



**HANSE** | **HALT**  
**HASS**  
Environmental, Inc.

*Operation,*  
*and*  
*Maintenance Instructions*

for  
*Hanse Environmental, Inc.*

***VK Series***



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# Introduction

The **Vibration Kit** system offers you the ability to excite products with multi-axial impact vibration. This system is intended to be install into Temperature chamber or enclosure for operation. The unique characteristics of the **Hanse Environmental Inc.** vibration systems are of the highest quality and performance.

You are urged to ***carefully*** read the following pages, and particularly the **SAFETY** section, (immediately following), before installing or operating this equipment. This will result in safer operation, longer equipment life, more effective testing, and probably a lot less frustration too!

The staff and employees of **Hanse Environmental, Inc.** thank you for choosing our product. Please don't hesitate to call us with any questions or comments that you may have.

## ***Hanse Environmental, Inc***

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## Safety Information

Your **Hanse Environmental Inc.** Equipment is provided with several safety systems designed to help prevent accidental damage to product and equipment, and avoid injury to personnel. Always operate this equipment in accordance with the procedures set forth in the **OPERATION** section of this manual. The safety systems described below should be checked at least once every 30 days, and any inoperative or questionable conditions must be corrected before resuming operation. Servicing of this equipment and its associated utility service must be done only by *properly trained* personnel! Compressed air, liquid nitrogen, and high voltages can all cause severe injury or death if not properly handled.

### **WARNING!**

#### **HIGH SOUND LEVELS!**

**The vibrators produce extreme sound power levels, which may cause temporary or permanent hearing damage, particularly after prolonged exposure. Do not attempt to operate vibration equipment with doors open unless adequate hearing protection is worn by all affected personnel!**

### **Vibration High Limit Control:**

A user-programmable limit is provided by the Watlow F4 alarms. Alarm 2 is setup for use with the vibration signal (input 2). When the limit is tripped the safety valves power down and bring the vibration to a halt. This is an option not always included in ALL VK systems. Refer to you model and specification requested.

## Specifications and Utility Requirements

**Hanse Environmental Inc.** builds multiple equipment sizes, with various optional features available, and maximum vibration levels. Information shown is for standard VK models. Your system may vary if special requests were made at time of purchase concerning dimensions, product mass. Other manufacturers, such as Watlow, provide their own manuals along with the chamber. Material data sheets are also provided.

### Utility Requirements

- **Electric:** Requirements vary With Control options.
- **Compressed Air:** Required pipe size, pressure, and flow requirements listed below in comparison chart. Clean dry air is required.

### Comparison Chart

Model	VK-1	VK-1.5	VK-4	VK-6	VK-9	VK-16	VK-25	VK-36
Table in Inches	12" x 12"	18" x 18"	24" x 24"	30" x 30"	36" x 36"	48" x 48"	60" x 60"	70" x 70"
Max Load in lbs *	100	250	700	700	700	500	500	500
Compressed Air 120 psig	1/2" Supply 15 SCFM	1/2" Supply 32 SCFM	3/4" Supply 55 SCFM	3/4" Supply 55 SCFM	1" Supply 75 SCFM	1" Supply 120 SCFM	1" Supply 150 SCFM	1" Supply 180 SCFM
Voltage/Amp	120/5	120/5	120/5	120/5	120/5	120/5	120/5	120/5

\*Note: Load based on spring capacity, mounts in chamber or enclosure must meet or exceed limits of table and hammers empty weight plus load.

## **Performance**

### **Overview**

- **Tri-Axial Vibration:** Six-Degree-of-Freedom (6DoF) Vibration, non-coherent broadband vibration 5-10,000Hz **100 gRMS New**. 90% of vibration energy in 5-4000Hz for maximum low energy in low frequency range.

### **Vibration Table and Vibrators:**

Vibration simulation is achieved using multiple pneumatically actuated pistons precisely oriented to act in conjunction with a carefully engineered set of aluminum plates to transmit broad frequency vibration patterns acting with six degrees of freedom at controlled intensity.

- **Tri-Ax Vibration:** Tri-axial non-coherent, six degree of freedom (6DoF) broadband vibration: 5 to 10000 Hz, 100 gRMS with unloaded table at ambient.
- **Vibration Control:** to within  $\pm 0.5g$  within one (1) minute of settling.
- **Tri-Ax Vibration Table:** Mounting surface uses square bolt down pattern with stainless steel 3/8"-16 insert on 4" centers or on metric tables M10-1.5 inserts on 100mm centers. Ceramic insulation thermally isolates mounting surface from vibration base for improved temperature cycling and vibrator life.

### **Control Software:**

HanseView Control allows for manual and profile control.

HanseView Analysis allows for manual and profile control as well as vibration analysis.

### **Vibration level Control:**

A GRMS meter connected to an accelerometer provides instantaneous readout of vibration intensity in one axis. Additional accelerometers can be purchased and installed to provide multi-axis indication. Software included with the system allows reading and control of g levels.

- **Miniature, Low Impedance, Voltage Mode Control Accelerometer:** one (1) Dytran model 3030B5, with a 10 ft. cable this has 10-32 to BNC.
- **Current Source:** for Control Accelerometer, one (1).

## Calibration

Only qualified technical personnel should do calibration procedures with access to the equipment listed in each section.

Before beginning calibration procedures, warm up the equipment for at least 20 minutes.

### [Watlow F4-1 Temperature and Vibration](#)

#### [Restore Factory Values](#)

**Each controller is calibrated before leaving the factory.** If at any time you want to restore the factory calibration values, use the last parameters in the menu: Restore In x (1 to 3) Cal. Press right arrow

No special equipment is necessary.

Following Chapter 9 of the Watlow F4 Manual:

#### [Input 1 Thermocouple Input Procedure](#)

##### **Equipment**

- Type J reference compensator with reference junction at 32°F (0°C), or type J thermocouple calibrator to 32°F (0°C).
- Precision millivolt source, 0 to 50mV minimum range, 0.002mV resolution.

##### **Setup and Calibration**

1. Connect the correct power supply to terminals 1, 2 and 3 (see the Wiring Chapter and the Appendix).
2. Connect the millivolt source to Input 1 terminals 62 (-) and 61 (+).
3. Enter 50.000mV from the millivolt source. Allow at least 10 seconds to stabilize. Press the Right Key once at the Calibrate Input 1 prompt (Factory Page). At the 50.00mV prompt press Right Key once and to store 50.00mV press the Up Key once.
4. Enter 0.000mV from the millivolt source. Allow at least 10 seconds to stabilize. At the 0.00mV prompt press Right Key once and to store 0.00mV press Up Key once.
5. Disconnect the millivolt source and connect the reference compensator or thermocouple calibrator to Input 1 terminals 62 (-) and 61 (+). With type J thermocouple wire, if using a compensator, turn it on and short the input wires. When using a type J calibrator, set it to simulate 32°F (0°C). Allow 10 seconds for the controller to stabilize. Press Right Key once at the Calibrate Input x (1 or 2) prompt (Factory Page). At the 32°F Type J prompt press Right Key once and to store type J thermocouple calibration press Up Key once.
6. Rewire for operation and verify calibration.

#### [Input 2 Voltage Input Procedure](#)

##### **Equipment**

- Precision voltage source, 0 to 10V minimum range, with 0.001V resolution.

##### **Setup and Calibration**

1. Connect the correct power supply to terminals 1, 2 and 3 (see the Wiring Chapter and the Appendix).
2. Connect the voltage source to terminals 53 (+) and 58 (-) of the controller.
3. Enter 0.000V from the voltage source to the controller. Allow at least 10 seconds to stabilize. Press right arrow once at the Calibrate Input 2 prompt. At the 0.000V prompt press right arrow once and to store the 0.000V input press up arrow once.
4. Enter 10.000V from the voltage source to the controller. Allow at least 10 seconds to stabilize. Press right arrow once at the Calibrate Input 2 prompt (Factory Page). At the 10.000V prompt press right arrow once and to store the 10.000V input press up arrow once.

### Accelerometers & Cables

Accelerometers should be calibrated on a yearly bases by a calibration lab. Accelerometers do need replacement when worn. We recommend keeping one to two spars available at all times. We recommend a 3030B5 made by Dytran. You may also use any standard 10 mv/g Accelerometer please make sure it has proper specs for the environment you are going to be putting it into.

The accelerometer cable also needs to be checked regularly for abnormal ware. These should be replaced yearly to provide best readings. Keeping one to two spars available at all times is recommended. We use a 6011A10 made by Dytran.

# **Calibration of the Dytran 4007 Quad Sensor Conditioner (Chambers Post 2006)**

## **1.0 SCOPE**

This procedure is dedicated to the explanatory of calibration technique for 4007 Quad Sensor Conditioner.

## **2.0 APPLICABILITY**

4007 series

## **3.0 EQUIPMENT**

- Oscilloscope, no manufacture specified
- Dual Display Multimeter, Fluke 45
- LIVM Sensor Simulator, Dytran 4515
- DC Power Supply, no manufacture specified
- Function Generator, no manufacture specified
- Set of appropriate cables

## **4.0 CALIBRATION CERTIFICATE CONTENT**

- Customer identification
- Unit Identification
- Environmental condition during calibration
- Sensor Supply Voltage (each channel)
- Sensor Drive Current (each channel)
- Filter @ 3kHz and 10kHz
- DC Voltage and Current
- List of equipment used
- Uncertainty of calibration and error

## 5.0 PROCEDURE

### 5.1 TEST SETUP

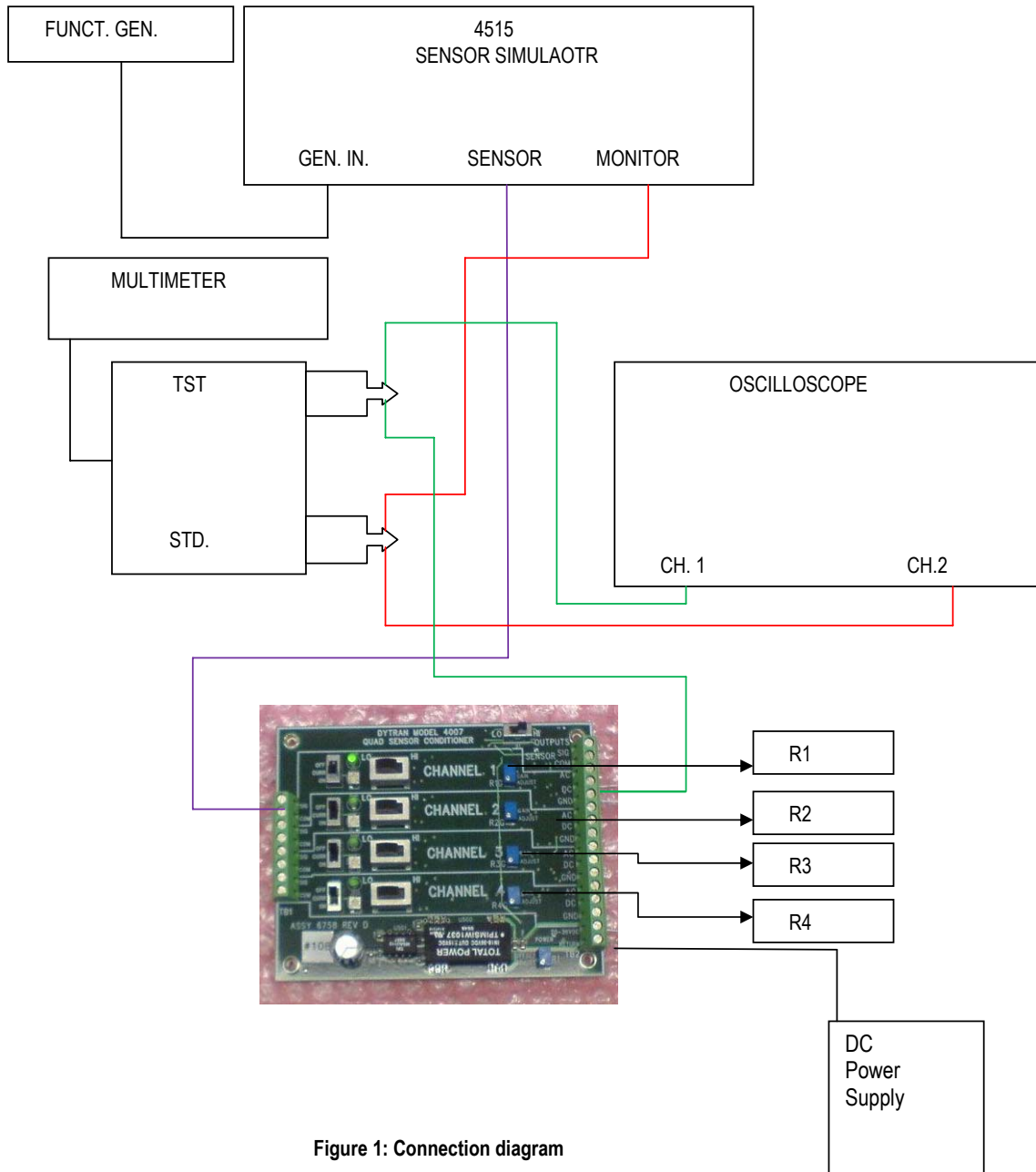




Figure 1: Connection diagram



## **IMI Model 682B03 ICP Vibration Transmitter**

Some Models are fitted with a single channel ICP current source.

Model Number <b>682B03</b>		<b>4-20MA DIN RAIL SIGNAL CONDITIONER/TRANSMITTER</b>		Revision: A ECN #: 32835	
<b>ELECTRICAL</b> Power Supply Voltage Power Supply Current ICP® Input Signal ICP® Sensor Excitation Temperature Sensor Input Vibration Output (milliamps) Zero Span Vibration Output (volts) Zero Span Temperature Output (milliamps) Zero Span Raw Vibration Output Input Channels Frequency Response: Fault Current Output <b>ENVIRONMENTAL</b> Warm Up Operating Temperature Range Storage Temperature Range Relative Humidity	<b>ENGLISH</b> 23 - 25 Vdc 100mA max. 100mV/g [3] 18Vdc/4mA, ±1V/±1mA [7], [8] 0 - 1.2V Full Scale [6] 4mA ±2% of Span 16mA ±5.0% 0-5/10Vdc 0Vdc ±2% of Span 5/10Vdc ±5.0% 4-20mA 4mA ±2% of Span 16mA ±5.0% ±1% of Input Vibration 1 3Hz to 10kHz [2],[4],[5] <1mA  0.9 x 3.9 x 4.5 in. 6.4 oz. max. Polyamide Removable Screw Terminals BNC Jack 24 - 14 AWG 1.38 in.  GREEN RED GREEN GREEN  GREEN	<b>SI</b> 23 - 25 Vdc 100mA max. 100mV/g [3] 18Vdc/4mA, ±1V/±1mA [7], [8] 0 - 1.2V Full Scale [6] 4mA ±2% of Span 16mA ±5.0% 0-5/10Vdc 0Vdc ±2% of Span 5/10Vdc ±5.0% 4-20mA 4mA ±2% of Span 16mA ±5.0% ±1% of Input Vibration 1 3Hz to 10kHz [2],[4],[5] <1mA  22.5 x 99 x 114.5 mm 181 grams Polyamide Removable Screw Terminals BNC Jack 0.2 - 2.5 mm <sup>2</sup> 35mm  GREEN RED GREEN GREEN  GREEN	<b>OPTIONAL VERSIONS</b>  Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used. N/A  <b>NOTES:</b>  1) Internal DIP Switch Selection: - Acceleration: 5.00g, 10.00g, 20.00g - Velocity: 0.50 in/sec, 1.00 in/sec, 2.00 in/sec - Displacement: 10.0 mils p-p, 20.0mils p-p, 40.0 mils p-p - Peak or RMS - 0-5 or 0-10Vdc Output  2) Frequency Response Tolerances: Acceleration: -3dB at 3Hz ±0.5Hz, -3dB at 10kHz ±0.5kHz Velocity: -3dB at 3.5Hz ±0.5Hz, -3dB at 10kHz ±0.5kHz Displacement: -3dB at 3.5Hz ±0.5Hz, 1000Hz max.  3) Output measurement range is based upon input from a 100mV/g accelerometer and will be scaled inversely proportional to any percentage deviation of this input.  4) Output Current/Voltage will fluctuate at frequencies below 5 Hz.  5) Attenuation is -40dB/Decade  6) Requires an accelerometer with TO option output.  7) Jumper selectable for 18Vdc Regulated, 24Vdc Power Supply Voltage, or ICP® Sensor Excitation Disabled.  8) 4mA Constant Current Diode is Internal to 682BX3.	<b>CERTIFICATIONS:</b>   See PCB Declaration of Conformance PS051 for details.	Drawn: LH Engineer: NF Sales: EGY Approved: EB Spec Number: <b>40536</b>
ICP® is a registered trademark of PCB Group, Inc.  In the interest of constant product improvement, we reserve the right to change specifications without notice.		Form DD030 Rev.F 2/23/99		Date: 4/29/10 Date: 4/24/10 Date: 4/26/10	
 <b>IMI SENSORS</b> A PCB PIEZOTRONICS DIV.		3425 Walden Avenue, Depew, NY 14043		800-959-4464 Fax (716) 684-3823 E-Mail: imisales@pcb.com	

# System Maintenance

Maintenance of this equipment should be done by a qualified technician. High voltage electrical systems, high pressure gas and mechanical systems all represent a potential for injury or death. The main power **must** be turned off at the main disconnect and all gas supplies should be turned off prior to servicing this equipment.

It is a good practice to keep a maintenance log for the chamber. The log should contain the tasks that must be accomplished and when they were performed.

The following is a list of maintenance tasks that should be performed on a monthly basis.

1. The proper function of the safety control devices should be checked on a regular basis. Replace any items that may be damaged or worn.
2. The electrical compartment should be kept clean and vacuumed if necessary.
3. The current draws of the major components should be checked with an amp. probe and recorded for future reference and to determine if there is any irregularity. Extreme caution must be taken whenever working with high voltage components.
4. The pneumatic vibration pistons should be checked for tightness and retightened if necessary to 125 ft./lb. torque for the large pneumatic pistons and 25 ft./lb. torque for the small pneumatic pistons.
5. Check the four screws on the bottom of the pneumatic pistons to insure that they are snagged.
6. The air lines to the pneumatic pistons should be checked for tightness and wear.
7. Check all the fasteners on the system and tighten, if necessary, any loose fasteners.
8. Check table edge bolts for correct torque. You must take jam nut free and torque to 25-30 Ft-Lb. See images below for location.

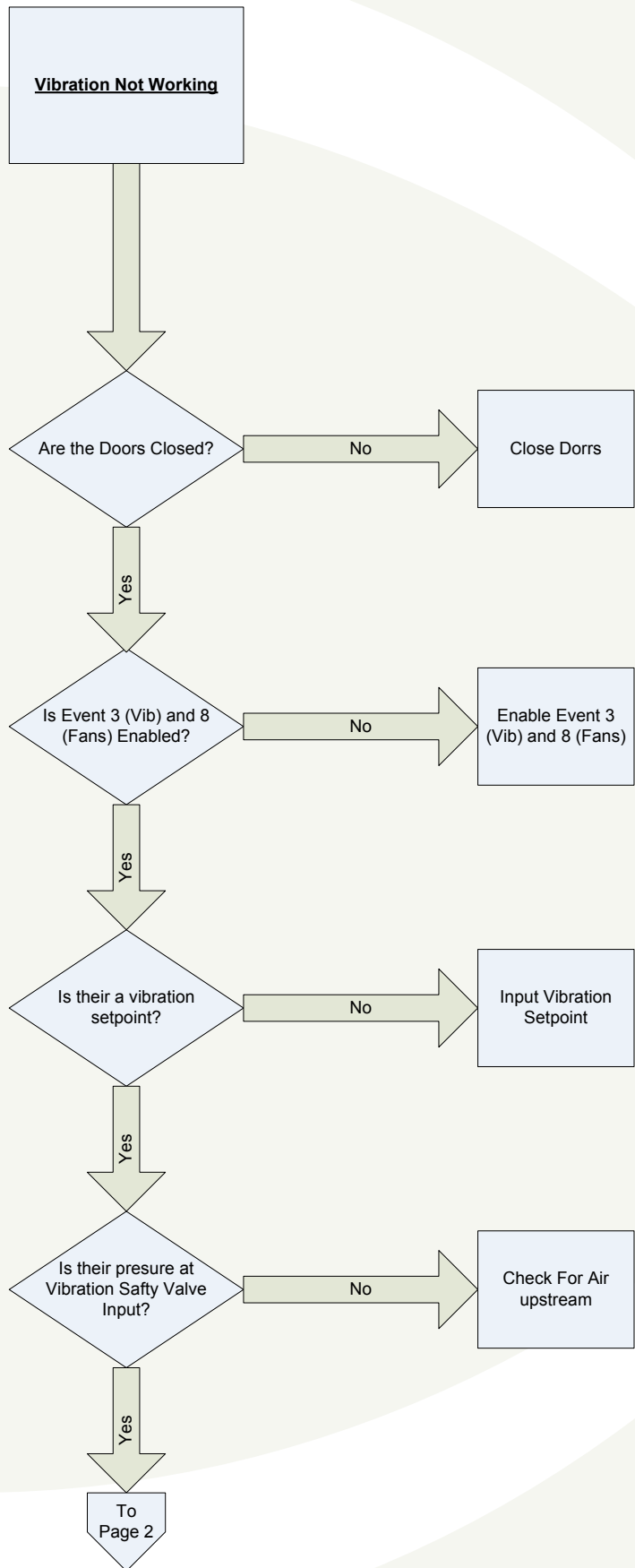
The following is a list of maintenance tasks that should be performed on a **daily** basis.

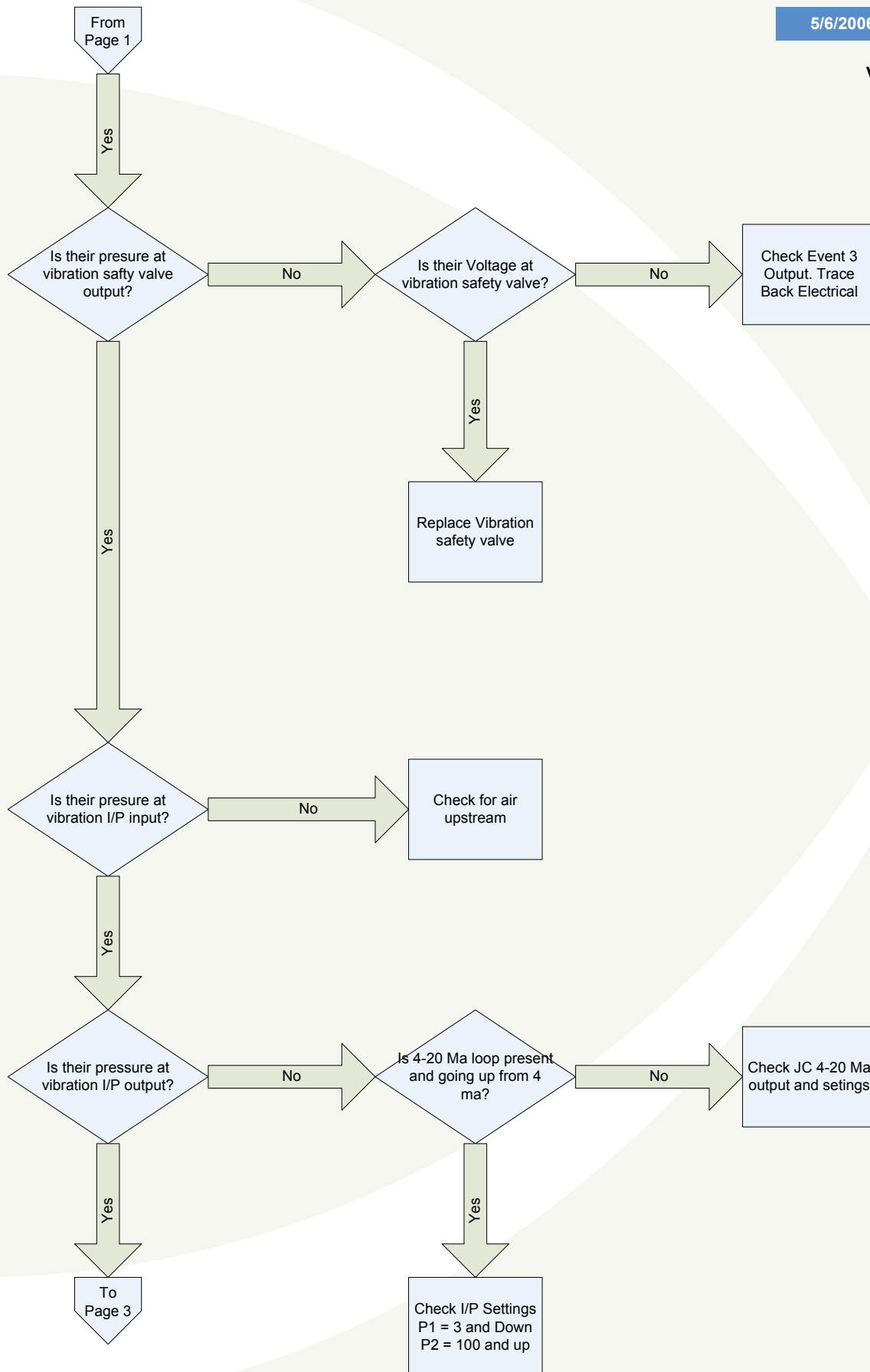
1. Check the air oiler to insure that there is enough oil to provide lubrication to the pneumatic pistons.
2. Check the bolts on the top of the vibration table to insure that they are tight.
3. Make sure that the air to the system is turned on.

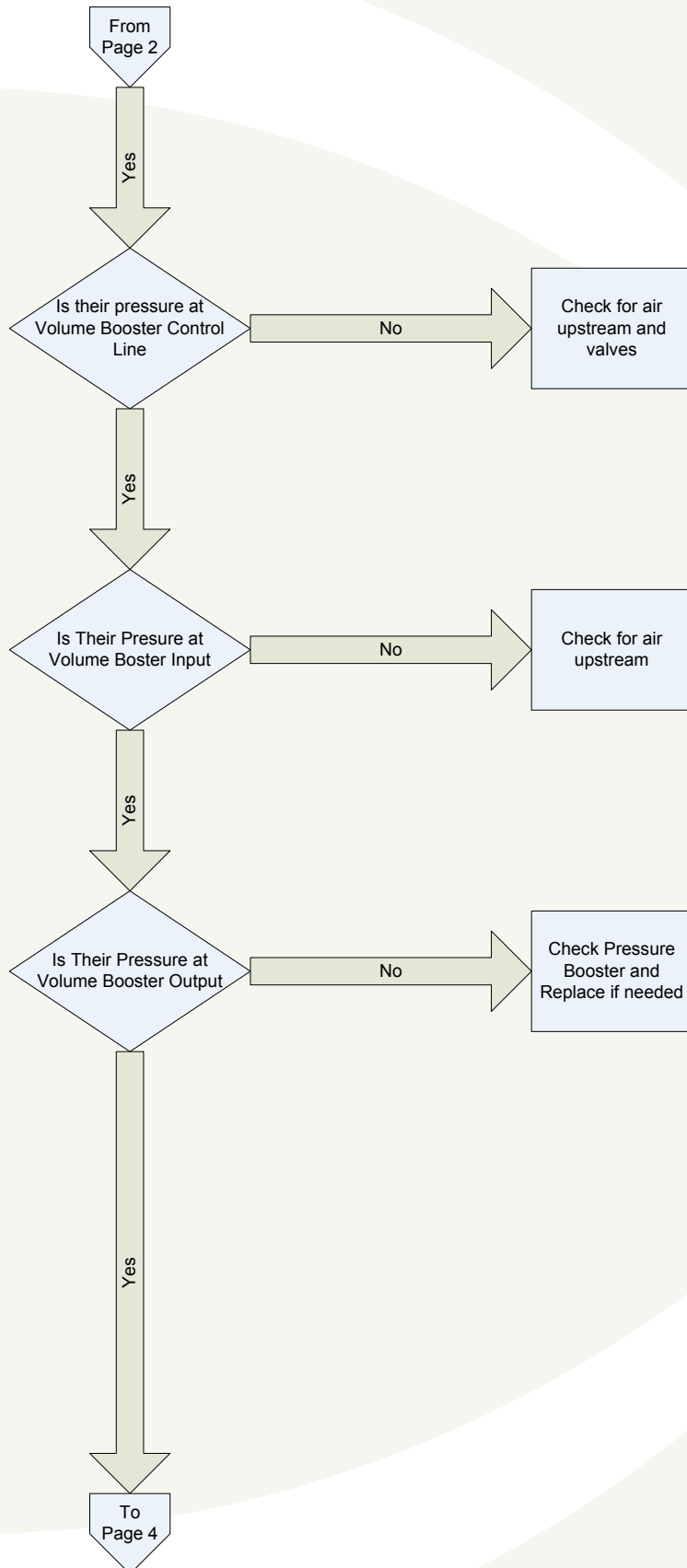
## **NOTE:**

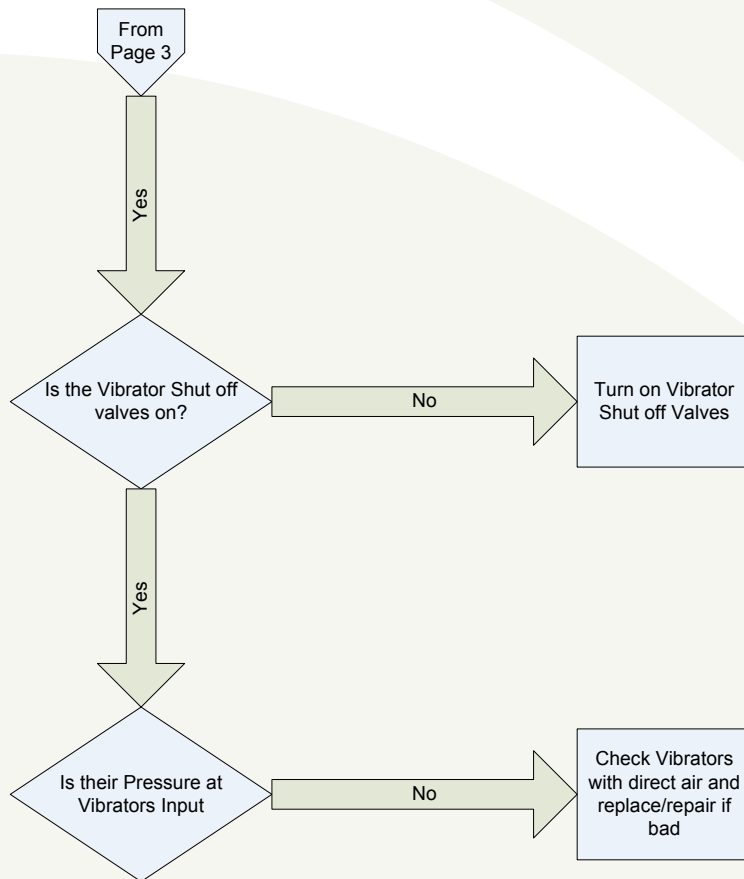
**If the vibration system is having difficulty controlling at low levels, the pneumatic pistons should be cleaned using the following procedure:**

Remove the Vibrator from the table. Then remove its bottom plate. Make sure you keep track of the rubber O-ring that is placed between the bottom plate and the cylinder. You then want to clean the inside of the cylinder and piston with denatured alcohol. You may use either a bath or rub down. You also want to inspect the inside of the cylinder checking for build up of oil and contaminants.











SMC I/P Regulator



VTC-1.5 I/P and Oiler





**HANSE** HALT  
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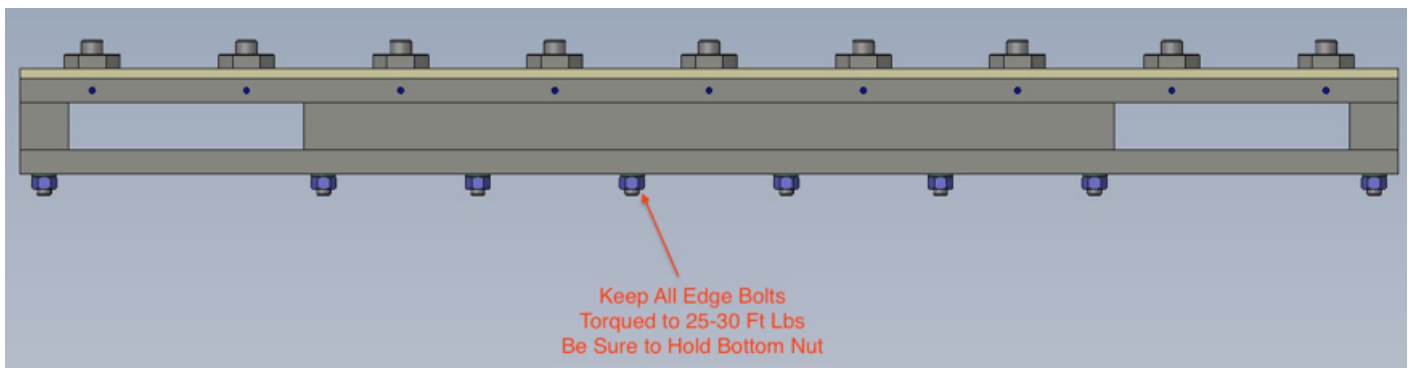
December 26, 2012

From time to time, we get complaints from customers regarding galling of stainless steel fasteners. Here is an excerpt from the Industrial Fastener Institute's Standards Book:

Thread galling seems to be the most prevalent with fasteners made of stainless steel, aluminum, titanium and other alloys which self-generate an oxide surface film for corrosion protection. During fastener tightening, as pressure builds between the contacting and sliding thread surfaces, protective oxides are broken, possibly wiped off and interface metal high points shear or lock together. This cumulative clogging-shearing-locking action causes increasing adhesion. In the extreme, galling leads to seizing – the actual freezing together of the threads. If tightening is continued, the fastener can be twisted off or its threads ripped out.

During minor galling, the fastener can still be removed, but in severe cases of galling, a strong bond between the bolt and nut can prevent removal of fasteners. Unfortunately, little is known on how to control it, but here are two ways to minimize this effect:

Decreasing installation RPM speed will cause less friction and decrease heat generation. Lubrication used prior to assembly can dramatically reduce or eliminate galling. Recommended lubricants should contain higher amounts of molybdenum disulfide, such as graphite which is very commonly used as a solid lubricant or special anti-galling lubricants sold by chemical companies.



*Peter Hanse*

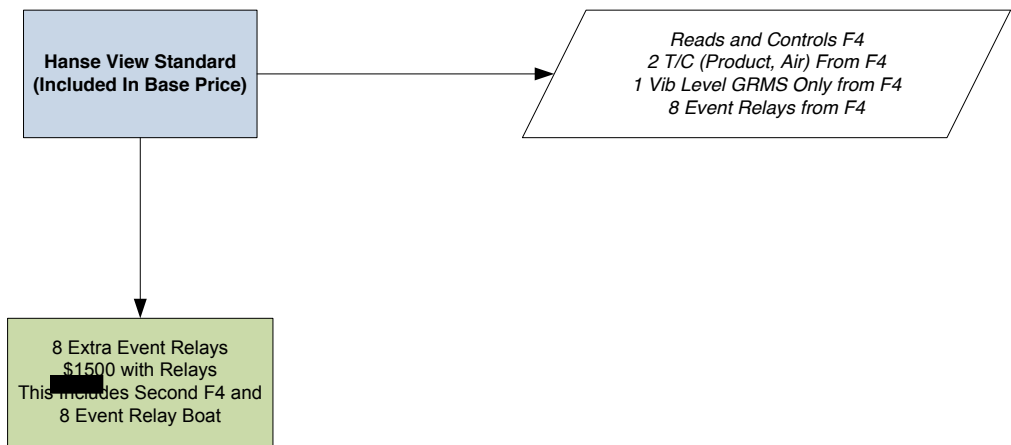
Peter Hanse  
Vice President

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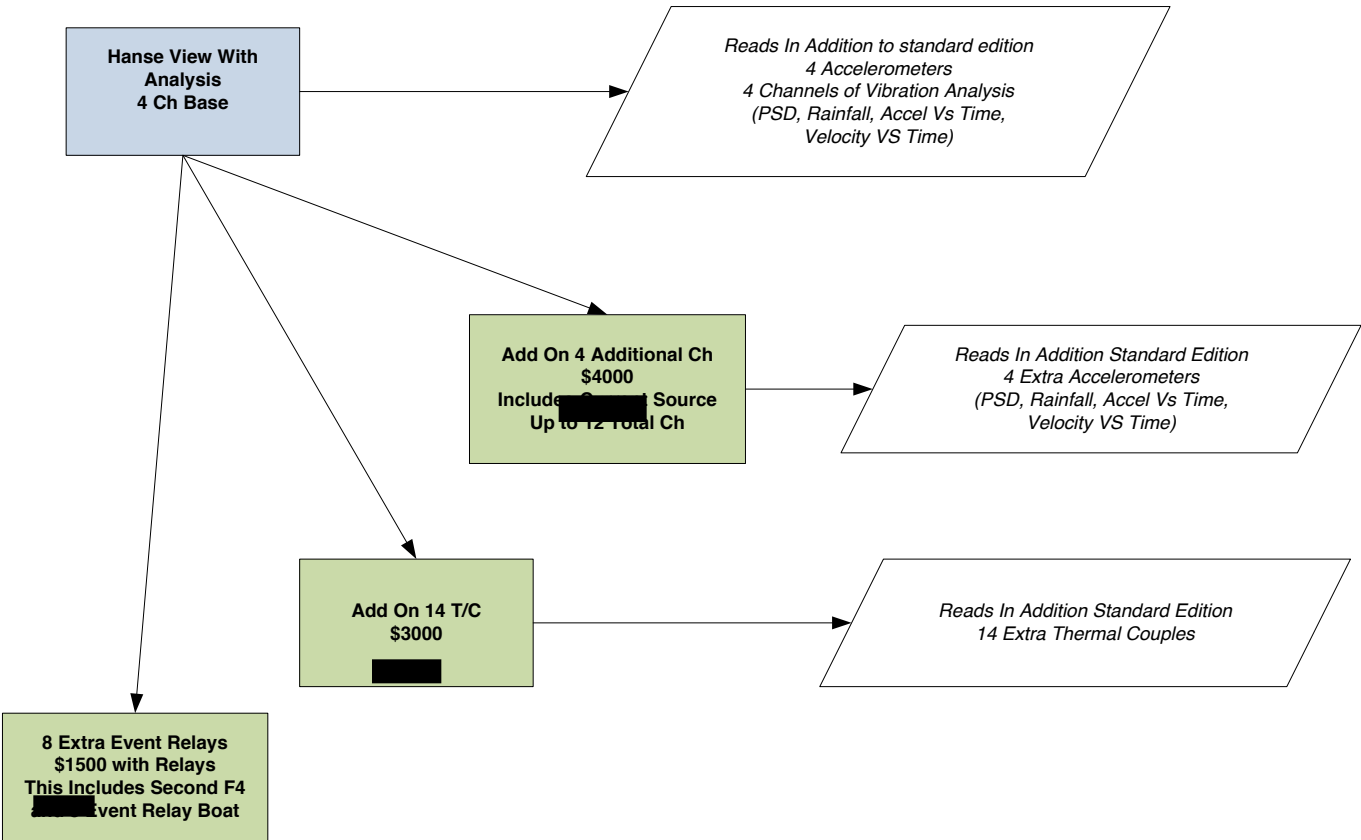
**Phone +1 269-673-8638**  
**Fax +1 269-673-8632**  
**Toll Free +1 866-424-8673**  
**Email: [Info@HanseEnv.com](mailto:Info@HanseEnv.com)**

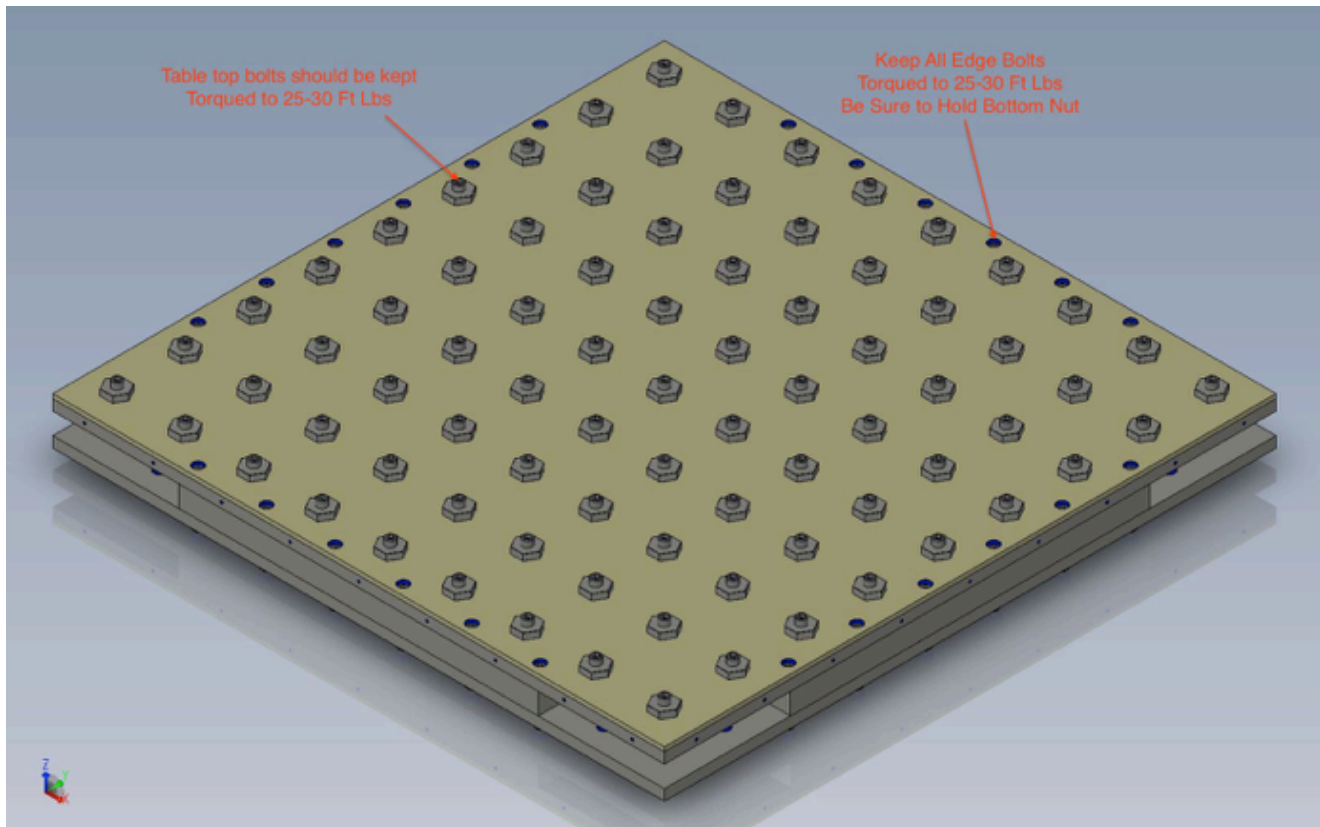
**HEI Recommends using Marvel Mystery Oil for it's lube of it vibration hammers.**

**HanseView Standard Additional**



**HanseView Analysis Edition**



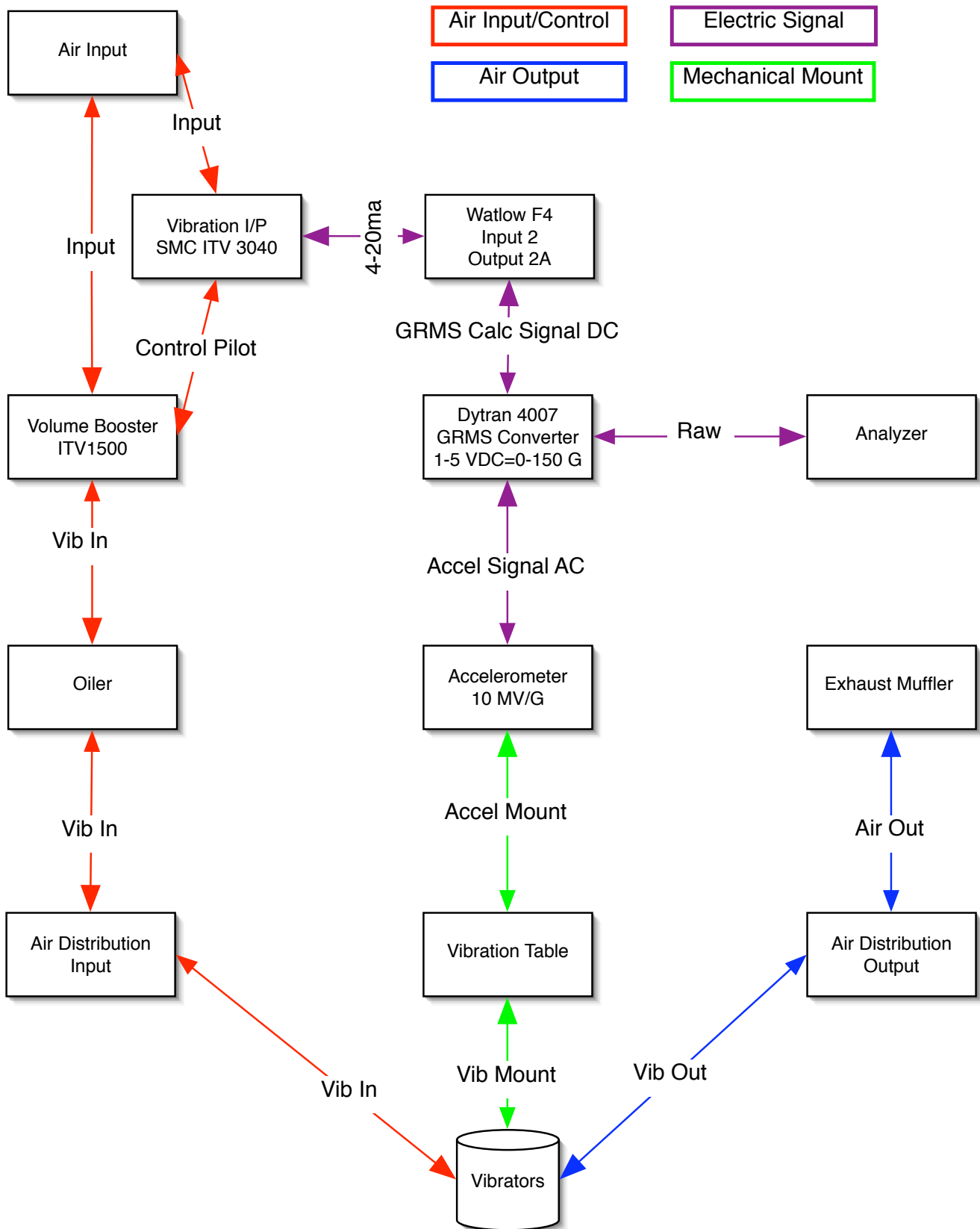


**If improper oil is used this can damage the equipment!**

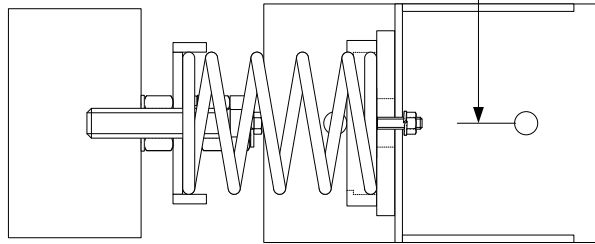
**Compressor Oil will cause damage to hammer and is not covered under warranty!**

## **Vibration trouble shooting flow chart.**

Please use the following flow chart to trouble shoot the vibration control system. You should also check with OEM or company that installed the vibration system into your equipment for how they might have changed the control operation.

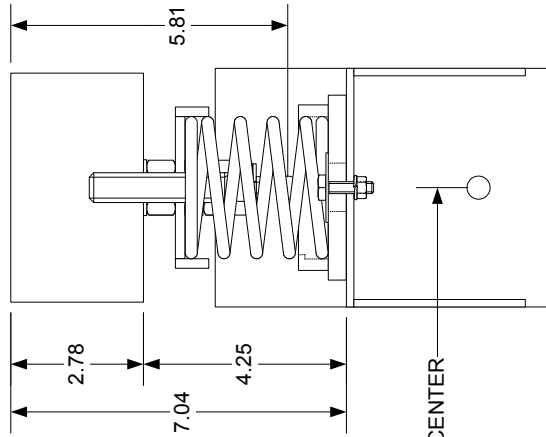


TOP OF  
TABLE



UNCOMPRESSED  
SPRING

TOP OF  
TABLE



VTC-16

NOTE: WORKING INTERNAL DIMENSION IS THE IMPORTANT FACTOR. THIS IS DETERMINED BY TABLE TOP HEIGHT.

THERE ARE TWO TABLE TOP HEIGHTS MEASURED FROM BOTTOM OF PLENUM TO THE TOP OF THE TABLE. THIS PROVIDES THE FOLLOWING WORK SPACE HEIGHTS

1. 38"      45.25" TO PLATFORM ON BRACKET
2. 50"      57.25" TO PLATFORM ON BRACKET

THE TOP HOLE IS 1 INCH ABOVE PLATFORM ON BRACKET

THE PLATFORM OF THE BRACKET SHOULD BE PLACED AN ADDITIONAL 7.25" TOWARDS FLOOR TO PROVIDE SPACE FOR SPRINGS AND TABLE HEIGHT. AS DIAGRAMED TO THE LEFT.

THESE ARE THE MEASUREMENTS FOR THE PLACEMENT OF THE VIBRATION TABLE MOUNTING BRACKETS FOR DIFFERENT SIZE TABLES.

- |                    |                                       |                         |
|--------------------|---------------------------------------|-------------------------|
| 1. 72" X 72" TABLE | 30 15/16" FROM CENTER OF CENTER LINER | 61.875 CENTER TO CENTER |
| 2. 48" X 48" TABLE | 18 15/16" FROM CENTER OF CENTER LINER | 37.875 CENTER TO CENTER |
| 3. 36" X 36" TABLE | 12 15/16" FROM CENTER OF CENTER LINER | 25.875 CENTER TO CENTER |
| 4. 24" X 24" TABLE | 11 15/16" FROM CENTER OF CENTER LINER | 23.875 CENTER TO CENTER |



PETER HANSE

05/08/2005

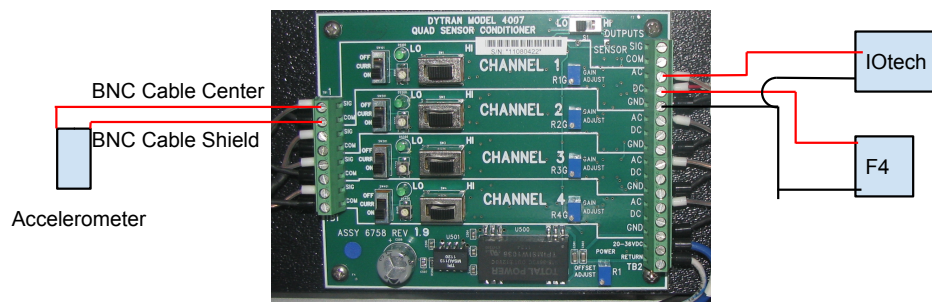
HANSE ENVIRONMENTAL INC.

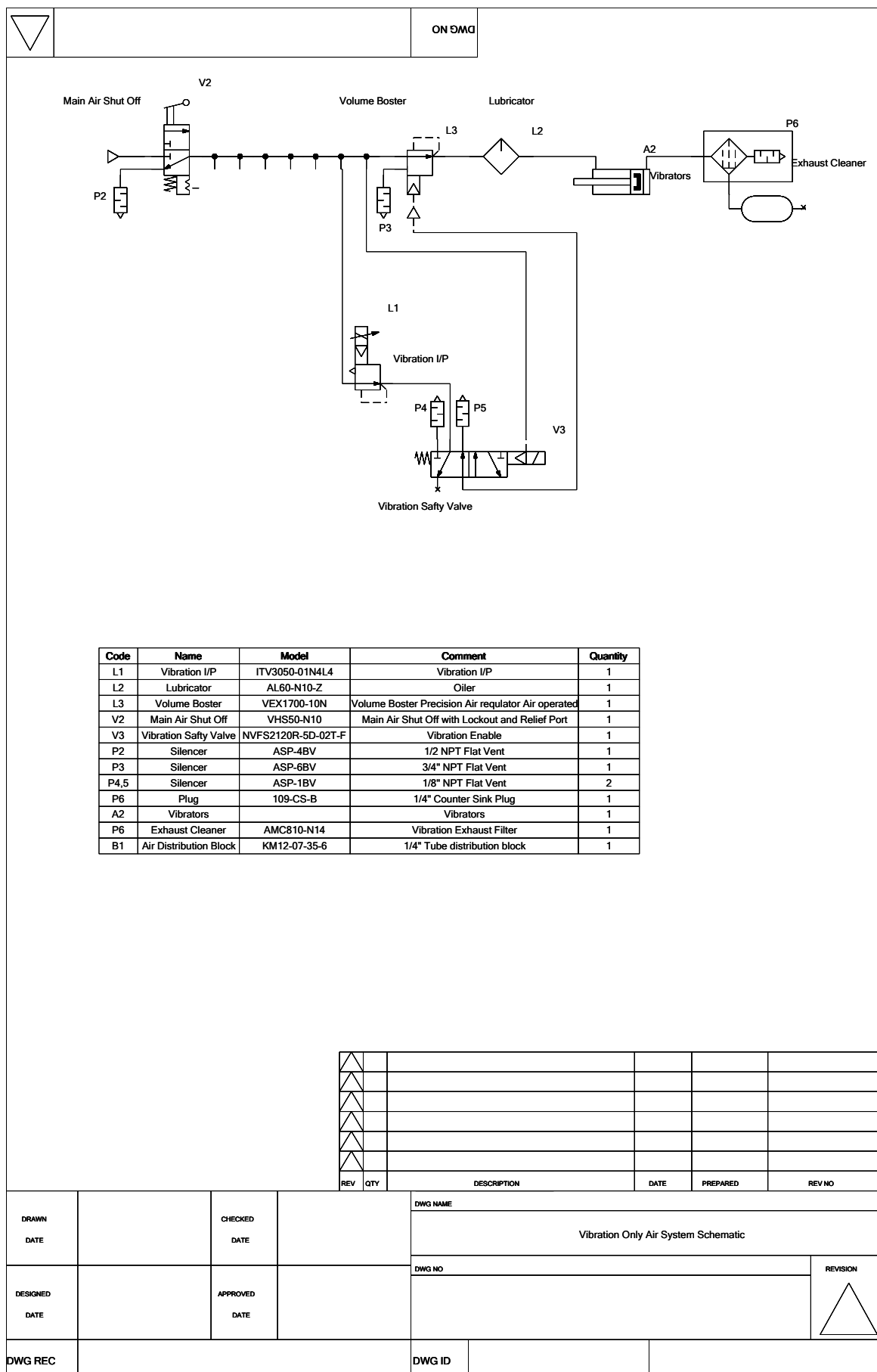
VTC-X TABLE MOUNT ASSEMBLY

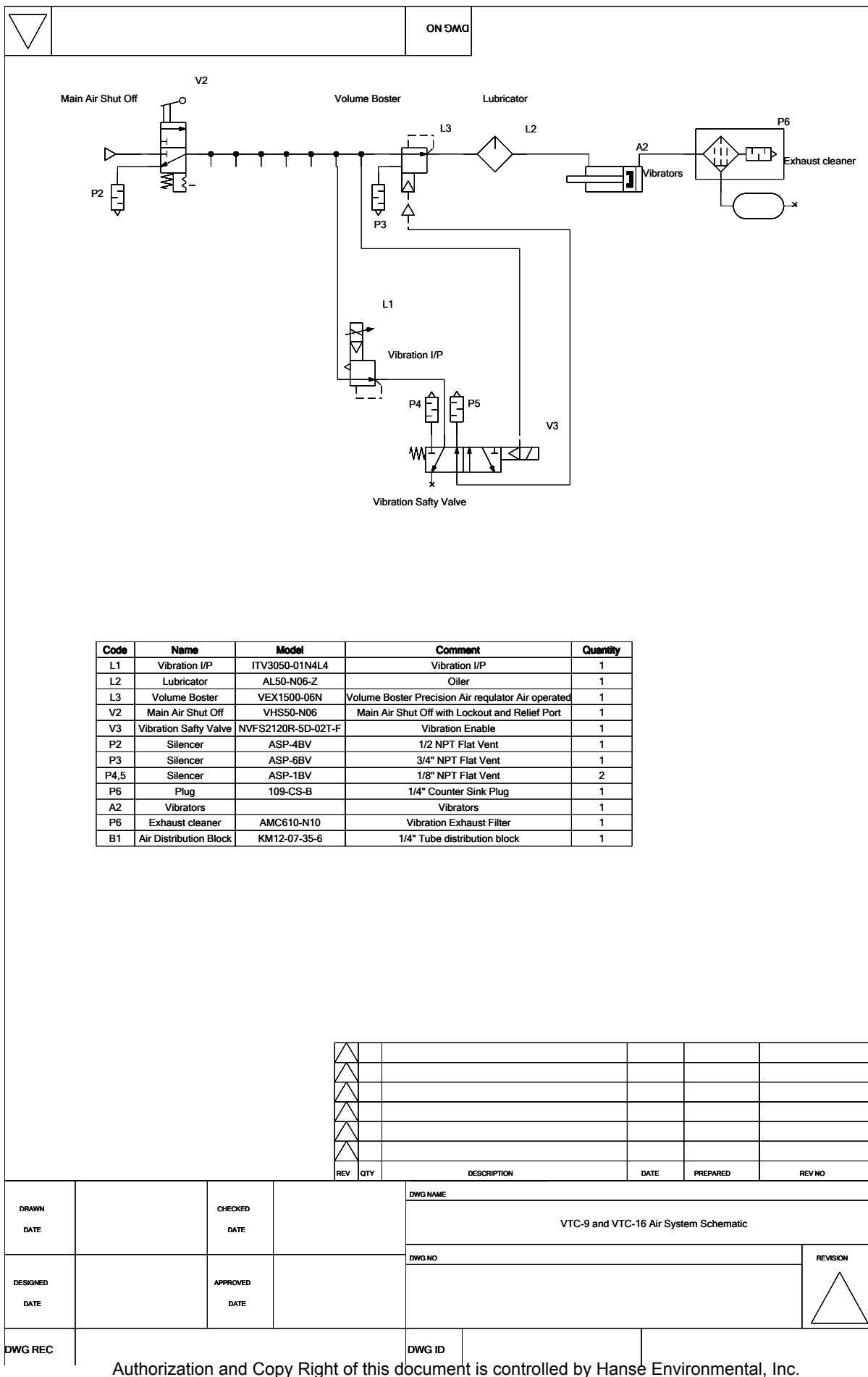
SIZE B	FSCM NO	DWG NO 09-160201	REV D
SCALE 1/4 : 1	SHEET	1 OF 1	

See F4  
PDF  
CD or

manual  
from  
Watlow











# OPERATION MANUAL

## E/P REGULATOR

MODEL NAME

### ITV1000, ITV2000, ITV3000 series

Series

#### CONTENTS

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Zero clear	P15
Initialize	P15-16
LED display	P16

SMC Corporation

URL <http://www.smcworld.com>

#### Safety instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of "CAUTION", "WARNING", or "DANGER". To ensure safety, be sure to observe ISO 4414, JIS B 8370 and other safety practices.

#### Explanation of label

Label	Meaning of label
WARNING	Operator error could result in serious injury or loss of life.
CAUTION	Operator error could result in injury or equipment damage.

#### WARNING

①The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analyses and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

②Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

③Do not service machinery / equipment or attempt to remove components until safety is confirmed.

A. Inspection and maintenance of machinery / equipment should only be performed once safety of personnel and equipment is confirmed.

B. When equipment is to be removed. Stop supplied air, exhaust the residual pressure, verify the release of air, turn the power off and confirm safety before performing maintenance.

C. Before machinery / equipment is restarted, ensure safety before applying power.

④Contact SMC if the product is to be used in any of the following conditions.

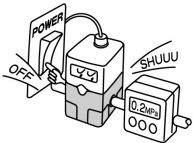
A. Conditions and environments beyond the given specifications, or if product is used outdoors.

B. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuit in press applications, or safety equipment.

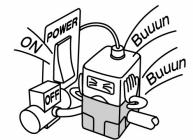
C. An application which has the possibility of having negative effects on people, property, or animals requiring special safety analysis.

#### Handling precautions

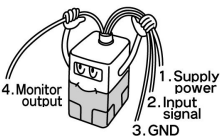
#### CAUTION



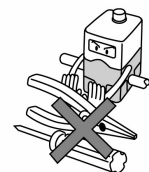
If power to this product is cut off due to a power failure, etc. when it is in a controlled state, residual pressure will be retained temporarily. Handle carefully when operating with output pressure released to the atmosphere, as air will continue to flow out.



If supply pressure to this product is interrupted or shut off, while the power is still on, the internal solenoid valve will continue to operate and a humming noise may be generated. Since the life of the product may be shortened, shut off the power supply also when supply pressure is interrupted or shut off.



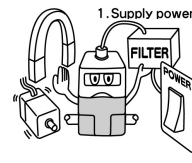
The optional cable connector is a 4 wire type. When the monitor output (analogue output or switch output) is not being used, prevent it from touching the other wires as a malfunction could occur.



This product is adjusted for each specification at the time of shipment from the factory. Avoid careless disassembly or removal of parts, as this can lead to malfunction.

—2—

#### CAUTION



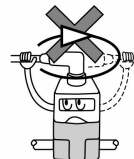
Take the following steps to avoid malfunction due to noise.

1) Install a line filter etc. to the AC power line to reduce / eliminate power supply noise.

2) Avoid malfunction due to noise by installing this product and its wiring away from strong electric fields, such as those of motors and power line, etc.

3) Be sure to implement protective measures against load surge for induction loads (solenoid valves, relays etc.).

4) Turn off the power supply before installing or removing the connector.



Please note that the right angled cable connector does not rotate and is limited to only one entry direction.

—3—

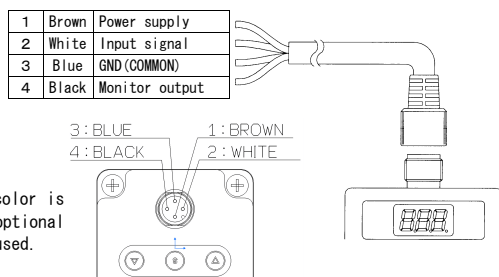
—4—

2

## Wiring method

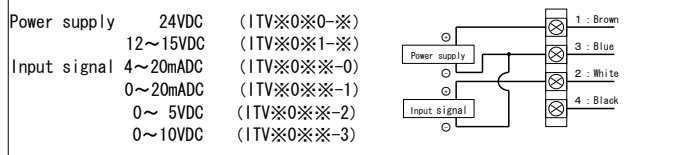
### CAUTION

- Proceed carefully, as incorrect wiring can cause damage.
- Use DC power supply with sufficient capacity and a low ripple.
- Turn off the power supply to remove and insert the connector.
- Never turn the right angled type connector as it is not designed to turn.



### Wiring diagram (Power supply and input signal)

Current/Voltage type (ITV※0※※-0, ITV※0※※-1, ITV※0※※-2, ITV※0※※-3)

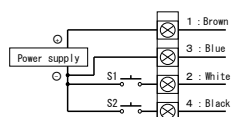


Preset input type (ITV※0※※-4)

Power supply 24VDC (ITV※0※0-4)  
12~15VDC (ITV※0※1-4)

Fig. 1 Relation between preset pressure and switch

Preset pressure	P.1	P.2	P.3	P.4
S1	OFF	ON	OFF	ON
S2	OFF	OFF	ON	ON



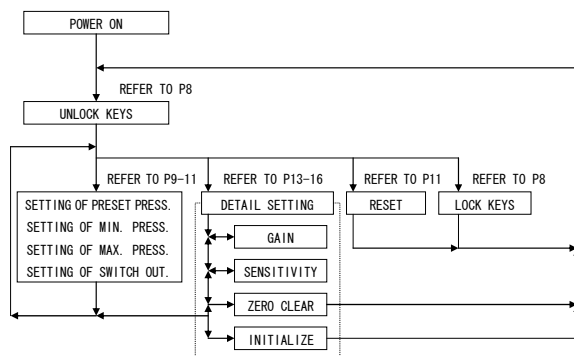
—5—

## Setting method

### CAUTION

- If the incorrect key is pressed or incorrect information is displayed during setting, power must be shut off and the procedure started again.
- It is recommended that the settings are changed without supply pressure. The product operates immediately maximum and minimum pressures are set and the S-key is pressed.
- It is recommended that the minimum pressure is output when air is supplied to the inlet, even if the input signal has not been entered.
- Output pressure from this product and state of operation are changed by changing of each setting and function. Each setting and function should be operated by trained and experienced operator.

### Flow of the setting



(Note 1) : Please refer to each contents about operation methode.

(Note 2) : The function of the setting of preset pressure is preset input type only.

(Note 3) : The function of the setting of switch output is switch output type only.

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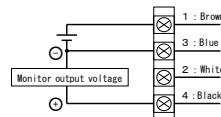
—7—

## Wiring diagram (Monitor output)

### CAUTION

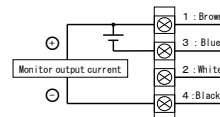
When the monitor output is not being used, prevent it from touching the other wires as this can cause a malfunction.

Analogue output • Voltage type  
(ITV※0※※-※1)



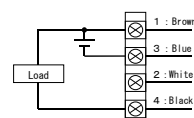
Only use equipment with a minimum load impedance of 100kΩ.

Analogue output • Current (sink) type  
(ITV※0※※-※4)



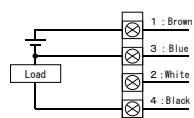
Only use equipment with a maximum load impedance of 250Ω.

Switch output • NPN type  
(ITV※0※※-※2)



When a current of approx. 150mADC or more is applied, the over current circuit is archived, "Er.5" is displayed and the operation stops. Please use with installing the load that the output current becomes to 80mADC or less.

Switch • PNP type  
(ITV※0※※-※3)



When a current of approx. 150mADC or more is applied, the over current circuit is archived, "Er.5" is displayed and the operation stops. Please use with installing the load that the output current becomes to 80mADC or less.

—6—

## Key locking function

### CAUTION

The keys are locked after turning the power on and can not be operated.

### Unlocking the keys

No	Key operation	LED Display
①		(current) pressure is displayed
②	Press ▽ key for 2 seconds or more.	LOC is displayed
③		LOC flashes on the display
④	Press S-key	
⑤		unL is displayed for approx. 1 second
⑥	Key lock is released	(current) pressure is displayed

※④ Press △ key to cancel.

### Locking the keys

No	Key operation	LED Display
①		(current) pressure is displayed
②	Press △ key for 2 seconds or more.	unL is displayed
③		unL flashes on the display
④	Press S-key	
⑤		LOC is displayed for approx. 1 second
⑥	Keys are locked	(current) pressure is displayed

※④ Press ▽ key to cancel.

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## Setting of min. pressure, max. pressure and switch output [current/voltage input type only]

No	Key operation	LED Display
①	Unlock keys (refer to P8)	
②	Press S-key	
③	Set the minimum pressure by using the $\Delta$ and $\nabla$ keys.	$F_1 \leftrightarrow .000$ (displayed alternately) *Adjusting range: Refer to note 1 to 6
④	Press S-key	
⑤	Set the maximum pressure by using the $\Delta$ and $\nabla$ keys.	$F_2 \leftrightarrow .900$ (displayed alternately) *Adjusting range: Refer to note 1 to 6
⑥	Go to no. ① for monitor output: analogue output (voltage and current) type.	
⑦	Press S-key	
⑧	Set the P_1 by using the $\Delta$ and $\nabla$ keys.	$P_1 \leftrightarrow .000$ (displayed alternately)
⑨	Press S-key	
⑩	Set the P_2 by using the $\Delta$ and $\nabla$ keys.	$P_2 \leftrightarrow .900$ (displayed alternately)
⑪	Press S-key	Return to (current) pressure display.
⑫	Lock keys (refer to P8)	

Minimum pressure (F_1) adjusting range	Maximum pressure (F_2) adjusting range
<p>100% 90% 0% -20%</p> <p>4 12 20mA 0 10 20mA 0 2.5 5V 0 5 10V</p>	<p>120% 100% 10% 0%</p> <p>4 12 20mA 0 10 20mA 0 2.5 5V 0 5 10V</p>

- (Note 1): F\_1 is adjustable in a range from -20% to 90% of the rated value.  
(DEFAULT VALUE: 0%)
- (Note 2): The pressure of less than 0% is not output, even if F\_1 is adjusted to less than 0%.
- (Note 3): F\_2 is adjustable in a range from 10 to 120% of the rated value.  
(DEFAULT VALUE: 100%)
- (Note 4): Do not input the signal as like output the pressure of more than 100%. Please use in a range of rating.
- (Note 5): The difference between F\_1 and F\_2 is adjustable in a range of 10% of the rated value.
- (Note 6): The adjustment like making the relation of  $F_1 > F_2$  is not available.

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## Setting of preset pressure [Preset input type only]

No	Key operation	LED Display
①	Unlock keys (refer to P8)	
②	Press S-key	
③	Set P_1 by using the $\Delta$ and $\nabla$ keys.	$P_1 \leftrightarrow .000$ (displayed alternately)
④	Press S-key	
⑤	Set P_2 by using the $\Delta$ and $\nabla$ keys.	$P_2 \leftrightarrow .000$ (displayed alternately)
⑥	Press S-key	
⑦	Set P_3 by using the $\Delta$ and $\nabla$ keys.	$P_3 \leftrightarrow .000$ (displayed alternately)
⑧	Press S-key	
⑨	Set P_4 by using the $\Delta$ and $\nabla$ keys.	$P_4 \leftrightarrow .000$ (displayed alternately)
⑩	Press S-key	Return to (current) pressure display.
⑪	Lock keys (refer to P11)	

(Note): P\_1 to P\_4 are adjustable in a range from 0% to 100% of the rated value.  
(DEFAULT VALUE: 0%)

## Reset function

### Reset method

No	Key operation	LED Display
①	Unlock keys (refer to P11)	
②	Press the $\Delta$ and $\nabla$ keys simultaneously for 3 seconds or more.	(Current) pressure is displayed
③		$rES$ is displayed for approx. 1 second
④	The setting is reset	

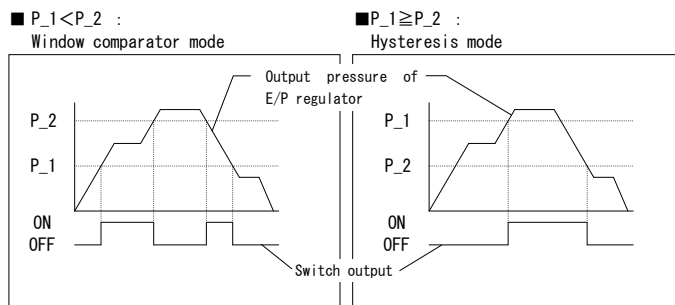
### Reset content

Item	Reset content	Application model
F_1	0%F.S.	Current·Voltage input type
F_2	100%F.S.	Current·Voltage input type
P_1, P_2	100%F.S.	Switch output type
P_1~P_4	0%F.S.	Preset input type

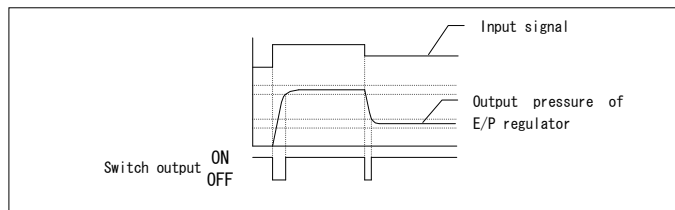
(Note): Gain (GL) and sensitivity (SL) are not reset.

## Mode of switch output

The following operation types are available by setting P\_1 and P\_2.  
Note). This function is available for monitor output: switch output type (ITV※0※※-※2 and ITV※0※※-※3).



■ P\_1 = P\_2 = 0 : Out of range mode  
(The switch output turns on when set pressure is achieved.)



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## Error indicating function

Error name	LED display	Contents of error	Countermeasure
Over range of input signal	$Er.1$	Input signal exceeds the rated value range.	Reduce input signal to within the rated range and restart the power supply.
System error	$Er.2$	Reading or writing errors occurred in EEPROM.	Please execute "initialize (refer to P16)" when ITV do not operate normally after restarting the power supply. Please contact us, when ITV do not operate normally after initialize.
	$Er.3$	Reading and writing errors occurred in memory.	Please contact us when ITV do not operate normally after restarting the power supply.
Solenoid valve error	$Er.4$	Solenoid valve failure.	Replace the solenoid valve. For the replacement procedure contact SMC.
Over current error	$Er.5$	Over current errors in switch output	Please use with installing the load that the output current becomes to 80mA DC or less.
Residual pressure error	$Er.6$	Out of range error of zero clear	Please operate "zero clear" within the range of 5%F.S.. Please operate "zero clear" after the secondary pressure of ITV is became to atmosphere.

Detail setting mode		
No	Key operation and LED display	
①	Unlock keys (refer to P8)	
②	Press S-key for 2 seconds or more.	
③	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre>       F01 ⇄ GL9       Δkey ↑       ↓ ∇key       F02 ⇄ SL0       Δkey ↑       ↓ ∇key       F03 ⇄ 0cL       Δkey ↑       ↓ ∇key       F99 ⇄ in 1           </pre> </div> <div style="flex: 1;"> <p>(displayed alternately)</p> <p>Press S-key To "GAIN" (refer to P13)</p> <p>(displayed alternately)</p> <p>Press S-key To "SENSITIVITY" (refer to P14)</p> <p>(displayed alternately)</p> <p>Press S-key To "ZERO CLEAR" (refer to P15)</p> <p>(displayed alternately)</p> <p>Press S-key To "INITIALIZE" (refer to P16)</p> </div> </div>	
④	In state of ③, press S-key for 2seconds or more.	
⑤	Return to (current) pressure display.	
⑥	Lock keys (refer to P8)	

### Gain setting

Normal operation does not require the adjustment of gain.  
This product can change the response with this gain setting.  
When the gain is changed to more larger, the response become quickly, but there is a possibility that stability is lost.

No	Key operation	LED Display
①	Unlock keys (refer to P8)	
②	Press S-key for 2 seconds or more, then go to detail setting mode.	
③	To "F01" by using the Δ and ∇ keys.	F01 ⇄ GL9 (displayed alternately)
④	Press S-key.	
⑤	Set the GAIN by using the Δ and ∇ keys.	GL9 (blink and change the most right digit)

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### Zero clear

The display can be set to zero again by executing "zero clear".  
When "zero clear" is executed with residual pressure in the secondary piping, the pressure is assumed to be zero. Please execute the operation of "zero clear" with the supply pressure is intercepted, and the piping of the second side removed.

No	Key operation	LED Display
①	Unlock keys (refer to P8)	
②	Press S-key for 2 seconds or more, then go to detail setting mode.	
③	To "F03" by using the Δ and ∇ keys.	F03 ⇄ 0cL (displayed alternately)
④	Press S-key.	0cL flashes on the display
⑤	Press Δ and ∇ keys for 3 seconds or more. (press S-key to ③)	0cL is displayed
⑥	"Zero clear" is executed, after 3 seconds. (Release keys till less than 3 seconds to ④)	0cL is displayed for approx. 1 second.
⑦	Returns to the state immediately after turning on of the power supply. (keys are locked)	

(note) : The adjustable range is within  $\pm 5\%$  F.S from the state of the factory shipment. When more than this range, *Err* is displayed and zero-clear is not executed.

### Initialize

"Initialize" is a function to return all the settings that the internal control constant are included to an initial value. Please execute "initialize" only when the error is displayed and this product doesn't operate at all.  
Please execute the "reset" function, when you want to return the pressure setting and the switch setting to an initial value.

No	Key operation	LED Display
①	Unlock keys (refer to P8)	
②	Press S-key for 2 seconds or more, then go to detail setting mode.	

⑥	Press S-key.	F01 ⇄ GL9 (displayed alternately)
⑦	Press S-key for 2 seconds or more, then go out from detail setting mode. (Select the menu with Δ or ∇ keys, then jump to another item.)	
⑧	Lock keys (refer to P8)	

Relation between setting of gain and response time

Response	Slow ← → Quick											
Setting of GAIN	GL0	GL1	GL2	~	GL7	GL8	GL9	GLA	GLb	GLc	GLd	GLE

※Default: GL9

### Sensitivity setting

Normal operation does not require the adjustment of sensitivity.  
When the sensitivity is changed, the correction operation of pressure changes.  
When the sensitivity is changed to sharp, the hunting of pressure might be occurred. And, when the sensitivity is changed to dull, there is a possibility that staggering of gradual pressure occur, because the pressure correction become lower.

No	Key operation	LED Display
①	Unlock keys (refer to P8)	
②	Press S-key for 2 seconds or more, then go to detail setting mode.	
③	To "F02" by using the Δ and ∇ keys.	F02 ⇄ SL0 (displayed alternately)
④	Press S-key.	
⑤	Set the SENSITIVITY by using the Δ and ∇ keys.	SL0 (blink and change the most right digit)
⑥	Press S-key.	F02 ⇄ SL0 (displayed alternately)
⑦	Press S-key for 2 seconds or more, then go out from detail setting mode. (Select the menu with Δ or ∇ keys, then jump to another item.)	
⑧	Lock keys (refer to P8)	

Relation between setting and sensitivity

Sensitivity	Sharp ← → Dull							
Setting of sensitivity	SL-	SL-	SL0	SL1	SL2	SL3	SL4	SL5

※Default: SL0

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③	To "F99" by using the Δ and ∇ keys.	F99 ⇄ in 1 (displayed alternately)
④	Press S-key.	in 1 flashes on the display
⑤	Press Δ and S keys for 5 seconds or more. (press S-key to ③)	in 1 is displayed
⑥	"Initialize" is executed, after 5 seconds. (Release keys till less than 5 seconds to ④)	Turning off for 1 second
⑦	Returns to the state immediately after turning on of the power supply. (keys are locked)	

### LED display

The range of the LED pressure display is different according to the pressure range and the unit of the display.

unit	ITV※01※	ITV※03※	ITV※05※	ITV209※
MPa	0.020~.120	0.100~.600	0.180~A.80	-
Kgf/cm <sup>2</sup>	0.20~.120	1.00~6.00	1.80~A.80	-
bar	0.20~.120	1.00~6.00	1.80~A.80	-
PSI	3.0~18.0	14.0~84.0	-26~156	-
kPa	-20~120	-100~600	-180~A80	16~96

(note1) : The mark "." is blinking the decimal point, and it is shown a minus.

(note2) : When the digit overflows, the following of "9" are substituted by "A".  
(example: The following of 999(kPa) are displayed as A00(kPa), and it shows 1000 kPa.)

(note3) : When the display exceeds the lower bound value, "LLL" is displayed.

(note4) : When the display exceeds the upper bound value, "HHH" is displayed.

This operation manual refers to all standard types and is partially applicable to special models.

This operation manual is subject to change without prior notice or any obligation on the part of the manufacturer.

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# Power Valve Regulator Valve Series VEX1

**Large Capacity Relief Regulator**  
3 port large capacity poppet exhausting regulator equipped with a relief port the same size as the connection port.



## Specifications

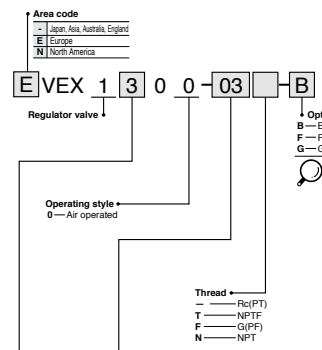
Model	VEX110□	VEX120□	VEX130□	VEX150□	VEX170□	VEX190□
Operating style	Air operated					
Fluid	Air, inert gas					
Proof pressure	1.5MPa					
Max. operating pressure	1.0MPa					
Set press. range	0.05 to 0.9MPa					
ambient and fluid temperature	0 to 50°C (Air operated: 0 to 80°C)					
Hysteresis	0.03MPa					
Repeatability	0.01MPa					
Sensitivity	0.01MPa					
Mounting	Free					
Lubrication	Not required (Use turbine oil No.1 ISO V332, if lubricated)					
Port size	P 1/4	A 1/4	R 1/4	T 1/4	1 1/4	2
Effective area	mm <sup>2</sup> 18	25	36	60	130	330
Weight (kg) Air operated	0.1	0.2	0.4	1.3	1.9	3.9

## Options

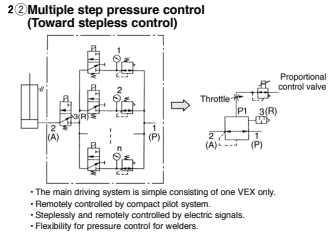
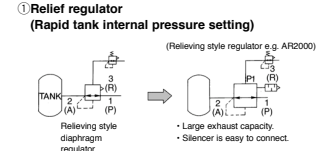
Parts name	Part No.
Bracket (with bolt and washer)	VEX1-18-1A VEX1-18-2A
Pressure gauge (1)	G27-10-01 G36-10-01 G46-10-01

Note 1) When requiring the gauge except mentioned above, specify the model number. Option is packed with 1.  
(Refer to Best Pneumatics 4.)  
Example: VEX130-03 G36-4-01

## How to Order



## Applications



## Caution

Refer to p.0-33 to 0-36 for Safety Instructions and common precautions.

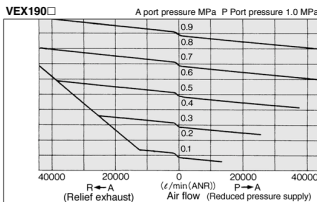
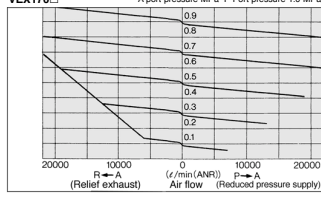
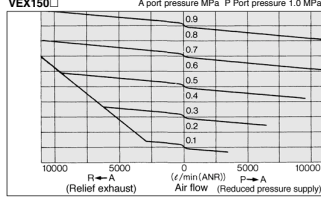
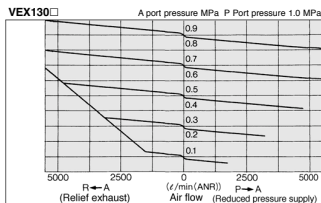
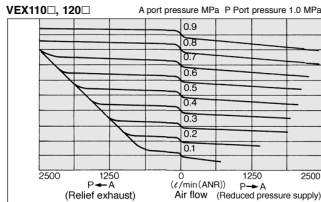
5.1-1



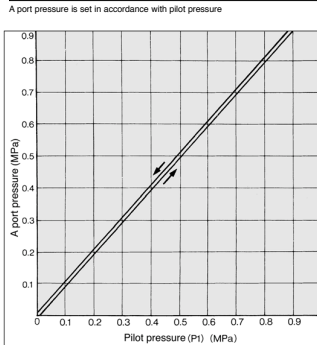
5.1-2

## VEX1

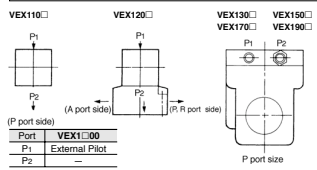
### Flow Characteristics



### Setting Pressure Characteristics



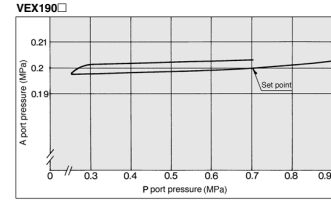
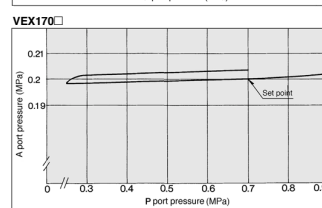
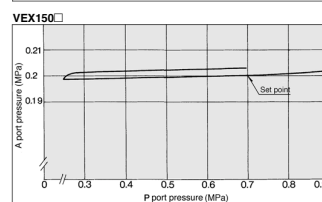
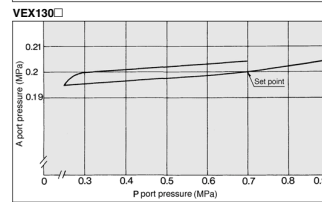
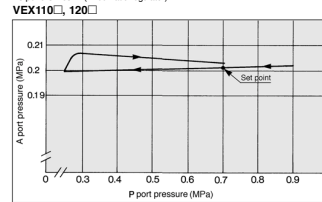
### External Pilot Piping



## VEX1

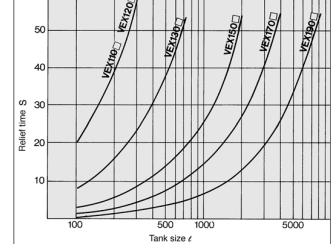
### Pressure Characteristics

Shown the change of secondary pressure (A port) to the change of supply pressure (P port).  
As per JIS B8372 (Pneumatic regulator)

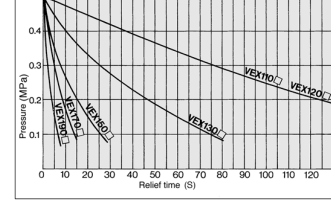


### Relief Time

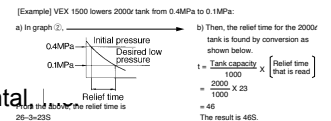
① Relief time from 0.5MPa to 1MPa



② Relief time from 1000 r tank



③ Relief time from an arbitrary pressure



5.1-3

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5.1-4

Construction/Operation Principles/Component Parts

[1] When A port pressure is high.

[2] Setting pressure condition

[3] When A port pressure is low. Pressure reducing supply.

• The balance between the acting force F1 of the pilot pressure (P1) port over the upper surface of the pressure regulating piston (3) and the acting force F2 of the pressure at A port leading to a space under the piston through the feed back flow root closes a couple of poppet valves (4) and sets A port pressure that corresponds to P1 port pressure. The poppet valves are backed up by spring (4) in the pressure balance structure by means of A port pressure. (DRW(2))

• When A port pressure exceeds P1 port pressure, F2 becomes larger than F1, and the pressure regulating piston moves upward, opening the upper poppet valves. Thus air is released from A port to R port. (DRW(1)) When A port pressure lowers enough to restore the balance, the regulator valve returns again to the DRA (2) condition.

• When A port pressure is lower than P1 port pressure, F1 becomes larger than F2, and the pressure regulating piston moves downwards, opening the lower poppet valves. Thus air is supplied from P port to A port. (DRW(3)) When A port pressure rises enough to restore the balance, the regulator valve returns again to the DRW(2) condition.

(Air operated)  
VEX1100

(Air operated)  
VEX1300/1500/1700/1900

(Air operated)  
VEX1200

No.	Description	Material
1	Body	Aluminium alloy die cast
2	Cover	Aluminium alloy die cast
3	Piston	Aluminium alloy
4	Spring	Stainless steel
5	Valve guide	Aluminium alloy
6	Poppet valve	Aluminium alloy, NBR
7	Shaft	Stainless steel
8	Valve guide	Aluminium alloy

5.1-5



Dimensions

Air operated: VEX1300

Air operated: VEX1500

5.1-7



Dimensions

Air operated: VEX1100

Air operated: VEX1200

VEX

AN

AMC

AMP

5.1-6



Dimensions

Air operated: VEX1700

Air operated: VEX1900

VEX

AN

AMC

AMP

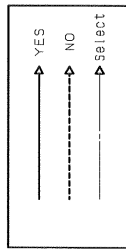
5.1-8



<START>

When the iTV series E/P regulator malfunctions, please refer to the corresponding items below.  
E/P regulator trouble may occur as a result of the operating environment (application). In such a case, please consult with us.  
This information refers to all standard types and is partially applicable to special models.

YES →  
NO →  
select →



blows are the answers to some of the most frequently asked questions we get about the ITV series electro-pneumatic regulator. We hope that you will find this information informative.

Q1. What does the red LED on the top mean?

A1. It indicates the ON/OFF status. It lights when the product is in the "ON" state and it turns off when the product is in the "OFF" state. The LED blinks when the input signal is over the rated range. In such a case, please remove the power supply. It will then return to the normal state when the power is supplied again.

Q2. How is the Zero/Span adjustment performed?  
A2. It cannot be performed.

Q3. What is the hole above the OUT port?  
A3. It is a breathing hole for the internal components, please do not block it.

Q4. ( would like to mount it on a DIN rail.  
A4. A single regulator unit can be mounted on a DIN rail by attaching the following part(sold separately).

PART NUMBER	PART NAME	QTY
VQ1000-10A-1-60	DIN Rail Mounting Bracket Supass'y	1
AXT632-27-6	ROUND HEAD SCREW	1
M3x4	ROUND HEAD SCREW	2

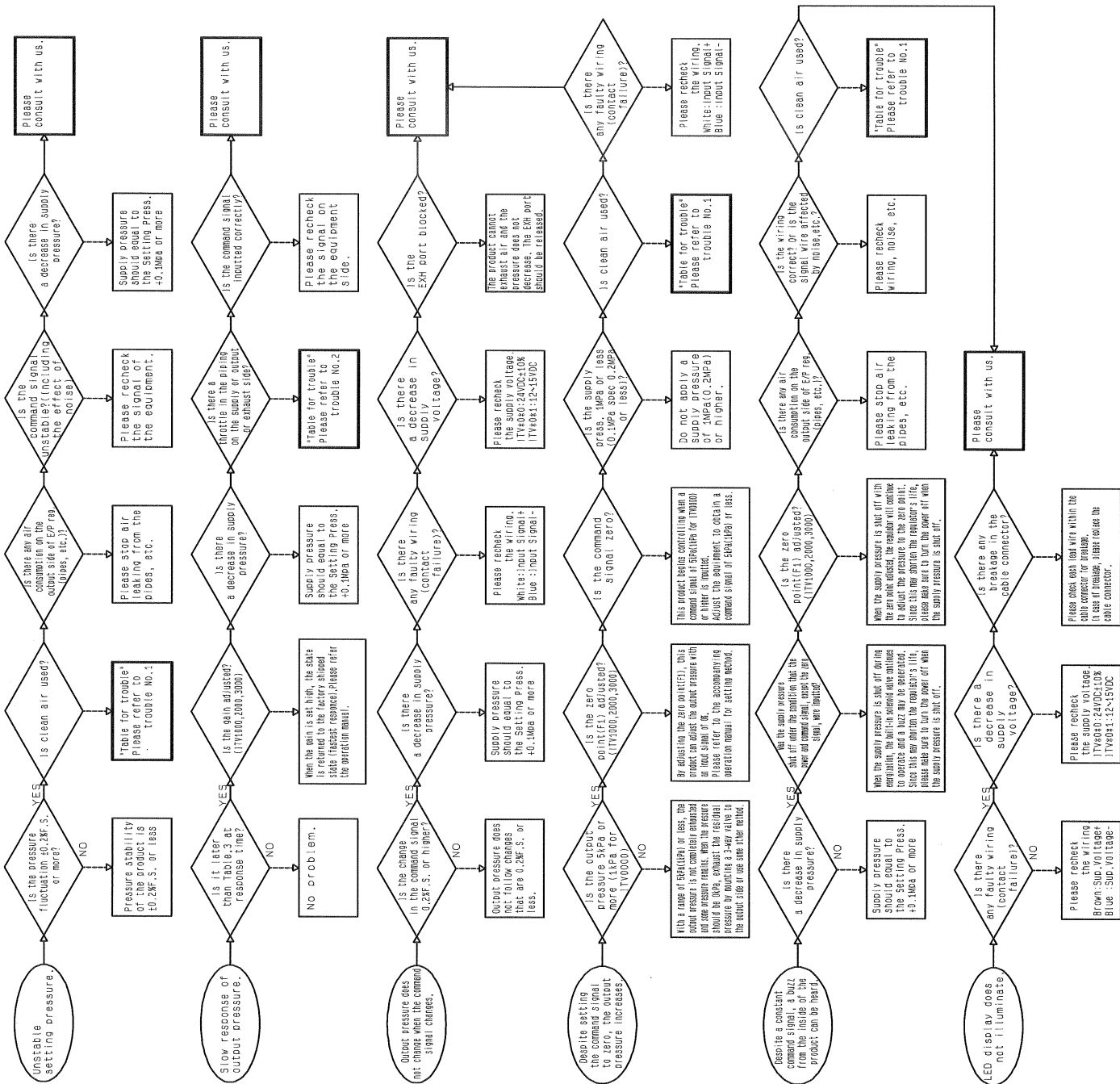
Q5. I would like to connect a 1/8 tube.  
A5. This tube size cannot be connected directly to the regulator. Please purchase a reducer separately.

Q6. I would like to disassemble the regulator since something is wrong with it.  
A6. Please do not disassemble it because it will cause a failure. Please contact us for any problems.

Q6. I would like to order the bush-Ass'y for manifold.  
A6. The part number is "VVQ1000-80A-7-2".

Q1. How is Zero / Range adjustment performed?  
A1. Please refer to the operation manual, they can be adjusted by setting F1 and F2 according to the "Setting method" information in the manual.

Q2. What is the W5 hole in the front of the product?  
A2. It is the exhaust port of the solenoid valve inside of the product.





- Q3. I would like to use this product in a manifold style.  
A3. A manifold type is available as a special product. Please refer to our catalog.
- Q4. Is a 2-wire type from 4 to 20 mA available?  
A4. This product requires a power supply voltage. Therefore, please prepare a power supply (12 to 15VDC or 24VDC  $\pm$  10%). Separately.
- Q5. I have purchased a product with the wrong parts number. Can I exchange it?  
A5. We will handle this issue as an after-sales service. Please contact us.
- Q6. Can I change the unit of measurement on the display?  
A6. Special equipment tools are required to change the unit. We will handle this issue as an after-sales service. Please contact us.
- Q7. The output pressure is exceeding the required level (overshooting). Can I prevent this?  
A7. It is possible to prevent the pressure from exceeding the required level by adjusting the gain adjustment. Please see the operation manual.
- Q8. I would like to have the LED display on another face (back or side).  
A8. Such products are available as made-to-order. Please contact us.
- Q9. An electricity failure occurred while the regulator was operating. How will the pressure change?  
A9. The regulator will temporarily maintain the output pressure level. However, the air will gradually be exhausted due to small leakage from the regulator. The time it takes for complete exhaustion depends on each regulator, since the quantity of leakage depends on the regulator.
- Q10. Are there any restrictions for the mounting orientation?  
A10. No.
- Q11. How long is the response time between the input signal and the output pressure.  
A11. The response time depends on the operating conditions. As a reference, please refer to the tables.
- Q12. I need a longer cable for remote operation.  
A12. A longer cable is available. Our recommended length is not more than 10m (standard length is 5m). The parts numbers are: P38000-500-4 (straight type) and P38000-500-4 (right angle type). Please refer to the length (unit: meter).
- Q13. What type of grease is applied to the product?  
A13. Silicon grease G-66.  
Please be advised that no grease is applied to the wetting parts of series ITV1000.
- Q14. What type of rubber is used for this product?  
A14. NBR is used for the standard products. Additionally, we are also supplying an ozone resistant specification, "80-".
- Q15. Are oil-free type products available?  
A15. Complete oil-free type products are not available. Only the wetting parts of the ITV1000 series have no grease.
- Q16. The LED display shows strange numerical values.  
A16. Please refer to the accompanying operation manual for error messages. When a wrong button is pressed during setup, or when the LED display is not showing what should be expected, please remove the power and start from the beginning again.
- Q17. Is a modular connection available for this product?  
A17. It is only available for the ITV2000 and ITV3000.  
Please refer to the table below for applicable models:
- | Applicable products       | Applicable models |
|---------------------------|-------------------|
| and accessories           | ITV2004           |
| Air Filter                | AF20              |
| Wet Separator             | AFW20             |
| Strainer                  | YS20              |
| Strainer with L-bar drain | YS20L             |
- Q18. Are explosion-protection type products available?  
A18. They are not available.
- Q19. Is bus wiring possible for this product?  
A19. The ITV series has only 1 wire for the GND (power) and for the COMMON (signal). If many ITVs are operated with 1 FC and some 0/VA units, it is possible to have an incorrect signal transmission due to the technical problems caused by the type of wiring in the 0/VA units. Accordingly, please contact the FC manufacturer prior to use.
- Q20. I would like to disassemble the regulator since something is wrong with it.  
A20. Please do not disassemble it because it will cause a failure.  
Please contact us for any problems.

Table for trouble

Trouble No.	Measures
1	When clean air is not used, there is a possibility of foreign matter in the air entering the orifice. Replace the solenoid valve assembly and body assembly according to the maintenance pressure (ITV1000: 200, 300). Install an air filter with a nominal filtration rating of 5um or less, to the supply side of the product. Perform maintenance on the air filter. When there is a trouble in the piping, response time will become slow. When strainers are mounted, please check them for clogging. When the output side is released for air flowing, etc., actual output pressure may be affected depending on the measuring point because the pressure drop is different. Since the LED display shows the pressure near the 0/0 port of the product, there may be a difference between the LED display pressure and the actual output pressure. Analog output current is a sink type. Please refer to the accompanying operation manual for correct wiring. Regarding a source type, please contact us since it is available as a special product.
2	When there is a trouble in the piping, response time will become slow. When strainers are mounted, please check them for clogging. When the output side is released for air flowing, etc., actual output pressure may be affected depending on the measuring point because the pressure drop is different. Since the LED display shows the pressure near the 0/0 port of the product, there may be a difference between the LED display pressure and the actual output pressure. Analog output current is a sink type. Please refer to the accompanying operation manual for correct wiring. Regarding a source type, please contact us since it is available as a special product.
3	When there is a trouble in the piping, response time will become slow. When strainers are mounted, please check them for clogging. When the output side is released for air flowing, etc., actual output pressure may be affected depending on the measuring point because the pressure drop is different. Since the LED display shows the pressure near the 0/0 port of the product, there may be a difference between the LED display pressure and the actual output pressure. Analog output current is a sink type. Please refer to the accompanying operation manual for correct wiring. Regarding a source type, please contact us since it is available as a special product.
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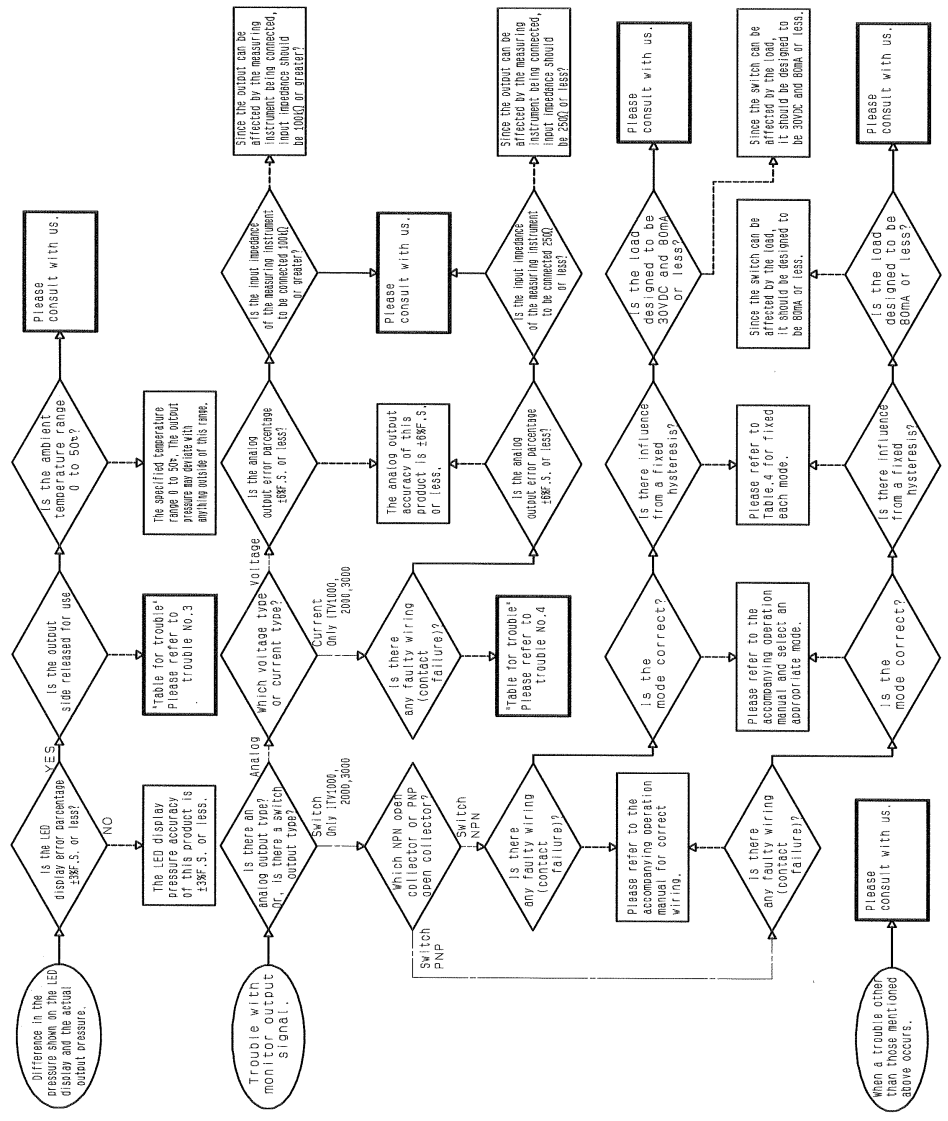
Tables Reference data for response time

Model	Input: Signal	50 to 100%
ITV0000	ITV1000	ITV2000
No. Load	approx. 0.15 to 0.35	approx. 0.3 to 0.45
Load 1L	approx. 0.3 to 0.55	approx. 0.4 to 0.85

Note: Since response time differs depending on the equipment, please conditions and operating conditions, please consider the above data as a reference.

Table 1. Fixation, response difference (unit: Pa/MPa S.1)

Unit of Pressure Display	Model	Window Comparator mode	Out of Range mode
MPa	ITV4011(100Pa Type)	3.0(3.0)	5.0(5.0)
kPa/cm <sup>2</sup>	ITV4034(500Pa Type)	15.0(3.0)	25.0(5.0)
bar	ITV4051(900Pa Type)	27.0(3.0)	45.0(5.0)
kPa	ITV2004(-80Pa Type)	3.0(3.8)	4.0(5.0)
	ITV4011(100Pa Type)	3.4(3.3)	5.5(5.3)
PSI	ITV4034(500Pa Type)	14.5(3.0)	24.1(5.0)
	ITV4051(900Pa Type)	27.6(3.1)	48.3(5.4)







# Operation Manual

PRODUCT NAME

*Pressure Relief 3 Port Valve With Locking Holes*

MODEL / Series / Product Number

VHS20-(F,N)01~02A,B(-B,S)(-K,R,Z)  
VHS30-(F,N)02~03A,B(-B,S)(-K,R,Z)  
VHS40-(F,N)02~04A,B(-B,S)(-K,R,Z)  
VHS40-(F,N)06A,B(-B,S)(-K,R,Z)  
VHS50-(F,N)06~10A,B(-B,S)(-K,R,Z)

VHS2510-(F,N)01~02A,B(-B,S)(-K,R,Z)  
VHS3510-(F,N)02~03A,B(-B,S)(-K,R,Z)  
VHS4510-(F,N)02~04A,B(-B,S)(-K,R,Z)  
VHS4510-(F,N)06A,B(-B,S)(-K,R,Z)  
VHS5510-(F,N)06~10A,B(-B,S)(-R,Z)

## SMC Corporation



### Pressure Relief 3 Port Valve With Locking Holes Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)<sup>\*)</sup>, and other safety regulations.

\*) ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)

ISO 10218-1992: Manipulating industrial robots - Safety.

etc.



**Caution** Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

**Warning** Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

**Danger** Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

#### Warning

##### 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

##### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

##### 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

##### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for the failure of the interlock mechanical protective function, and periodical checks to confirm proper operation.

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### Pressure Relief 3 Port Valve With Locking Holes Safety Instructions

#### Caution

##### 1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

#### Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

#### Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.<sup>\*)</sup>  
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.  
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

##### \*) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

#### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

#### Precautions on Design

#### Warning

1. Please consult with SMC in cases where the ambient environment does not permit leakage or if a fluid other than air is used.
2. Do not apply negative pressure. It may result in malfunction.
3. Do not supply air pressure from ports other than the 1(P) port. The valve will malfunction when air pressure is supplied from other ports.

#### Selection

#### Warning

1. In some cases, mineral oil grease used for internal parts and sealant may be exhausted. Please contact SMC if this causes any inconvenience in use.

#### Installation and Adjustment

#### Warning

1. Confirm the symbols "1" and "2" before the valve is connected. The port marked "1" is the air inlet and the port marked "2" is the outlet.  
Pressurization is only possible via the inlet port "1". Reverse connection may cause malfunction. The port symbols and corresponding piping types are shown in the table below.

Port symbol	Piping type
1	Inlet
2	Outlet
3	Exhaust

#### Caution

1. The valve must be switched to each position instantly and securely. Stopping the knob between the extreme positions may cause malfunction.
2. Do not remove the mounting screws from the bonnet. This may cause malfunction.
3. Double action type requires two actions (push the handle + turn). Confirm that the handle is pushed properly before turning it. If the handle is not pushed properly to the end, the internal parts will be broken by turning the handle.

- 3 -

4. A protective cover should be used to shield valves from direct sunlight.
5. Shield valves from radiated heat generated by nearby heat sources.
6. Employ suitable protective measures in locations where there is contact with water droplets, oil, or welding spatter.
7. Install a silencer into port (3) to prevent the ingress of dust if there is a lot of dust in the atmosphere. If dust enters the valve via port (3), it may cause air leakage.

If above conditions are applicable, use metal handle / bonnet type for your safety.

#### Maintenance

#### Warning

1. Perform maintenance procedures as shown in the instruction manual. If handled improperly, malfunction or damage of machinery or equipment may occur.
2. Do not disassemble the product. Improper handling will cause malfunction or breakage of the machinery or equipment.
3. When equipment is to be removed, first confirm that measures are in place to prevent dropping of driven objects and run-away of equipment, etc. Then cut the supply air pressure and electric power, and exhaust all compressed air from the system using its residual pressure release function.  
When the equipment is to be started again after remounting or replacement, first confirm that measures are in place to prevent lurching of actuators and then confirm that equipment operates normally.

#### Caution

1. Once lubricant is introduced, be sure to continue lubrication. If it is discontinued, malfunction may result due to loss of the initial lubricant. Apply class 1 turbine oil (ISO VG32) as a lubricant. Use of other lubricants may cause malfunction.

Built-in Silencer (Option)  
Bronze Sintered Metal Element

#### Caution

1. Products made of bronze may contain uneven color due to the oxidation process of the atmosphere. However, this oxidation process occurs in the limited range of less than 1 μm of thickness and is so thin as to not affect the product characteristics. The uneven color occurs depending on the storage duration before utilization (stock as a product, stock in customers).  
\* If this is a problem, please contact SMC so that SMC can pre-treat them with nickel plating.

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#### Piping

#### Warning

1. Before piping is connected, the pipes should be thoroughly blown through with air (flushing) or washed to remove chips, cutting oil and other debris from inside. Should they remain, they could cause malfunction.
2. When connecting pipes and fittings, etc., be sure that neither chips from the pipe threads nor sealing material get inside the valve. When using sealant tape, leave 1.5 to 2 thread ridges exposed at the end of the pipe/fitting.
3. When screwing a piping component into the valve, secure the female threaded side and apply the recommended tightening torque. Under tightening may result in loosening or sealing failure while over tightening may cause damage to threads and other problems.

Recommended tightening torque						Unit: N·m
Connection thread	1/8	1/4	3/8	1/2	3/4	1
Torque	7 to 9	12 to 14	22 to 24	28 to 30	28 to 30	36 to 38

#### Air Supply

#### Warning

1. Use clean air. Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.
2. Install an air dryer or after cooler on the upstream side of the pressure release 3 port valve because air containing excessive drainage may cause malfunction.

#### Caution

1. Install an air filter of 5 μm filtration on inlet side.
2. Install a mist separator on the inlet side to remove carbon powder from the compressor or other equipment. An excessive amount of carbon dust ingress via the inlet may cause the valve to malfunction.

Refer to SMC's "Air Cleaning Equipment" catalog for further details on compressed air quality.

#### Operating Environment

#### Warning

1. Do not use valves where there is direct contact with, or in atmospheres of, corrosive gases, chemicals, salts water or steam.
2. Do not use in an explosive atmosphere.
3. Do not use in locations subject to vibration or impact. Confirm the specifications for each series.

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## 2. Applications

This product is a residual pressure release valve which is switched by hand.

## 3. Standard specifications

(1) Single action type

Model		VHS20	VHS30	VHS40	VHS40-06	VHS50
Fluid		Air				
Ambient and fluid temperature		-5 to 60°C (No freezing)				
Proof pressure		1.5MPa				
Operating pressure range		0.1 to 1.0MPa				
Color (Standard)		Handle: Red Body: Urban white				
Handle operation	Pushing stroke	-		-		
	Switching angle	90°				
Handle operating force	Push force <sup>Note1)</sup>	-				
	Rotating torque <sup>Note1)</sup>	0.7N-m or less	1.0N-m or less	3.0N-m or less	3.0N-m or less	3.5N-m or less
Mass (Handle / Bonnet material)	A (Flame resistant PBT)	76g	127g	247g	293g	532g
	B (Aluminum)	92g	156g	301g	349g	630g

(2) Double action type

Model		VHS2510	VHS3510	VHS4510	VHS4510-06	VHS5510
Fluid		Air				
Ambient and fluid temperature		-5 to 60°C (No freezing)				
Proof pressure		1.5MPa				
Operating pressure range		0.1 to 1.0MPa				
Color (Standard)		Handle: Red Body: Urban white				
Handle operation	Pushing stroke	3.2mm		4.2mm		
	Switching angle	90°				
Handle operating force	Push force <sup>Note1)</sup>	10N or less				
	Rotating torque <sup>Note1)</sup>	0.7N·m or less	1.0N·m or less	3.0N·m or less	3.0N·m or less	3.5N·m or less
Mass (Handle / Bonnet material)	A (Flame resistant PBT)	77g	129g	250g	296g	536g
	B (Aluminum)	93g	158g	304g	352g	635g

Note 1) Supply pressure: 1.0 MPa

3

- 6 -

#### Flow characteristics

Model	Port size			Supply (IN→OUT)			Exhaust (OUT→EXH)		
	IN, OUT	EXH		C(dm³/S-bar)	b	Cv	C(dm³/S-bar)	b	Cv
VHS20 VHS2510	1/8	1/8		2.4	0.43	0.65	2.5	0.39	0.69
	1/4			3.3	0.40	0.88	3.1	0.51	0.84
VHS30 VHS3510	1/4	1/4		6.4	0.45	1.7	6.2	0.38	1.7
	3/8			8.3	0.41	2.3	7.0	0.41	1.9
VHS40 VHS4510	1/4	3/8		7.3	0.49	2.0	8.5	0.35	2.3
	3/8			10.9	0.45	3.0	11.6	0.40	3.1
	1/2			14.2	0.39	3.8	13.3	0.43	3.6
VHS40-06 VHS4510-06	3/4	1/2		18.3	0.31	5.0	17.7	0.37	4.8
	3/4			23.8	0.41	6.4	21.8	0.41	5.9
VHS50 VHS5510	1	1/2		31.9	0.33	8.6	23.5	0.44	6.4

#### 4. How to Order

(1) Single action type

VHS 40 - 04 A - BS -

Body size	Thread type
20	Nil Rc
30	F G
40	N NPT
50	

Port size	Body size				
Symbol	Port size	20	30	40	50
01	1/8	X			
02	1/4	X	X	X	
03	3/8		X	X	
04	1/2			X	
06	3/4			X	X
10	1				X

Handle / Bonnet material
A Flame resistant PBT
B Aluminum

Option	Symbol	Description
Nil	-	
K		Handle color: Black
R		Flow direction: Right→Left
Z <sup>Note1)</sup>		psi as unit displayed on label

Note 1) Only for NPT thread.  
Under the New Measurement Law, products for overseas use only (SI unit type for use in Japan).

Options	Symbol	Description
Nil	-	
B		With bracket
S		Built-in Silencer (EXH port)

B: Packed together  
S: Assembled for shipping

(2) Double action type

VHS 4510 - 04 A - BS -

Body size	Thread type
2	Nil Rc
3	F G
4	N NPT
5	

Port size	Body size				
Symbol	Port size	2	3	4	5
01	1/8	X			
02	1/4	X	X	X	
03	3/8		X	X	
04	1/2			X	
06	3/4			X	X
10	1				X

Handle / Bonnet material
A Flame resistant PBT
B Aluminum

Made to Order	X1	Red body
---------------	----	----------

Option	Symbol	Description
Nil	-	
K		Handle color: Black
R		Flow direction: Right→Left
Z <sup>Note1)</sup>		psi as unit displayed on label

Note 1) Only for NPT thread.  
Under the New Measurement Law, products for overseas use only (SI unit type for use in Japan).

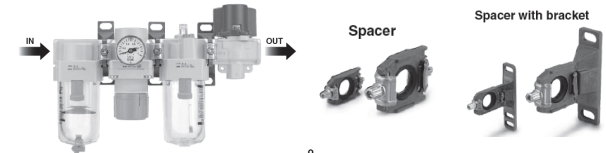
Options	Symbol	Description
Nil	-	
B		With bracket
S		Built-in Silencer (EXH port)

B: Packed together  
S: Assembled for shipping

# For connection of the modular type FRL combination, the spacer or the spacer with bracket shown below is necessary. Please order separately.

3-port valve for residual pressure release	Spacer p/n	With bracket Spacer p/n	Applicable air combination
VHS20, VHS2510	Y200-A	Y200T-A	AC20-A
VHS30, VHS3510	Y300-A	Y300T-A	AC25-A, AC30-A
VHS40, VHS4510	Y400-A	Y400T-A	AC40-A
VHS40-06, VHS4510-06	Y500-A	Y500T-A	AC40-06-A
VHS50, VHS5510	Y600	Y600T	AC50, AC55, AC60

\* New VHS series compatible with Old spacer Y200(T) to Y600(T) and Old AC20 to AC60.

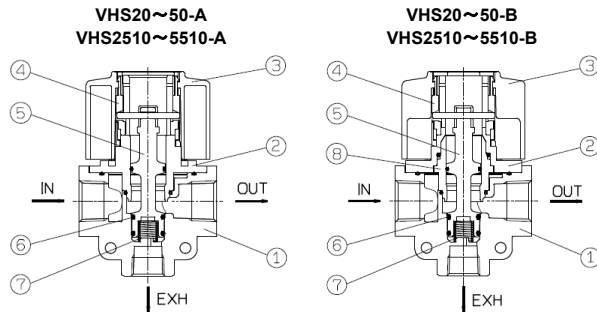


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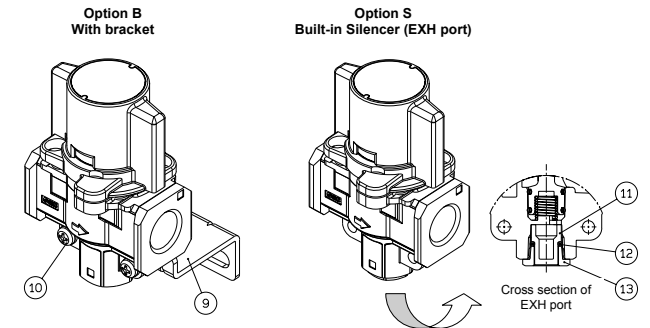
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#### 5. Construction/Parts list

(1) Standard



(2) Optional specifications



No.	Description	Material		Note
		VHS20~50-A VHS2510~5510-A	VHS20~50-B VHS2510~5510-B	
1	Body	ADC12		Urban white
2	Bonnet	Flame resistant PBT (Equivalent to UL-94 Standard V-0)	ADC12	Urban white
3	Handle	Flame resistant PBT (Equivalent to UL-94 Standard V-0)	ADC12	Red
4	Cam ring	POM		
5	Spool	PBT		
6	Spool O-ring	H-NBR		
7	Spool spring	Stainless steel		
8	Sleeve	POM		

\* VHS series cannot be disassembled. No repair parts available.

#### Optional parts

3-port valve for residual pressure release	Bracket assembly p/n	Silencer assembly p/n
VHS20, VHS2510	VHS20PW-180AS	VHS20PW-190AS
VHS30, VHS3510	VHS30PW-180AS	VHS30PW-190AS
VHS40, VHS4510	VHS40PW-180AS	VHS40PW-190AS
VHS40-06, VHS4510-06	VHS40PW-180-06AS	VHS40PW-190-06AS
VHS50, VHS5510	VHS50PW-180AS	VHS50PW-190AS

#### Construction of Optional parts

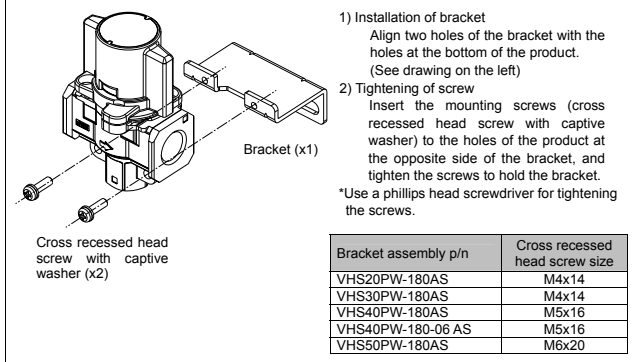
No.	Description	Material	Bracket assembly	Silencer assembly	Note
9	Bracket	SPCC	1 pc		Zinc chromate
10	Mounting screw	Steel wire	2 pc		Zinc chromate
11	Element	BC		1 pc	-
12	Element O ring	NBR		1 pc	-
13	Element cover	C3604		1 pc	-

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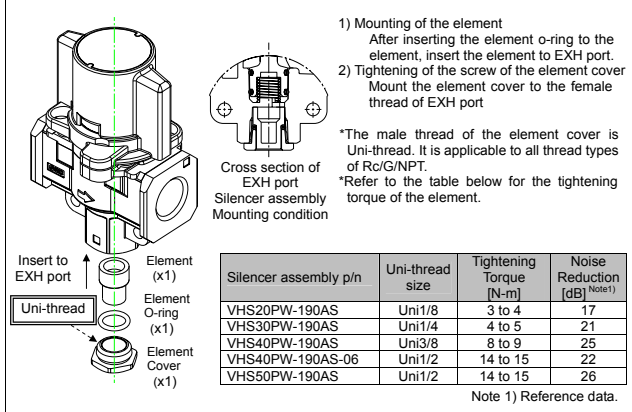
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## 6. Assembly of Optional parts

### (1) Bracket assembly

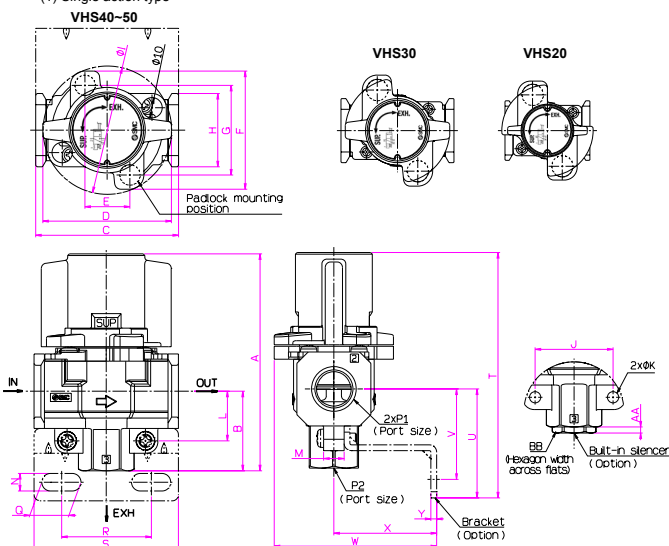


### (2) Silencer assembly



## 7. Dimensions

### (1) Single action type

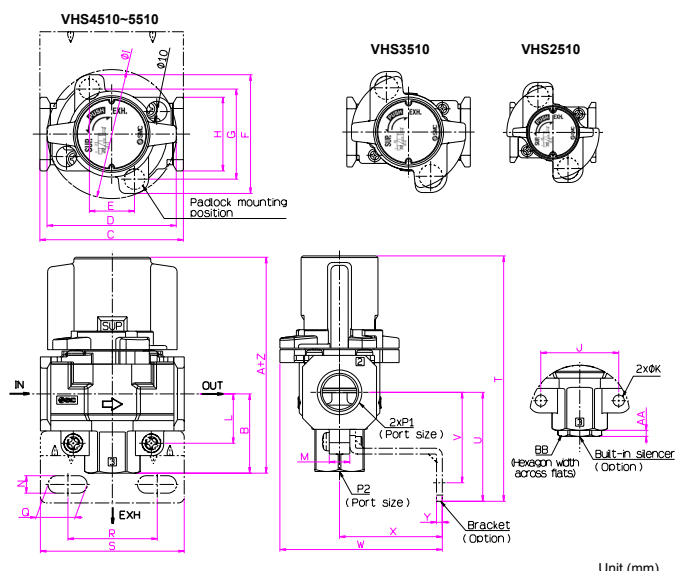


Model	Standard Specifications														
	P1	P2	A	B	C	D	E	F	G	H	I	J	K	L	M
VHS20	1/8, 1/4	1/8	66.4	22.3	40	37.5	14	46.6	33.6	28	43	24	4.5	14.8	9
VHS30	1/4, 3/8	1/4	80.3	29.4	53	49	19	52	39	30	49	30	4.5	19	9
VHS40	1/4, 3/8, 1/2	3/8	104.9	38.5	70	63	22	58	44	36	63	38	5.5	24	10
VHS40-06	3/4	1/2	110.4	42	75	63	22	58	44	44	63	43	5.5	26	10
VHS50	3/4, 1	1/2	134.3	53	90	76	26	76	61	53	81	50	6.5	31	12

Model	Optional Specifications											
	With bracket										Built-in silencer	
	N	Q	R	S	T	U	V	W	X	Y	AA	BB
VHS20	5.4	8.4	27	40	75.4	31.3	25.3	53.3	30	2.3	3	12
VHS30	6.5	10	36.5	53	90.9	40	33	67	41	2.3	3	14
VHS40	8.5	19	43.5	70	119.4	53	44	79	50	2.8	4	19
VHS40-06	8.5	19	43.5	70	123.4	55	46	79	50	2.8	4	22
VHS50	11	27.5	49.5	90	152.3	71	60	108	70	3.2	4	22

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### (2) Double action type



Unit (mm)

Model	Standard Specifications																
	P1	P2	A	B	C	D	E	F	G	H	I	J	K	L	M	Z	
VHS2510	1/8, 1/4	1/8	66.4	22.3	40	37.5	14	46.6	33.6	28	43	24	4.5	14.8	9	3.2	
VHS3510	1/4, 3/8	1/4	80.3	29.4	53	49	19	52	38	30	49	30	4.5	19	9	3.2	
VHS4510	1/4, 3/8, 1/2	3/8	104.9	38.5	70	63	22	58	44	36	63	38	5.5	24	10	4.2	
VHS4510-06	3/4	1/2	110.4	42	75	63	22	58	44	44	63	43	5.5	26	10	4.2	
VHS5510	3/4, 1	1/2	134.3	53	90	76	26	76	61	53	81	50	6.5	31	12	4.2	

Model	Optional Specifications											
	With bracket										Built-in silencer	
	N	Q	R	S	T	U	V	W	X	Y	AA	BB
VHS2510	5.4	8.4	27	40	75.4	31.3	25.3	53.3	30	2.3	3	12
VHS3510	6.5	10	36.5	53	90.9	40	33	67	41	2.3	3	14
VHS4510	8.5	19	43.5	70	119.4	53	44	79	50	2.8	4	19
VHS4510-06	8.5	19	43.5	70	123.4	55	46	79	50	2.8	4	22
VHS5510	11	27.5	49.5	90	152.3	71	60	108	70	3.2	4	22

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.  
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