaced* prior to putting the valve back in service. Contact any MKS Service Center, listed on the back cover, for assistance.

Connect the air supply for the pneumatic close feature through the  $\frac{3}{8}$ " NPT port on the back side of the Bonnet flange. MKS recommends installing a normally open solenoid valve (solenoid valve is closed when powered during normal operation) to control the air flow. Consult the MKS Applications group for further information about this feature.

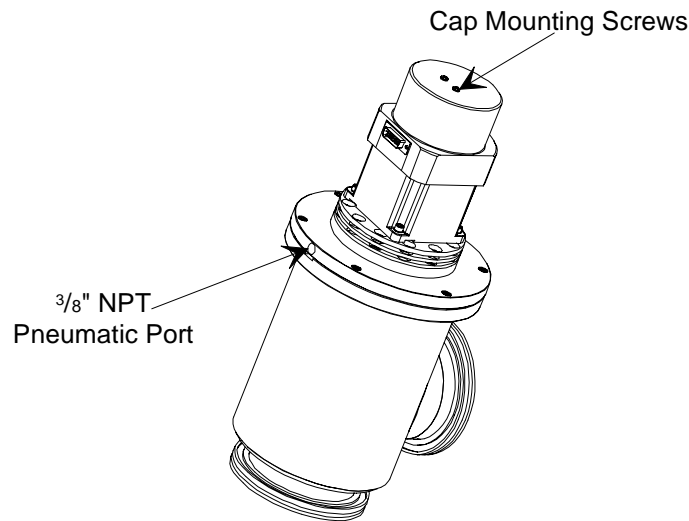


Figure 4: Location of the Pneumatic Port

## Labels

### **Serial Number Label**

The serial number label, affixed to the side of the unit, lists the model code of the unit. Refer to *Appendix B: Model Code Explanation*, page 45, to interpret the model code.



Figure 5: The Serial Number Label

### **Additional Label for Heated Units**

Heated units carry an additional label affixed to the heater jacket. This label displays the IEC symbol for a hot surface.



Figure 6: Additional Label on Heated Units

## Chapter Four: Operation

### General Information

MKS products are designed and tested to provide the highest degree of safety attainable. To use your MKS valve safely, you must always conform to the following instructions:

- Follow all directions in this manual on the installation and operation of the valve.

#### **Warning**



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**The moving parts in the valve create a risk of personal injury until the valve is securely incorporated into a system. To avoid injury keep all objects away from any valve opening.**

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- Do not insert objects into openings where contact with moving parts is possible.
- Isolate the equipment from any electrical or pneumatic power supply before handling the valve.

## How To Configure the Type 655 Controller

An MKS Type 655 controller is necessary to operate the 656 valve. You must configure the controller properly to work with the 656 valve. Refer to the 655 instruction manual for detailed information.

### Caution



Be sure that the 655 controller is configured correctly, otherwise the 656 valve will not function properly.

### 655A Controller Settings

The 656 valve utilizes two of the programmed selections in the 655 controller for the earlier model Type 654 Valve Series, however the selections are not identical. Use the “654 50/80” selection for a 40 mm 656 valve.

Valve Selection Entries for the Type 655 Controller	
Type 656 Valve Size	655 Controller Selection
40 mm	654-50/80
50 mm	654-50/80
80 mm	654-50/80
100 mm	654-100

Table 9: Valve Selection Entries for the Type 655 Controller

### Note



You must run the “learn” function when the valve is initially connected or re-connected to the 655 controller.

## How To Adjust the Valve Closed Position

The 656 valve uses an opto-interrupt switch to determine when the valve is fully closed. The normal factory setting of the opto interrupt switch results in a spring preload that maintains the valve in a closed position until the valve opens approximately 5% to 10% of its full travel. If your system requires that the valve be effectively open at some lower percentage of full stroke, you must adjust the opto-interrupt switch. (Valves can be special ordered with this adjustment complete.)

### Note




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Adjusting the valve closed position to open the 656 valve earlier requires lowering the spring preload. A lower spring preload results in a lower valve “blow-by” pressure. The blow-by pressure is defined as the pressure, applied below the bellows nosepiece, that will lift the nosepiece off the seat.

---

1. Remove the two (2) cap mounting screws on the top of the unit and lift off the valve cover.  
Refer to Figure 4, page 29, for the location of the screws.
2. Install the 656 valve in a vacuum system in the same orientation in which it is normally operated.

### Warning




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**Be sure the valve is installed in a system or securely bench-mounted, BEFORE connecting it to the controller.**

---

3. Use a CB656S-1 or CB656-1 interface cable to connect the valve to a 655 controller.

### Warning




---

**Keep fingers, other body parts and objects away from the valve opening. Severe injury could result if a body part were caught in the valve.**

---

4. Set the 655 controller to the Position Control mode and “Learn” the valve.  
Refer to the 655 Instruction Manual for instructions on how to operate the 655 controller.
5. Use the 655 controller to drive the valve to the fully closed position.
6. Slowly open the valve, using the 655 controller, until the valve is open the desired amount. Record the position (as a percent of full open) shown on the display of the 655 controller.
7. Using a  $\frac{3}{16}$ ” hex key, turn the opto-adjuster to change the opening point.

**Note**

---

The opto-adjuster is set with Loctite<sup>®</sup> at the factory, so the breakaway torque will be high.

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*Clockwise (downward)* to lower it

*Counter-clockwise (upward)* to raise it.

On a 100 mm or 80 mm valve, one-half turn  $\approx$  1%

On a 50 mm or 40 mm valve, one-third turn  $\approx$  1%

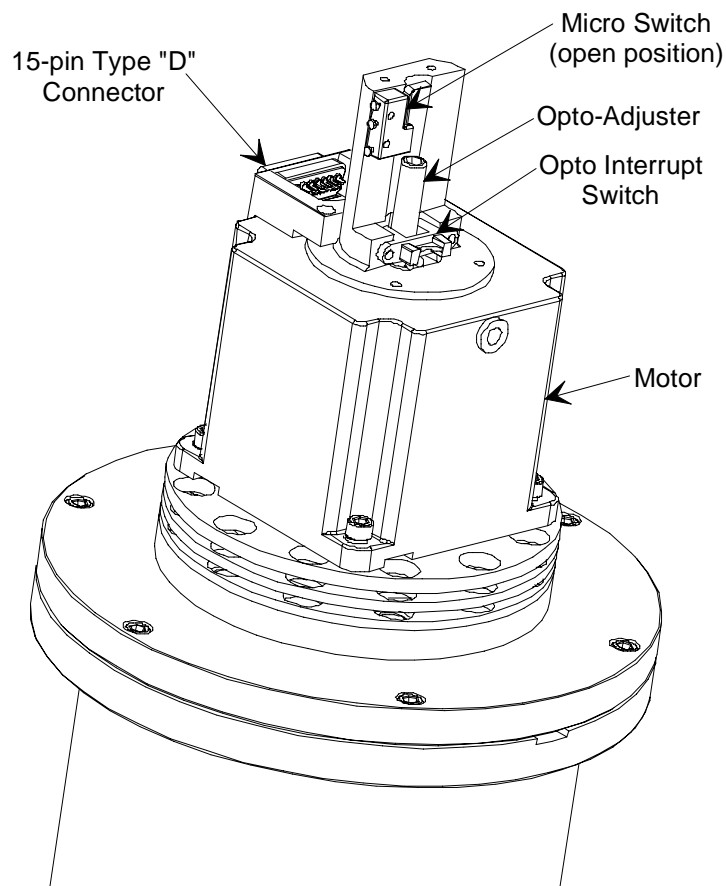


Figure 7: Location of the Opto-Adjuster and Opto Switch

**Note**

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After each adjustment, learn the valve before checking the result of the adjustment.

---

**Caution**

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**The Opto Adjuster *must be reset* with Loctite prior to making the final adjustment. You make the final adjustment while the Loctite hardens.**

---

8. Once the final position has been determined, remove the opto-adjuster while counting the number of turns.
9. Apply Loctite 242 or equivalent to the threads, and reinstall. Make the final adjustment within 2 to 3 minutes of applying the Loctite; *before* the Loctite hardens.

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## Chapter Five: Maintenance

### General Information

Periodically check for wear on the cables and inspect the enclosure for visible signs of damage.

### How To Clean the Valve

#### Note




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The cleaning procedure is identical for heated and ambient valves. The heater blanket, which surrounds heated valves, may remain in place during the cleaning process, however, MKS recommends that you remove it. The cleaning solvent must not contact the heater blanket.

---

#### *Necessary Equipment:*

Allen wrench

Solvent appropriate for the process material

Replacement O-rings (refer to Table 10, page 40, for information)

#### Warning



- 
1. **Keep fingers, other body parts, and other materials away from the valve opening. Objects can get caught in the opening when the valve closes.**
  2. **Be sure the valve is disconnected from the controller before removing it from the system.**
- 

1. Open the valve to 50% to relieve the preload force on the valve spring.
2. Disconnect the valve from the process tool.
3. Remove the cap screws on the bonnet/stem guide. There will be either six (6) or twelve (12) screws, depending upon the size of the valve.

Refer to Figure 8, page 38, for the location of the cap screws.

#### Caution




---

**Do not disassemble the valve beyond the procedure described in this section. Specifically, do not disassemble the bellows sub-assembly from the motor drive screw sub-assembly. These sub-assemblies *cannot* be re-assembled in the field.**

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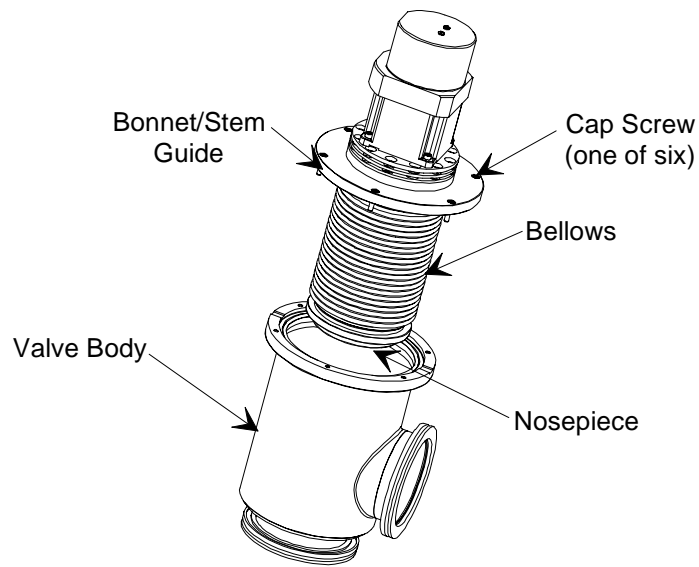


Figure 8: Partially Disassembled View of the Type 656 Valve

4. Grasp the bonnet/stem guide and lift it out of the valve body.

The bonnet O-ring, under the bellows, may fall out of its groove when you lift the bonnet/stem guide out of the valve body. Before reassembling the unit, you must reposition the O-ring back in its groove. Compressing the bellows will allow more access to the O-ring groove.

5. Place the bonnet/stem guide on a counter *upside down*, so that the nosepiece is the top surface.

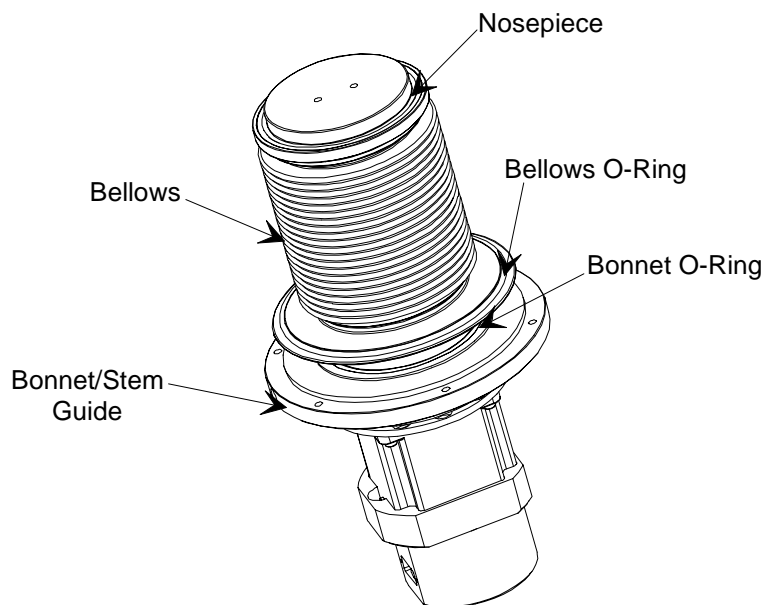


Figure 9: Upside Down View of the Type 656 Valve

6. Clean the surfaces of the bellows, nosepiece assembly, and the body assembly with an appropriate solvent.

**Caution**

- 
1. **Do not use any harsh or strong acids, such as sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) since such acids may damage the stainless steel.**
  2. **Do not use hand tools or brushes that may puncture or otherwise damage the bellows.**
  3. **Do not allow any solvent to contact the motor assembly or heater blanket.**
  4. **Be careful not to contaminate the bellows or motor while cleaning the valve surfaces.**
- 

7. Clean the inside of the body; pay particular attention to the seat sealing surface.

**Caution**


---

**Replace the nosepiece O-ring and the bellows O-ring during each regularly scheduled cleaning cycle. Refer to Table 10, page 40, for the appropriate replacement O-ring part numbers.**

---

8. The nosepiece O-ring must be installed in the trapezoidal O-ring groove using the following procedure:
  - A. Place the O-ring directly over the groove and press it in *gently* at four places, each 90° apart.
  - B. To prevent the O-ring from puckering, repeat this step at a position 45° from the first, and continue to repeat as necessary until the O-ring is installed.
  - C. Verify the O-ring surface is flat and free from undulations.

**Note**


---

Replacement of the bonnet O-ring requires further disassembly. This procedure must be done by an MKS Service Center (refer to the inside back cover for a list of locations). This O-ring is not exposed to process gases so it does not normally require replacement.

---

9. Replace the bellows O-ring.
10. To reassemble the unit, reposition the valve body over the bonnet/stem guide.
11. Grasp the bonnet/stem guide and valve body flanges and flip the unit over rightside up.
12. Reconnect the six (6) or twelve (12) cap screws (depending upon valve size), tightening each in a diagonal pattern. Tighten each to a torque of 45 inch pounds.

## How To Order Replacement O-Rings

The 656 valve contains several O-rings that are exposed to the material flowing through the valve. Depending upon the type of service the valve is used in, it may be necessary to replace the O-rings periodically. Refer to Table 10 for the MKS part number for the replaceable O-rings.

<b>Replacement O-Ring Information</b>			
<b>Valve Size</b>	<b>O-Ring Description</b>	<b>Material</b>	<b>MKS Part Number</b>
50 MM/40 MM	Nosepiece	Viton	149-8146/149-0735
		Silicone	149-8918/149-0736
		Kalrez	149-0549/149-0727
		Chemraz	149-0547/149-0728
40 MM & 50 MM	Bellows	Viton	149-8242
		Silicone	149-0540
		Kalrez	149-0400
		Chemraz	149-0546
	Bonnet	Viton	149-0516
		Silicone	149-0539
		Kalrez	149-0517
		Chemraz	149-0545
80 MM & 100 MM	Nosepiece	Viton	149-0391
		Silicone	149-0536
		Kalrez	149-0519
		Chemraz	149-0542
	Bellows	Viton	149-0392
		Silicone	149-0537
		Kalrez	149-0520
		Chemraz	149-0543
	Bonnet	Viton	149-0500
		Silicone	149-0538
		Kalrez	149-0518
		Chemraz	149-0544

Table 10: Replacement O-Ring Information

## Chapter Six: Troubleshooting

### Symptoms and Possible Solutions

Listed below are symptoms with possible causes and solutions.

#### *The valve cannot be pumped down to high vacuum.*

1. The valve could be dirty and contaminated with a material that is outgassing.

Correct by thoroughly cleaning the valve, following the procedure *How To Clean the Valve*, page 37.

2. The valve could be leaking from external atmosphere into the vacuum system or across the nosepiece seal.

Perform a careful leak test with a quality leak detector to locate the leak. Some possible sources of leaks are:

- A. Non-sealing flanges between the valve and the system due to damage, excessive dirt, or incorrect assembly.
- B. Incorrect installation of nosepiece O-ring which results in twisting or surface undulations.

Locate the problem and assemble correctly.

- C. A leak at the nosepiece. This indicates that the nosepiece O-ring may be bad, the seat damaged, or that excessive dirt on the seat is preventing it from sealing properly.
- D. The opto-interrupt switches could also be improperly set. This causes the close switch to activate too early.

Inspect the O-ring and valve seat for wear, damage, or excessive dirt. Replace the O-ring or clean the valve seat if needed. If the problem remains, adjust the opto-interrupter adjustment screw. (Refer to *How To Adjust the Valve Closed Position*, page 33.)

- E. A leak from the bellows vents. This indicates that either the bellows has failed or the bellows flange O-ring is defective.

Inspect the O-ring for wear, damage, or excessive dirt and replace if needed. If the problem persists, return the unit to MKS.

- F. Leaks in the body proper. These could arise if the body has been modified or subjected to undue stress or otherwise damaged. A new valve body is needed.

***The valve doesn't fully open.***

1. The controller may be defective.
2. The valve may not be getting enough current.  
Check all electrical connections.
3. Limit switches may be dirty. Inspect, and if needed, clean the adjustment screw and/or opto-interrupt switches. Adjust the adjustment screw if necessary. (Refer to *How To Clean the Valve*, page 37.)

***The valve doesn't fully close.***

1. The controller may be defective.
2. Limit switches may be dirty. Inspect, and if needed, clean the adjustment screw and/or opto-interrupt switches. Adjust the adjustment screw if necessary.
3. Excessive pressure in the valve body may be holding the bellows open.  
Internal pressure should not exceed the specified value (35 psig).

***The motor or opto-interrupt switches won't operate properly.******The motor stalls in the open or close position, or overheats.***

1. The above symptoms could be caused by a short due to an exposed wire. Check all wires for damage.

## Appendix A: Product Specifications

### General Specifications

CE Compliance <sup>1</sup>	
Electromagnetic Compatibility <sup>2</sup>	89/336/EEC
Machinery Directive	89/392/EEC
Leak Integrity (Internal to External and across a closed valve)	10 <sup>-9</sup> scc/sec He
Input Power	2 Amps / 24 VDC
Materials Exposed to Process	304 & 321 SST
O-ring material	standard: Viton® optional: Kalrez®, Chemraz®, Silicone
Maximum Cable Length	50 feet
Operating Temperature	
Ambient	15° to 40° C (59° to 104° F)
Body	150° C (302° F) with optional heaters

---

<sup>1</sup> An HPS Series 45 heater must be used with the heated version of the 656 valve to meet CE specifications.

<sup>2</sup> An overall metal braided shielded cable, properly grounded at both ends, is required during use.

## **Valve Size Specific Specifications**

<b>Valve Size (nominal)</b>	<b>40 mm</b>	<b>50 mm</b>	<b>80 mm</b>	<b>100 mm</b>
Flanges Available	KF-40 2 3/4" CF weld stub	KF-50 3 3/8" CF weld stub	MF-80 4 5/8" CF weld stub	MF-100 6" CF weld stub
Controllable Conductance (molecular flow)	0.001 - 26 l/s	0.002 - 52 l/s	0.003 - 144 l/s	0.004 - 288 l/s
Open to Close Speed	< 6 seconds	< 6 seconds	< 10 seconds	< 10 seconds
Blow-by Pressure	> 1.5 atm.	> 1.5 atm.	> 1.5 atm.	> 1.5 atm.
Weight	14 lbs. (6.4 kg)	14 lbs. (6.4 kg)	27 lbs (12.2 kg)	27 lbs (12.2 kg)

## **Environmental Specifications**

Ambient Operating Temperature Range	15° to 40° C (59° to 104° F)
Storage Temperature Range	-20° to 80° C (-4° to 176° F)
Storage Humidity Range	0 to 80% relative humidity, non-condensing

Due to continuing research and development activities, these product specifications are subject to change without notice.

## Appendix B: Model Code Explanation

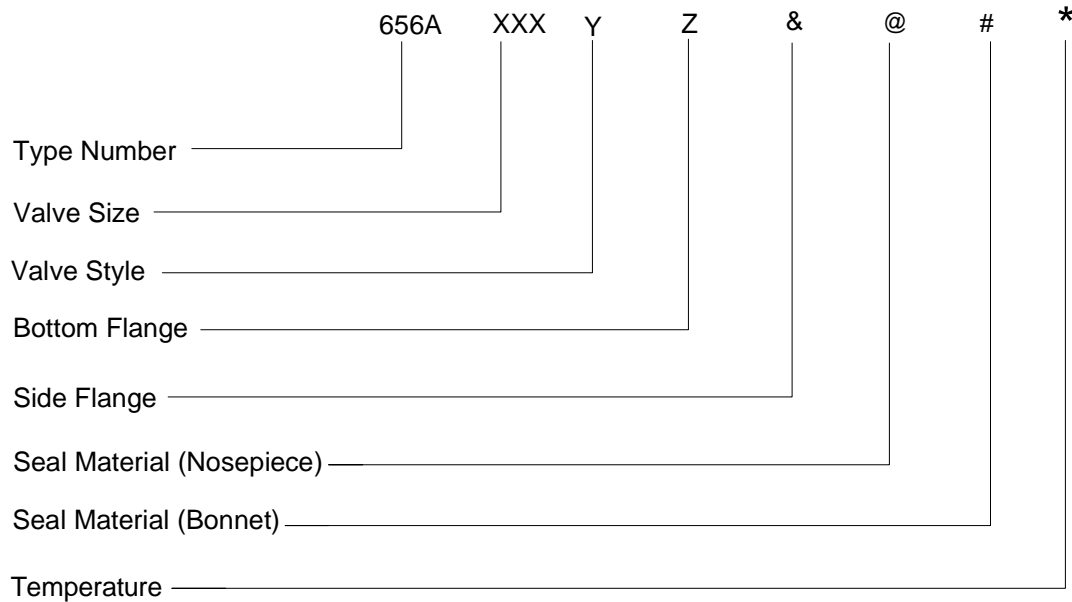
### Model Code

The options of your valve are identified in the model code when you order the unit.

The model code is identified as follows:

**656AXXYZ&@#\***

where:



### **Type Number (656A)**

This designates the model number of the instrument.

**Valve Size (XXX)**

The valve size is indicated by a three digit code.

<b>Valve Size (mm)</b>	<b>Ordering Code</b>
40	040
50	050
80	080
100	100

**Valve Style (Y)**

The 656 valve is available in either a right angle or in-line configuration, as designated by a single letter code.

<b>Valve Style</b>	<b>Ordering Code</b>
Right angle	A
In-line	I

**Bottom Flange (Z)**

The type of flange on the bottom of the valve is indicated by a single letter code.

<b>Flange Type</b>	<b>Ordering Code</b>
ISO-KF (40 and 50 mm sizes)	K
ISO-MF (80 and 100 mm sizes)	M

**Side Flange (&)**

The type of flange on the side of the valve is indicated by a single letter code.

<b>Flange Type</b>	<b>Ordering Code</b>
ISO-KF (40 and 50 mm sizes)	K
ISO-MF (80 and 100 mm sizes)	M

**Seal Material Nosepiece (@)**

A single letter denotes the choice of seal material for the valve nosepiece.

Seal Material	Ordering Code
Viton	V
Silicone	S
Kalrez	K
Chemraz	C

**Seal Material Bonnet (#)**

A single letter denotes the choice of seal material for the bonnet.

Seal Material	Ordering Code
Viton	V
Silicone	S
Kalrez	K
Chemraz	C

**Temperature (\*)**

A single letter denotes the temperature, either heated or non-heated.

Temperature	Ordering Code
Heated Body (150° C)	H
Non-heated	N

**Note**


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When the 656 valve has the heater option installed, an *HPS Series 45 heater must be used* to ensure compliance with CE Mark requirements. Failure to use a Series 45 heater with a heated version of the 656 valve will void the CE compliance.

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