

# PRODUCT MANUAL

LYNX™ 6 MM MULTI-CHANNEL  
STRAIN GAGE SENSORS

**MCSG-50 & MCSG-250**



*Training and Technology for Injection Molding*



# PRODUCT MANUAL

## LYNX™ 6 MM MULTI-CHANNEL STRAIN GAGE SENSORS

### MCSG-50 & MCSG-250

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## LYNX™ 6 MM MULTI-CHANNEL STRAIN GAGE SENSORS

### MCSG-50 & MCSG-250

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# PRODUCT MANUAL

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### MCSG-50 & MCSG-250

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## INTRODUCTION

Read, understand, and comply with all following instructions. This guide must be kept available for reference at all times.

## DISCLAIMER


Inasmuch as RJG, Inc. has no control over the use to which others may put this material, it does not guarantee that the same results as those described herein will be obtained. Nor does RJG, Inc. guarantee the effectiveness or safety of any possible or suggested design for articles of manufacture as illustrated herein by any photographs, technical drawings, and the like. Each user of the material or design or both should make his own tests to determine the suitability of the material or any material for the design as well as the suitability of the material, process, and/or design for his own particular use. Statements concerning possible or suggested uses of the material or designs described herein are not to be construed as constituting a license under any RJG, Inc. patent covering such use or as recommendations for use of such material or designs in the infringement of any patent.

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## ALERTS

The following three alert types are used as needed to further clarify or highlight information presented in the manual:

 **DEFINITION** *A definition or clarification of a term or terms used in the text.*

 **NOTES** *A note provides additional information about a discussion topic.*

 **CAUTION** *A caution is used to make the operator aware of conditions that can cause damage to equipment and/or injury to personnel.*

## ABBREVIATIONS

DIA	diameter
MIN	minimum
MAX	maximum
R.	radius

[illegible]



## PRODUCT DESCRIPTION

The MCSG-50/250 line of sensors from RJG, Inc. are multi-channel, digital strain gage, 6 mm (0.236") button-style cavity pressure sensors that can withstand forces of up to 50 lb. (0.22 kN) or 250 lb. (1.1 kN), and temperatures of up to 250 °F (120 °C).

The button-style sensor has a permanent cable which connects the sensor head to the sensor connector. The sensor connector is housed inside the mold and plugs into the Eight-Channel MCSG Sensor Plate SG-8 on the outside of the mold.

All sensors are fully functional and properly named with a single cable connection from the mold SG-8 plate to the Eight-Channel MCSG Sensor Adapter SG/LX8-S-ID and eDART® or CoPilot® process control and monitoring systems.



## APPLICATIONS

### BUTTON-STYLE SENSORS

Button-style cavity pressure sensors are suitable for injection molding applications in which the following conditions are met:

- Sensor will be installed behind an ejector, blade, or core pin.
- Applied plastic pressure is high enough to prevent poor sensor resolution, but low enough to prevent sensor damage.
- Only one point of contact (single pin) to the sensor.
- Sensor will be kept below 250 °F (120 °C)

in the mold; sensor connectors will be kept below 185 °F (85 °C).

**CAUTION** MCSG-XXX model sensors *MUST* be used only within the recommended temperature ranges; failure to comply will result in the damage or destruction of equipment.

## OPERATION

## SENSOR AND EJECTOR PIN SIZE

### SELECTION CHARTS

The last number in the product model code signifies the full-scale rating in pounds of each sensor model; for example, the MCSG-250 is a 250-pound sensor, full-scale, while the MCSG-2000 is a 2,000-pound sensor. Locate the pin size that will be used and match it to the location on the part (near the end of fill or near the gate). The recommended sensor is the intersection of the row and column.

RJG® recommends that expected peak force is less than or equal to 75% of the sensor model's full scale. The expected peak force can be determined by multiplying the expected peak plastic pressure at the sensor's pin location by the project surface area of the pin on the cavity wall—this is recommended for each sensor location in an instrumented tool. The expected peak plastic pressure can be found from simulation or similar processes, or estimated from the material tonnage on the material safety data sheet (MSDS).

The charts below are only a guide. In order to assure correct sensor selection for an application, please contact RJG.

#### 1. Imperial Units

NORMAL PRESSURE		HIGH PRESSURE
Pin Size	Sensor Model	Sensor Model
3/64	MCSG-50	MCSG-50
1/16	MCSG-50	MCSG-50
5/64	MCSG-50	MCSG-50/250
3/32	MCSG-50	MCSG-250
7/64	MCSG-50/250	MCSG-250
1/8	MCSG-50/250	MCSG-250
9/64	MCSG-250	MCSG-250
5/32	MCSG-250	MCSG-250
3/16	MCSG-250	-
7/32	MCSG-250	-
1/4	MCSG-250	-

## SENSOR AND EJECTOR PIN SIZE (continued)

### 2. Metric Units

NORMAL PRESSURE		HIGH PRESSURE
Pin Size	Sensor Model	Sensor Model
1.0 mm	MCSG-50	MCSG-50
1.5 mm	MCSG-50	MCSG-50
2.0 mm	MCSG-50	MCSG-50/250
2.5 mm	MCSG-50	MCSG-250
3.0 mm	MCSG-50/250	MCSG-250
3.5 mm	MCSG-250	MCSG-250
4.0 mm	MCSG-250	MCSG-250
4.5 mm	MCSG-250	MCSG-250
5.0 mm	MCSG-250	-
5.5 mm	MCSG-250	-
6.0 mm	MCSG-250	-

## INDIRECT/UNDER PIN

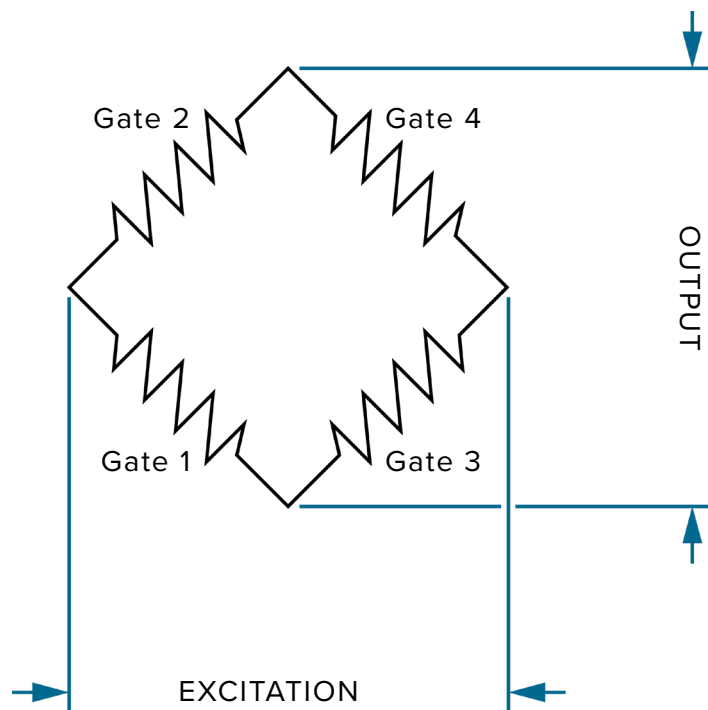
Each Lynx™ multi-channel strain gage sensor is placed in the mold behind an ejector pin. As plastic is injected into the cavity, the pressure of the plastic applies force to the ejector pin; the plastic pressure force is transferred to the strain gage sensor.

### STRAIN GAGE SENSORS

The strain gage sensing element inside the sensor body converts the applied force to an electrical signal that can read using the eDART system or CoPilot system software. The sensing element uses a Wheatstone bridge configuration (four strain gage elements positioned in a circuit) to convert small amounts of sensor deformation into a measurable voltage through the change in resistance of the strain gage sensing elements. The sensor sends out a low-level voltage signal which is proportional to the amount of force applied by the pressure placed on the pin and transferred to the sensor.

The voltage or measurement is carried through the sensor cable, through the SG-8 plate and C-SG/LX8-S-ID cable, to the SG/LX8-S-ID adapter electronics case mounted outside of the mold. The output voltage signal is calibrated by the sensor's electronics and directly correlates with pressure from within the cavity.

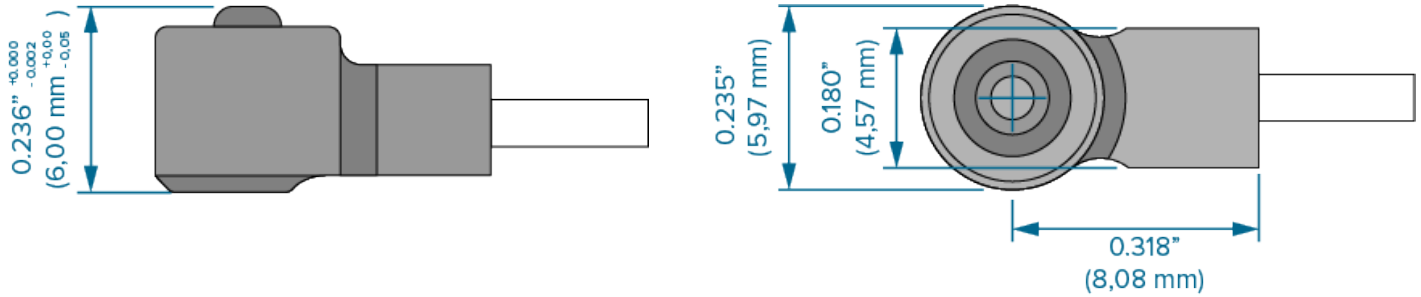
STRAIN GAGE OPERATING PRINCIPLE



The SG/LX8-S-ID is connected to the RJG, Inc. eDART system, which records and displays the sensor's measurement for operator aid in process control. In the eDART and CoPilot™ software, the sensor model is assigned to each channel in order to provide correct calibration. This configuration only needs to be completed once, after which the software automatically recalls the configuration each time the SG-8 plate is connected.

## DIMENSIONS

### SENSOR

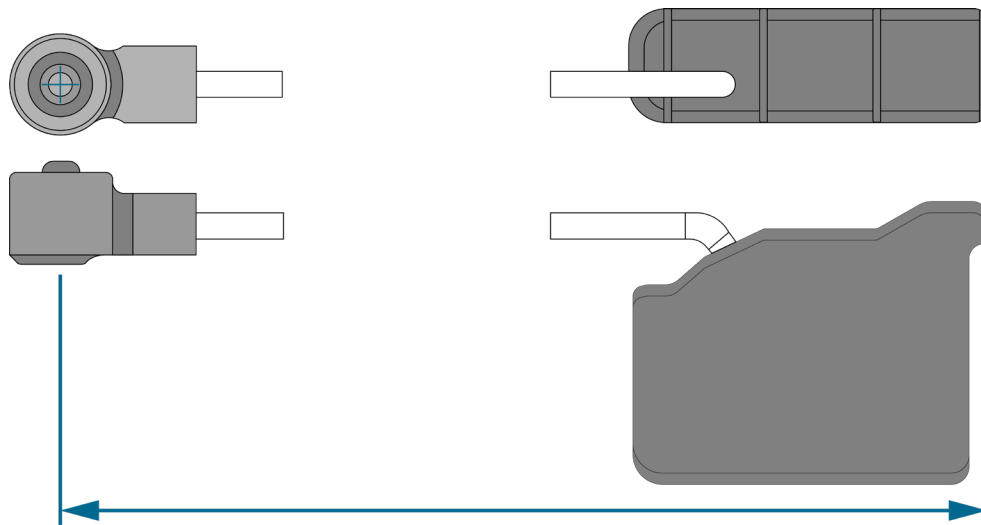


### CABLE LENGTHS

All standard lengths  $\pm 0.13''$  (3.2 mm) at build.

MODEL NO.	LENGTH
MCSG-50-.2      MCSG-250-.2	7.87" (200 mm)
MCSG-50-.4      MCSG-250-.4	15.75" (400 mm)
MCSG-50-.6      MCSG-250-.6	23.62" (600 mm)
MCSG-50-.8      MCSG-250-.8	31.50" (800 mm)
MCSG-50-1.0      MCSG-250-1.0	39.37" (1000 mm)
MCSG-50-1.2      MCSG-250-1.2	47.24" (1200 mm)
MCSG-50-1.4      MCSG-250-1.4	55.12" (1400 mm)
MCSG-50-1.6      MCSG-250-1.6	62.99" (1600 mm)
MCSG-50-2.0      MCSG-250-2.0	78.74" (2000 mm)

Also available in custom-order lengths at an additional cost.



SPECIFY CABLE LENGTH AT ORDER

[illegible]

## INSTALLATION

### INSTALLATION OVERVIEW

#### EJECTOR PLATE INSTALLATION

The sensor connector plate is mounted on the mold. Pockets and channels are machined into the mold for the sensor connector, cable, and sensor head. The sensor head is placed under the ejector pin in the ejector plate. The ejector pin is retained in the ejector retainer plate and reaches through to the B-Plate or cavity insert (refer to figure at right).

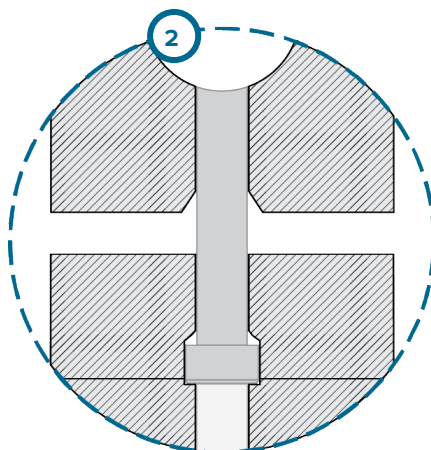
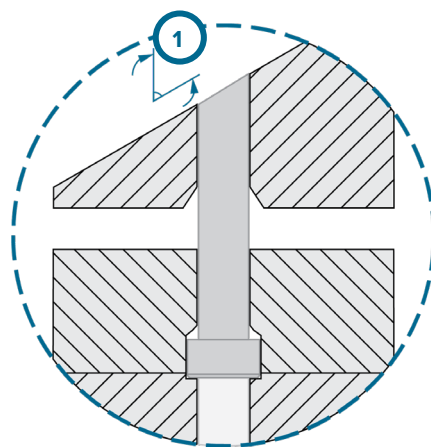
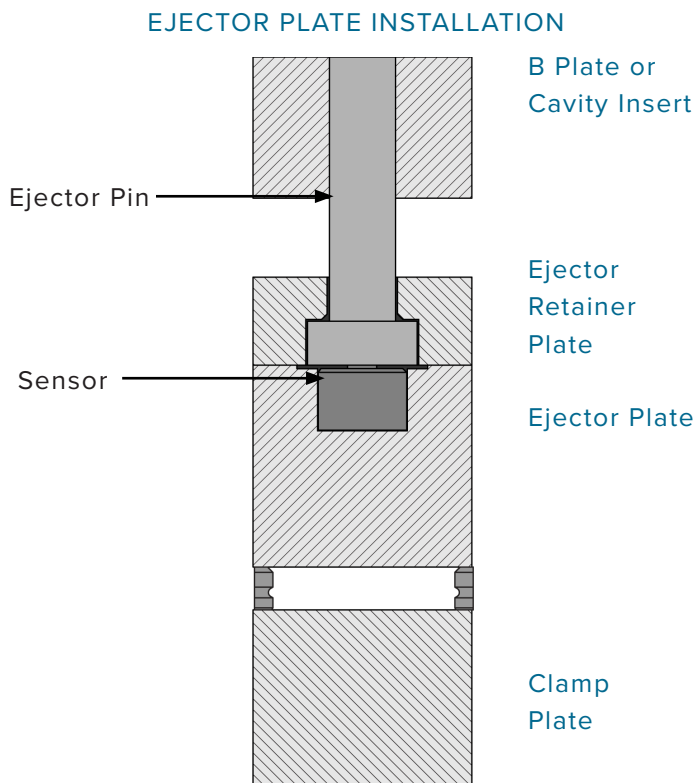
#### ANGLED EJECTOR PINS

Ejector pins that are located on angled surfaces of a part can utilize sensors depending on the angle of the pin. The maximum pin angle that can be used with sensors is 30° (1 at right). Beyond 30°, force is lost to friction as the pin is pushed sideways against the mold steel instead of directly back onto the sensor, which in turn can create errors in sensor readings. If the angle is greater than 30°, contact RJG customer support for assistance in verifying suitability for use with an RJG sensor (refer to “Customer Support” on page 30).

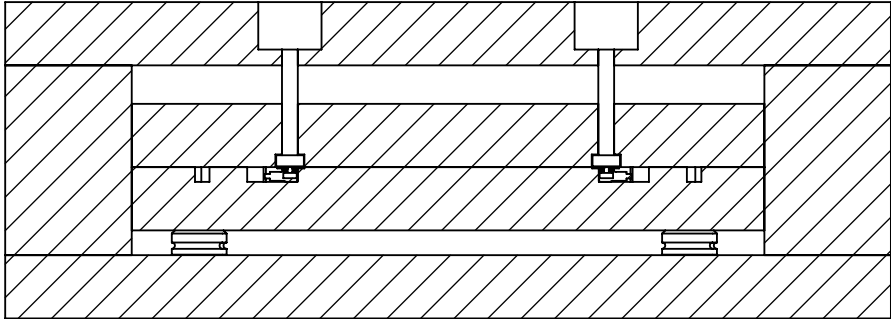
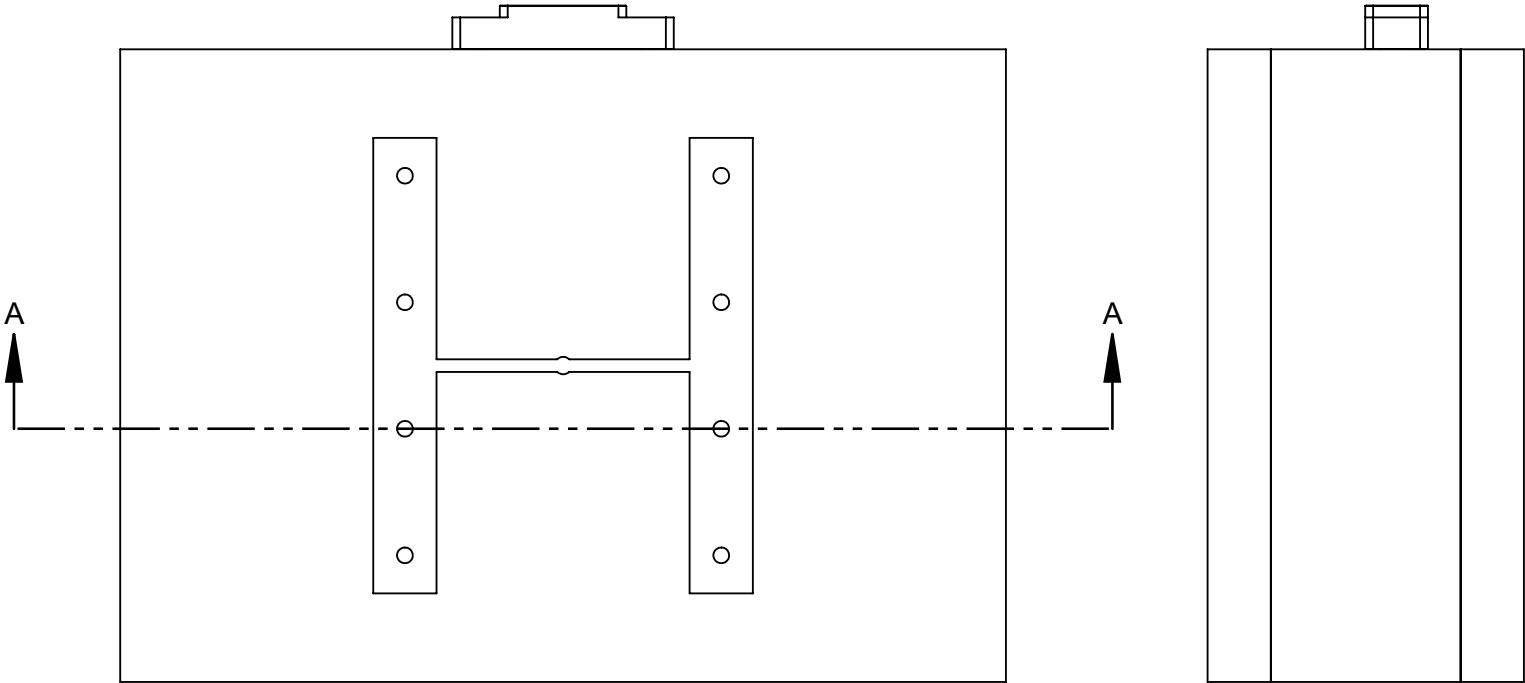
#### CONTOURED EJECTOR PINS

Ejector pins that are located on contoured surfaces of a part can be used on either concave and convex surfaces (2 at right) provided the shape of the contour is symmetric, as this cancels out any sideways forces generated by cavity pressure pushing on the pin.

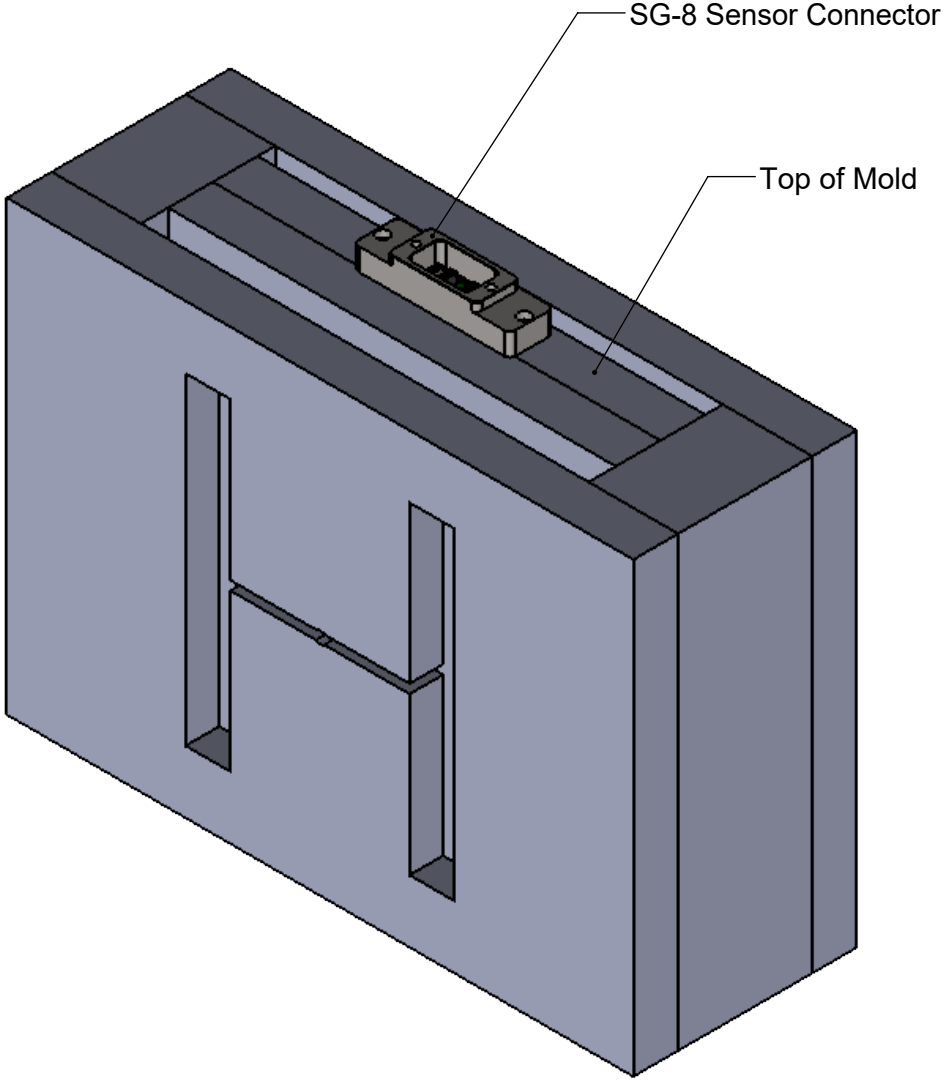
Do not use an asymmetrically-contoured ejector pin if the net contour is greater than a comparable pin with a 30° angle. If a contour is unique or asymmetrical, contact RJG customer support for assistance in verifying suitability for use with an RJG sensor (refer to “Customer Support” on page 30).



INSTALLATION SPECIFICATIONS  
EJECTOR PLATE INSTALLATION



SECTION A-A  
SCALE 1 : 3





INSTALLATION SPECIFICATIONS (continued)  
EJECTOR PLATE INSTALLATION

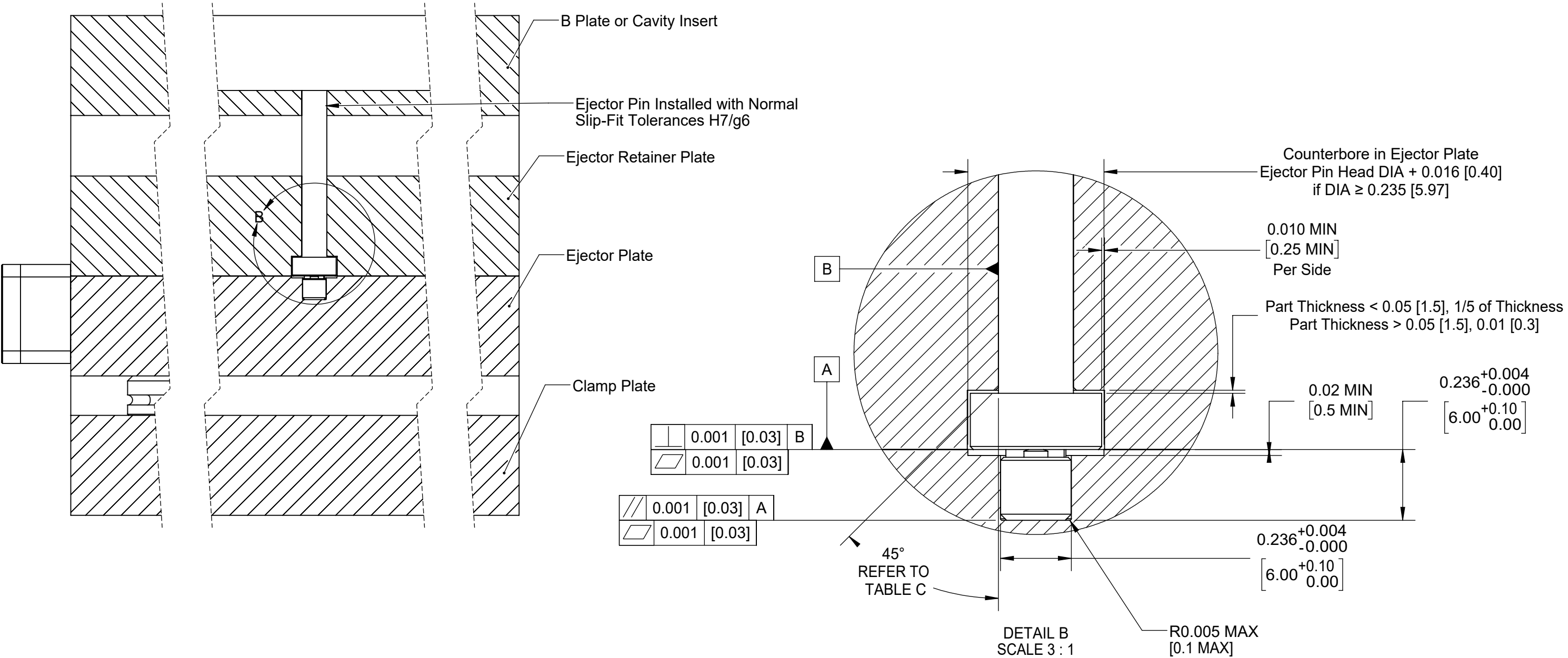


TABLE C	
Ejector Pin Ø	Chamfer Length
0.04–0.08 [1.0–2.5]	0.01 [0.3]
0.10–0.20 [2.5–5.0]	0.02 [0.4]
0.24–0.40 [6.0–10.0]	0.025 [0.6]

### 1. Sensor Pocket Machining

Sensor pockets are machined into the ejector plate. The pockets must be centered under the selected ejector pin measuring 0.236" +0.004/-0.0 (6,0 mm +0,10/-0,0 [1 at right]) DIA, and 0.236" +0.004/-0.0 (6,0 mm +0,10/-0,0 [2 at right]) deep.

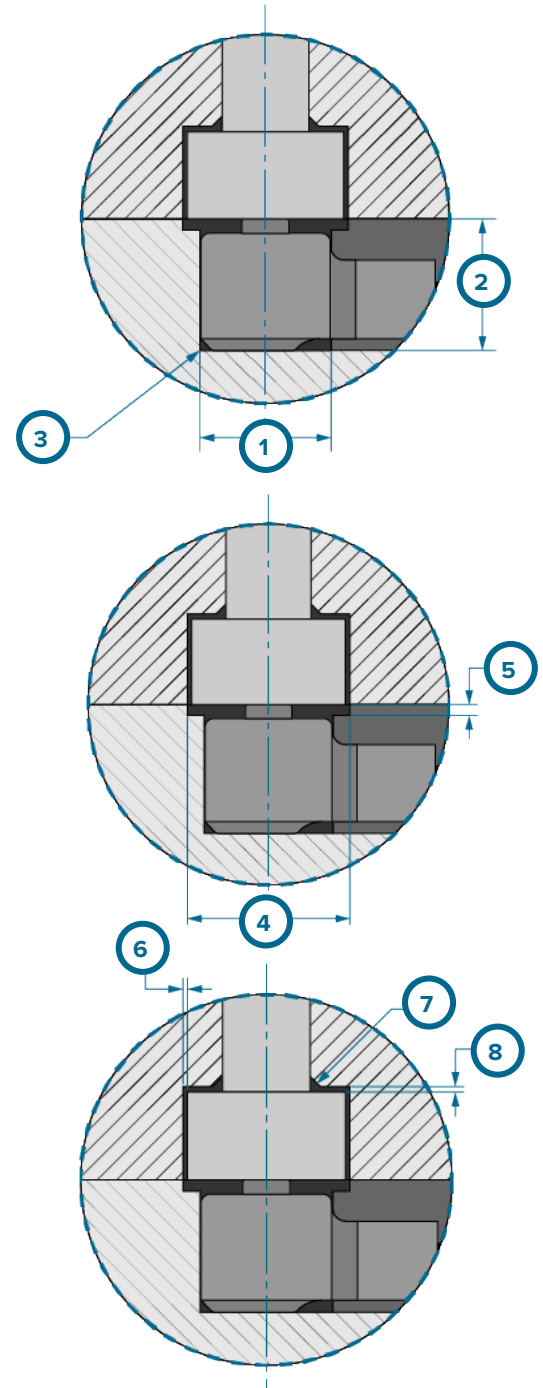
- Use a “dead sharp” end mill to achieve correct radius—sensor pocket corner radius MAX R 0.005" (0,10 mm [3 at right]).

If the ejector pin head DIA is greater than 0.25" (6,4 mm), machine a counterbore into the ejector plate equal to the ejector pin DIA plus 0.016" (0.4 mm) MIN by 0.02" (0,5 mm) MIN deep to allow the head of the ejector pin to clear the plate and rest only on the sensor when under pressure (4 & 5 at right).

### 2. Ejector Pin Pocket

Choose an ejector pin appropriate for the application (refer to “Sensor and Ejector Pin Size” on page 2). Machine a pocket for the ejector pin head in the ejector retainer plate that is equal to the ejector pin head DIA plus 0.010" (0,25 mm [6 at right]) MIN per side by ejector pin height plus 0.010" (0,25 mm [7 i at right]) MIN to eliminate potential preload on the sensor when installed.

Hole basis for ejector pins is ISO standard clearance fit H7g6—H7g6 is a sliding fit suitable for precision location fits.



**NOTES** Ejector pin head clearance not to exceed 20% (1/5th) of part thickness at point of pin/part convergence

<b>1</b> $\varnothing$ 0.236" +0.004/-0.0 (6,0 mm +0,10/-0,0)	<b>5</b> 0.02" (0,5 mm) MIN
<b>2</b> 0.236" +0.004/-0.0 (6,0 mm +0,10/-0,0)	<b>6</b> 0.01" (0,3 mm) MIN per side
<b>3</b> 0.005" (0,10 mm) MAX R.	<b>7</b> 45° Chamfer
<b>4</b> Pin Head DIA + 0.016" (0,40 mm), IF DIA $\geq$ 0.25" (6,4 mm)	<b>8</b> 20% part thickness if $\leq$ 0.05" (1,5 mm), 0.01" (0,3 mm) if part thickness $>$ 0.05" (1,5 mm) <b>i</b>

## INSTALLATION SPECIFICATIONS *(continued)*

### SENSOR CONNECTIONS POCKET

The sensor electronics connections are made within the plate to the SG-8 sensor plate mounted on the outside of the plate.

① **NOTES** *Dimensions shown for depths will change if a recessed cover plate is utilized; account for recessed cover plate depth in design and machining if applicable.*

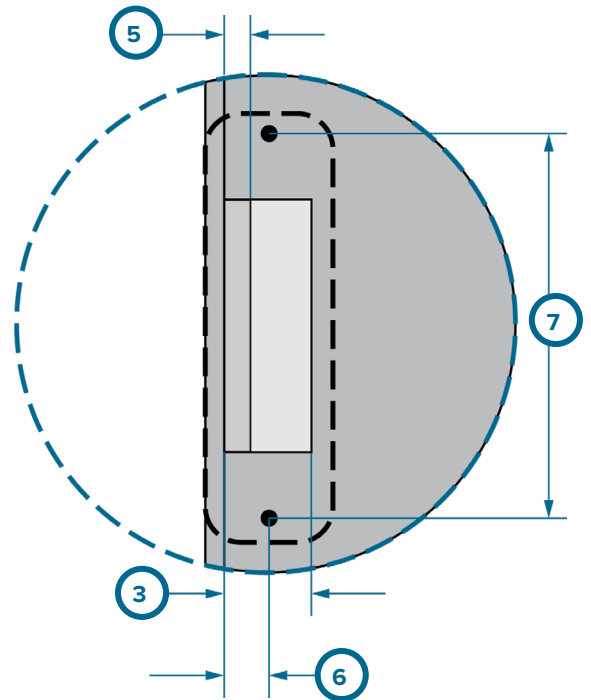
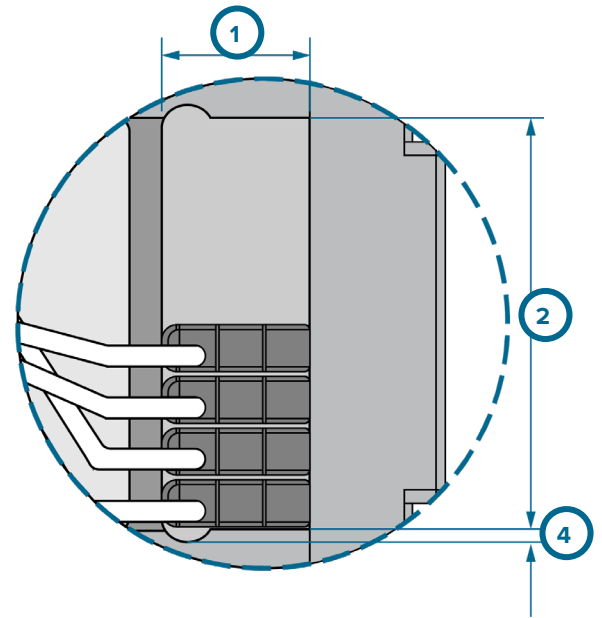
Machine a pocket 2.10" (53,4 mm [2 at right]) long by

- 0.8"  $\pm 0.005$  (20,3 mm  $\pm 0,13$  [1 at right]) wide for clamp plate installations
- 0.780"  $\pm 0.005$  (19,8 mm  $\pm 0,13$  [1 at right]) wide for ejector plate installations

by 0.72" (18,3 mm [3 at right]) deep for the sensor connections to the sensor plate in the clamp plate; allow 0.24" (6 mm [5 at right]) clearance above for sensor cables.

Incorporate small radii 0.125" (3,18 mm [4 at right]) MIN R. on each side to facilitate machining.

Drill and tap two points for SG-8 sensor plate installation 0.38" (9,5 mm [6 at right]) from cover plate, 3.16" (80 mm [7 at right]) apart, centered over the sensor connections pocket.



#### ⚡ CAUTION

*The SG-8 sensor plate/sensor connections pocket dimensions for ejector plate installations differ from dimensions specified for clamp plate installations. Always verify dimensions are correct for selected installation method.*

1	0.8" $\pm 0.005$ (20,3 mm $\pm 0,13$ ) clamp plate installations
1	0.780" $\pm 0.005$ (19,8 mm $\pm 0,13$ ) ejector plate installations
2	2.10" (53,4 mm)
3	0.72" (18,3 mm)
4	0.125" (3,18 mm) MIN R.
5	0.24" (6 mm)
6	0.38" (9,5 mm)
7	3.16" (80 mm)

Refer to the SG-8 product manual for more information on the SG-8 specifications, operation, and installation.

## INSTALLATION SPECIFICATIONS (continued)

### SENSOR CABLE CHANNELS

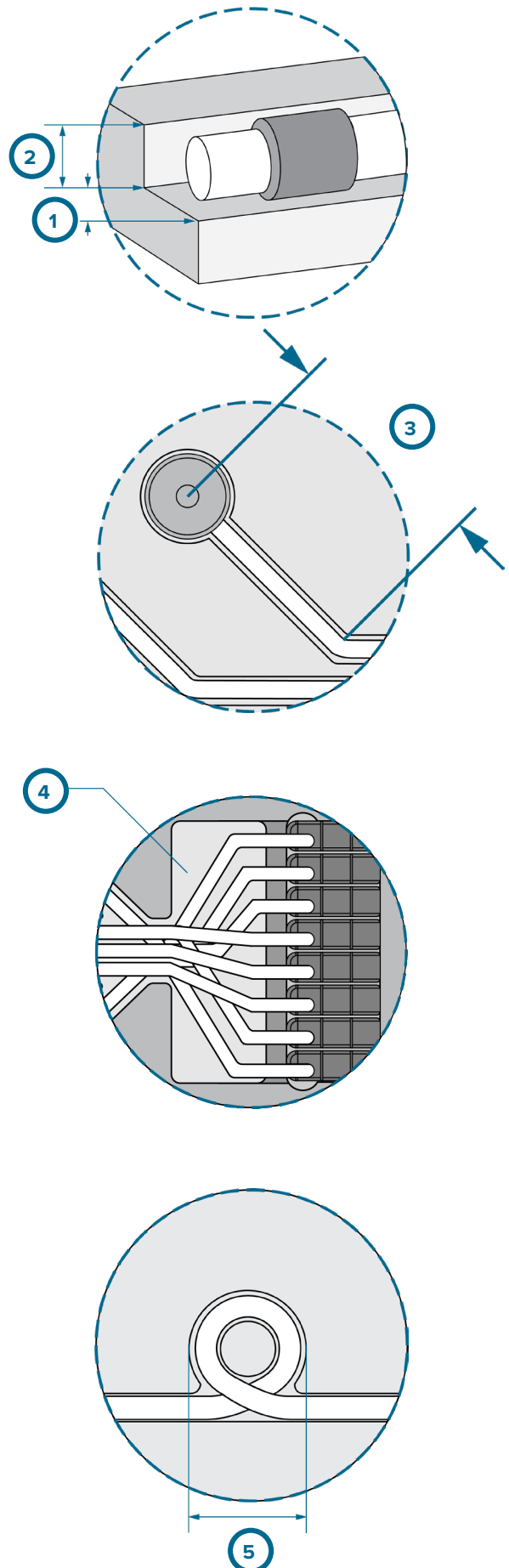
Machine a cable channel width of 0.20" +0.01/-0.0 (5,1 +0,3/-0,0 mm [1 at right]) and depth of 0.24" (6,0 mm [2 at right]) for a single sensor; if more than one sensor will be placed in the channel, provide a width of 0.50" (12 mm.)

#### 3. Sensor Cable Bend

- The sensor cable must not be bent within 0.40" (10 mm [3 at right]) MIN of sensor head center.

#### 4. Excess Cable Pockets

- The excess cable pocket (4 at right) is machined into the ejector or plate to store excess cable. All dimensions to be determined by customer.
- If necessary, a cable pocket may be machined to store excess cable. This requires a 1.00" (25,4 mm [5 at right]) MIN internal radius for the cable to coil.

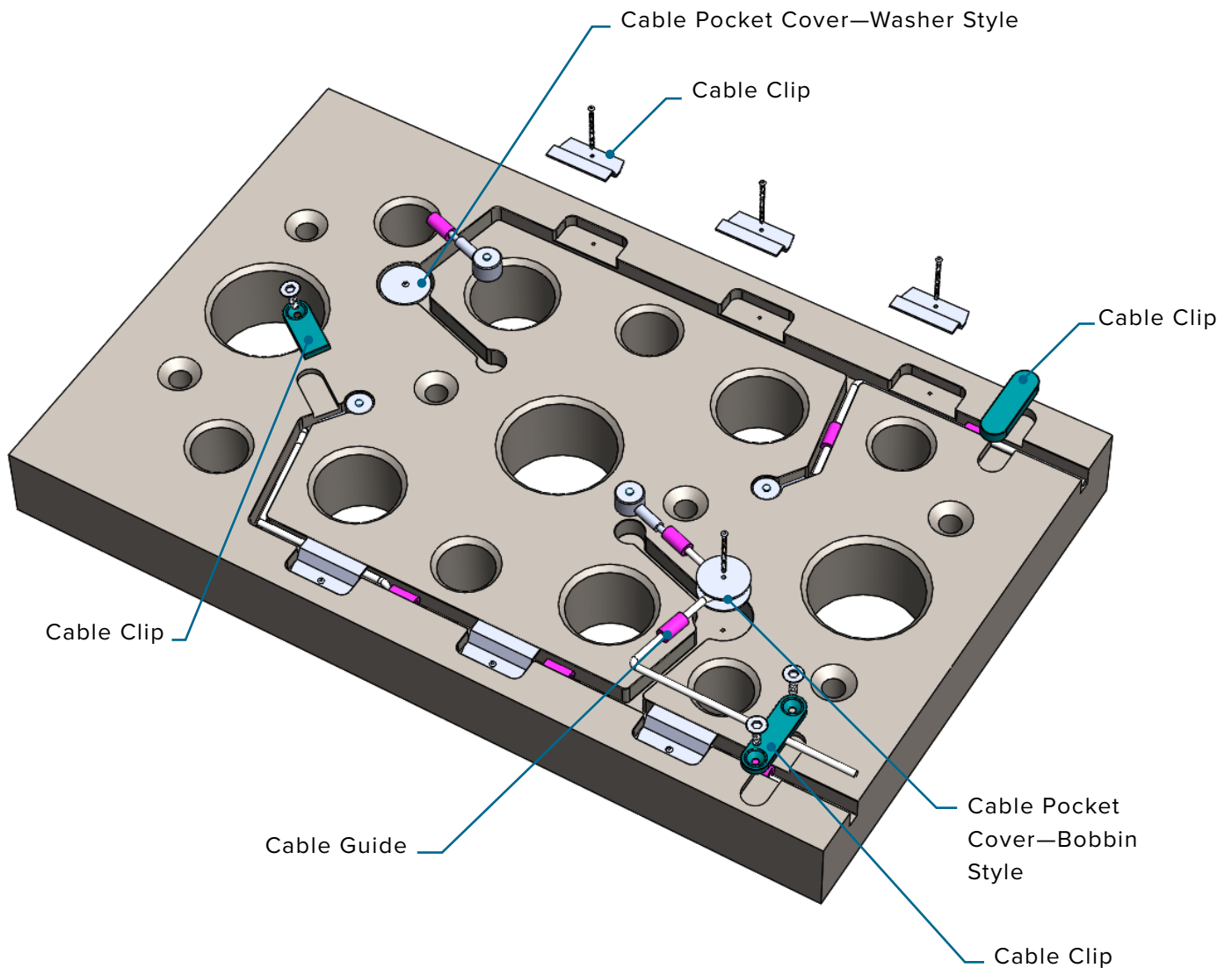


1	0.20" +0.01/-0.0 (5,1 mm mm) for one sensor; 0.50" (12 mm) if more than one in a channel
2	0.24" (6,0 mm)
3	0.40" (10 mm) MIN
4	to be determined
5	ø 1.00" (25,4 mm)

## INSTALLATION SPECIFICATIONS *(continued)*

### SENSOR CABLE RETENTION

Sensor cable retention strategies must be considered during the mold design phase. Cables are often not the exact size needed, or do not easily remain in the cable channels during assembly and must be retained using one or more of the following methods.

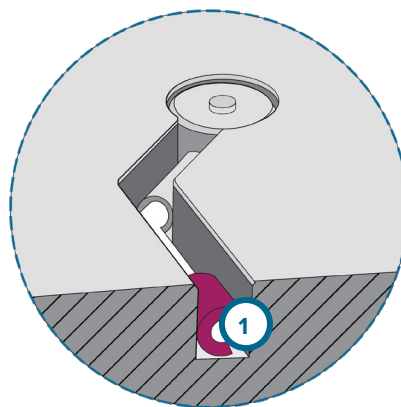


## INSTALLATION SPECIFICATIONS *(continued)*

### SENSOR CABLE RETENTION

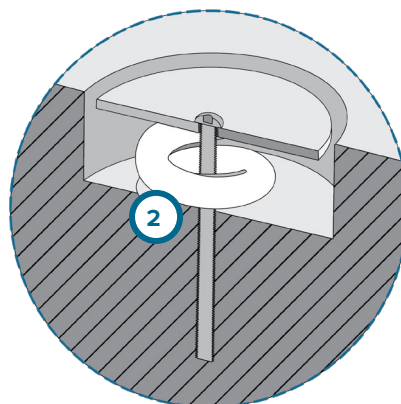
#### 1. Cable Guides

Use self-locking cable guides (① at right) in cable channels to retain the sensor cable. Cable guides are silicone rubber tubes with a slot in them to accommodate the sensor cable; the cable guides fit snugly within the cable channel dimensions provided.



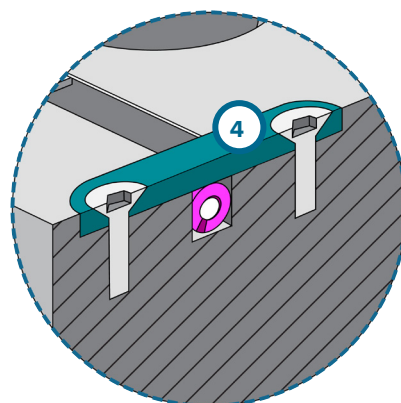
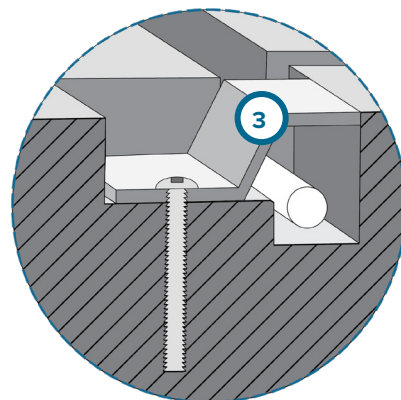
#### 2. Cable Pocket Covers

If excess cable pockets are present, it may be useful to provide a cover (② at right) for the cable pocket with which to retain extra cable. Though RJG does not currently provide a solution specifically for this application, plastic or metal discs with a centrally-located hole, retained by a single bolt through the center, can be used to easily retain cable within the pocket. Alternatively, a bobbin-style device can be used similarly to retain cable within a pocket.



#### 3. Cable Clips

Cables may also be retained in channels using cable clips (③ & ④ at right); RJG does not currently provide this solution. Clips can be formed from sheet or plate metal and retained by machine screws, or purchased from a molding components supplier. The clips can supplement or replace the use of silicone rubber cable guides, enabling an easier assembly of the tool.





## NON-STANDARD INSTALLATIONS

### STATIC (NON-MOVING) EJECTOR PINS

While cavity pressure sensor installation with moving, or “working” ejector pins is recommended, in some situations a non-moving or “static” pin must be utilized. In most cases, static pins are installed directly into the cavity plate, or into a cavity insert. In some cases, static pins will extend through multiple plates, such as applications that extend back to the clamp plate. Read and follow all instructions, and refer to the provided figures to properly install sensors with static ejector pins.

#### 1. Static Ejector Pins Overview

Static ejector pins are non-moving pins which sit on top of button-style sensors to transfer plastic pressure in the cavity to the sensor in a mold plate. Unlike moving ejector pins which self-clean during each ejection cycle, static pins can allow build-up of material around the pin over time. Static pins should have an O-ring on the end of the pin to prevent contamination build-up that contributes to measurement errors, allowing the sensors to read accurately over time.

Successful static pin installation provides lower sensor and installation costs; easier sensor maintenance; flexibility in sensor and pin sizing; and freedom in sensor location.

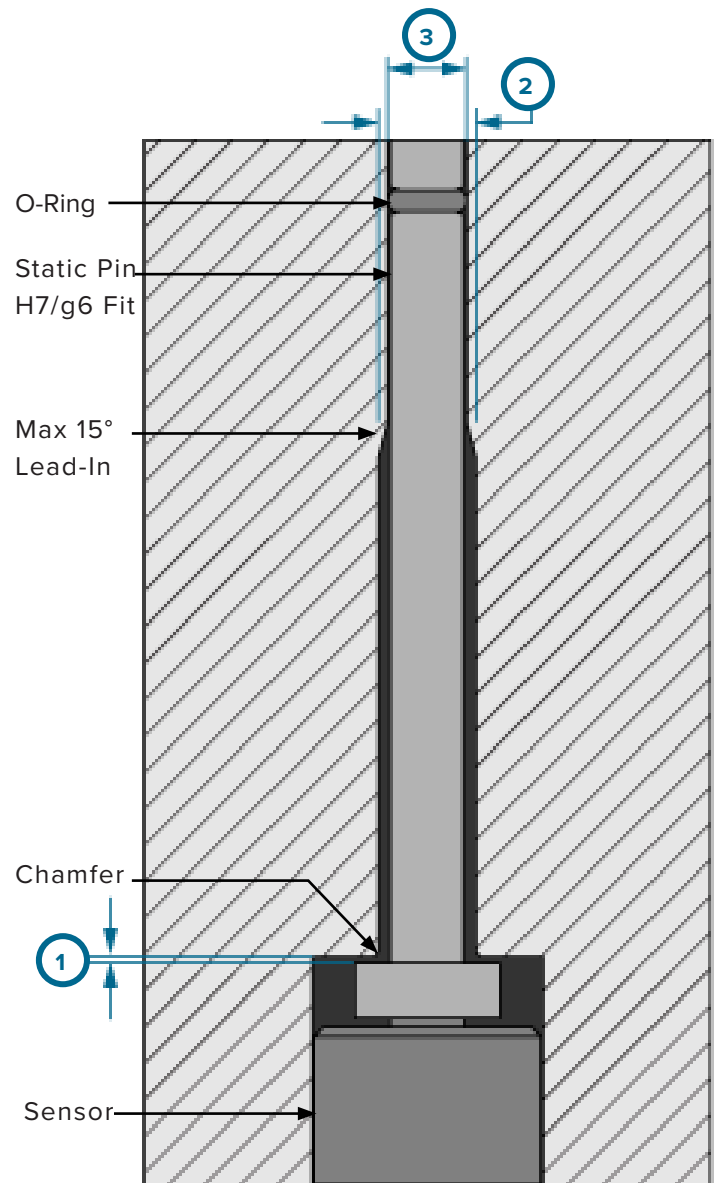
#### 2. Ejector Pin Bore and Lead-In

Provide space in the sensor pocket for the sensor and static pin allowing for clearance above the pin head equal to 1/5th of the part thickness at pin location (1 at right) if part thickness is less than or equal to 0.06” (1,5 mm), or 0.012” (0,3 mm [1 at right]) if the part thickness at pin location is greater than 0.06” (1,5 mm).

From the sensor and pin head pocket, provide a clearance of the pin diameter plus 0.06” (1,5 mm [2 at right]).

Step down the bore to a standard ejector pin bore of H7/g6 (3 above) (in which the ejector pin is able to freely move) before

STATIC PIN INSTALLATION



#### ⚡ CAUTION

*These guidelines are for pins 3/32” (2,5 mm) diameter or larger. Please contact RJG Customer Support for installation of static pins smaller than 3/32” (2,5 mm) in diameter*

the cavity to provide a sealing surface for the O-ring at the end of the static pin. Chamfer the transition between the sensor and pin head pocket and the pin bore, and also the transition between the pin bore and standard fitment at the end of the pin (no more than 30°/15° per side).

## NON-STANDARD INSTALLATIONS (continued)

### 3. O-ring Sizing

O-ring sizes are designated by inside diameter (ID [1 at right]) and cross section (CS [2 at right]), usually in inches. A 0.072 X 0.036 O-ring would have an ID of 0.072" and a CS of 0.036".

The O-ring is installed in the ejector pin's groove. The groove is measured by diameter (3 at right) and width (4 at right). The diameter is cut to ensure O-ring stretch of 0–10%. The depth is cut to ensure O-ring compression of 20–35%. Ensure the pin end before O-Ring groove is 0.030" (0,76 mm [5 at right]) MIN for steelsafe. Contact RJG® for assistance in sizing and tolerancing O-rings and installation requirements. Refer to the table below for RJG recommended, in-stock O-rings.

### 4. O-Ring Installation

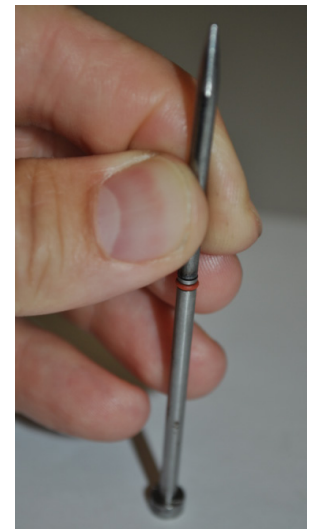
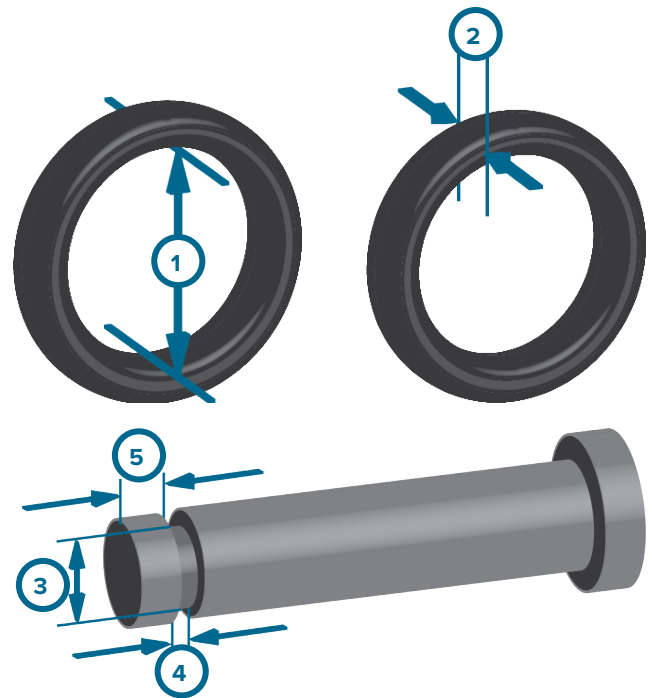
Improper O-ring installation can cause tears if it is pulled over the sharp ejector pin edge. Use an installation tool constructed of the same diameter as the ejector pin, with a tapered end.

The end can be ground, usually by a grinding wheel, and buffed by a wire wheel to remove any burrs. Slide the O-ring onto the tapered end of the installation tool, and then slide onto the end of the static pin. (Refer to figures at right.)

### 5. Pin and O-Ring Bore Installation

Use an O-ring lubricant to help prevent damage when inserting the pin into the bore. Many silicone-based lubricants can damage silicone O-rings. RJG, Inc. recommends P-80 THIX lubricant from International Products Corporation (<http://www.ipcol.com/shopexd.asp?id=31>). Rotate the pin as it is being inserted to ease installation and limit potential O-ring damage.

### STATIC (NON-MOVING) EJECTOR PINS



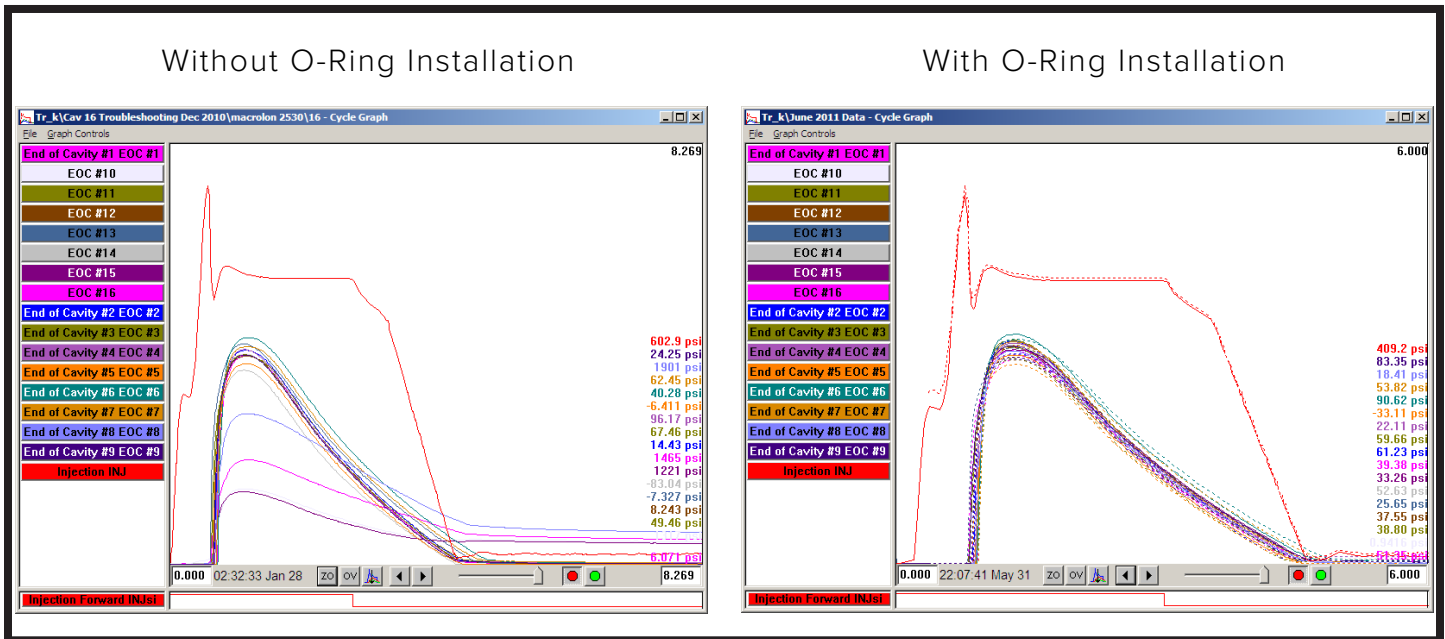
		O-RING		Units	GROOVE SPEC.				BORE SPEC.	
Nominal Pin Size	Material	Size (Metric)	RJG Part #		Width (4, above)	Width Tol (+/-)	Groove DIA (3, above)	DIA Tol (+/-)	Bore DIA	Bore Tol (+ Tol, -0)
4,0 mm	Silicone	2,7 x 0,65	85-6157-000	inches	0.038	0.003	0.1137	0.0019	0.1575	0.0005
2,5 mm		1,4 x 0,6	85-6159-000		0.032	0.003	0.0667	0.0010	0.0984	0.0005
4,0 mm		2,7 x 0,65	85-6157-000	mm	1,00	0,08	2,888	0,048	4,0	0,012
2,5 mm		1,4 x 0,6	85-6159-000		0,80	0,08	1,695	0,025	2,5	0,012



## NON-STANDARD INSTALLATIONS (continued)

### 6. Sensor Readings

Data from the same mold is pictured below (typical results—not guaranteed).



Above Left: Three sensors are reading too low due to contamination—without O-rings installed.

Above Right: The template and solid lines after four months of continuous production; the sensors continue to read consistently with O-rings installed.

Proper installation will provide a long service life of O-rings inside the mold. Only in the event of the following two instances will O-rings require replacement:

### 7. Flashing

If material flashes around the pin, it is necessary to pull the pin and remove the flashed material during regular preventative maintenance cycles. The O-ring must be replaced.

### 8. O-Ring Damage

When a pin is removed for inspection and/or cleaning during mold maintenance, inspect the O-ring for damage. Repeated installation and removal can cause nicks, cuts, or other damage to O-rings. Damaged O-rings must be replaced.

### MULTIPLE EJECTOR PINS

Ejector pins are often grouped in small areas that do not allow for traditional cavity pressure sensor installation. Read and follow all instructions, and refer to the provided figures to properly install sensors with multiple ejector pins.

#### 1. Multiple Ejector Pin and Sensor Placement

When multiple ejector pins are located too closely together to permit cavity pressure sensor placement under a single pin, a cover plate can be utilized to allow a selected pin to contact the sensor and prevent other pins from interfering.

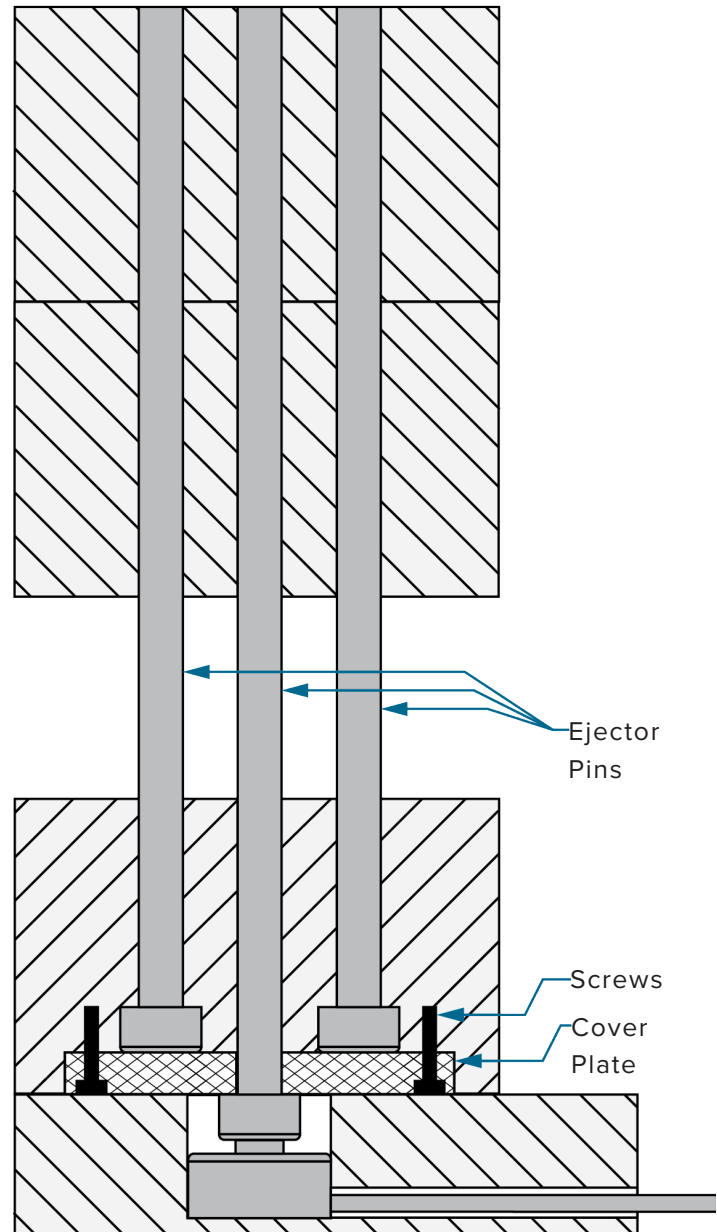
The ejector pin retainer plate is modified to fit the cover plate so that it is recessed and flush with the ejector plate, and covers the area of the sensor body and unused ejector pins. The cover plate is mounted with four screws.

The cover plate mounting screws must be flush with the ejector plate and must not be in contact with the ejector pins, since constant pressure on the screws will cause them to fail.

#### 2. Ejector Pin and Counter-Bore Clearance

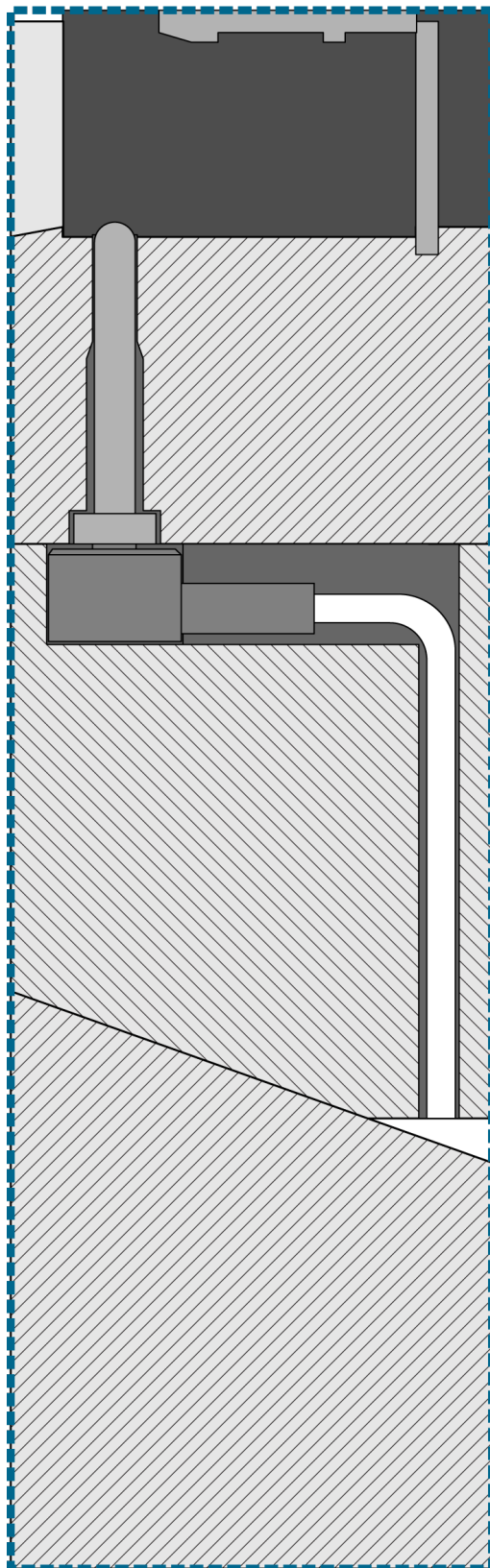
Always use standard ejector pin clearances when installing cavity pressure sensors under ejector pins to prevent damage or destruction of the pins, sensors, and mold. Proper ejector pin head and counter-bore clearance will allow the static pin to move freely in the ejector pin bore.

PIN, SENSOR, & PLATE INSTALLATION

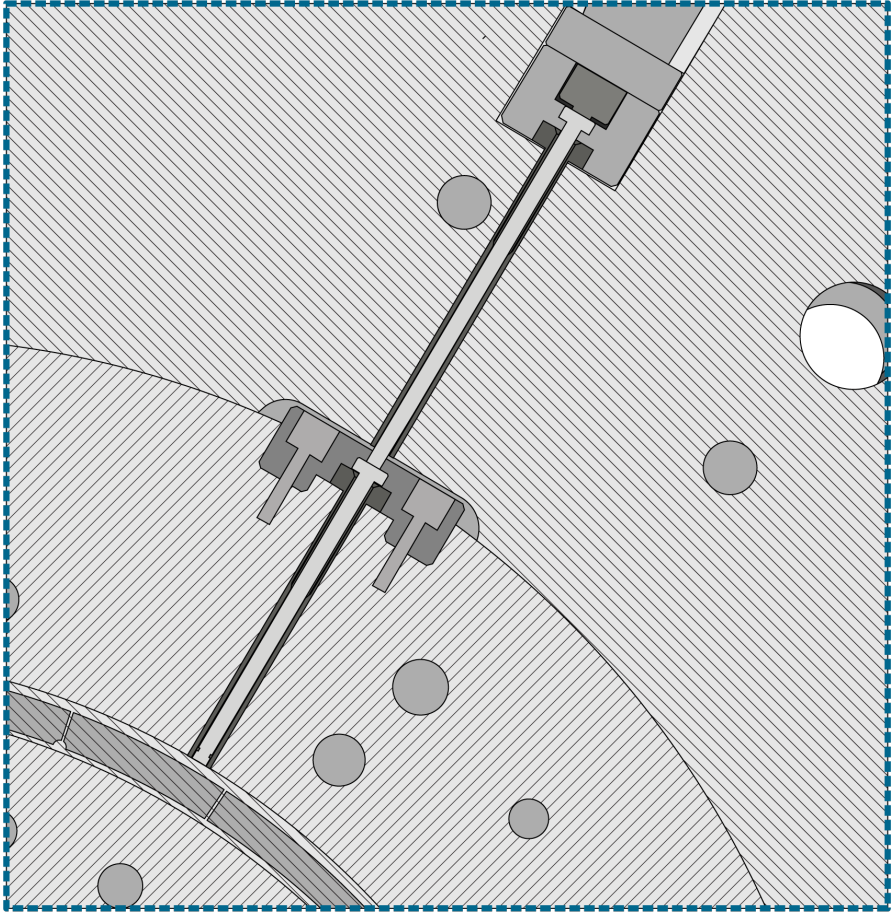
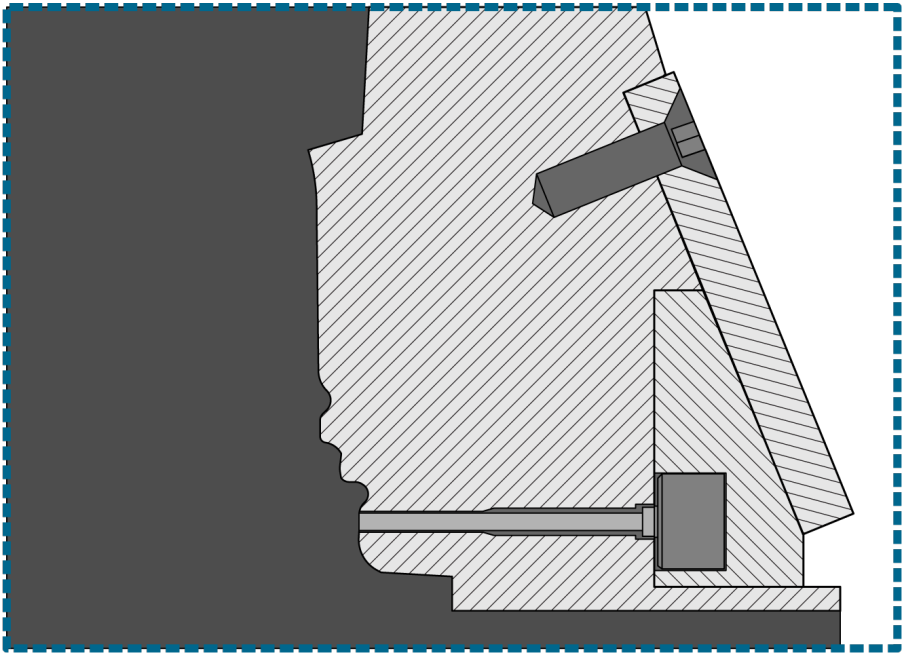


## NON-STANDARD INSTALLATIONS *(continued)*

### STATIC PIN EXAMPLE



NON-STANDARD INSTALLATIONS *(continued)*  
STATIC TRANSFER PIN EXAMPLES



## INSTALLATION VALIDATION

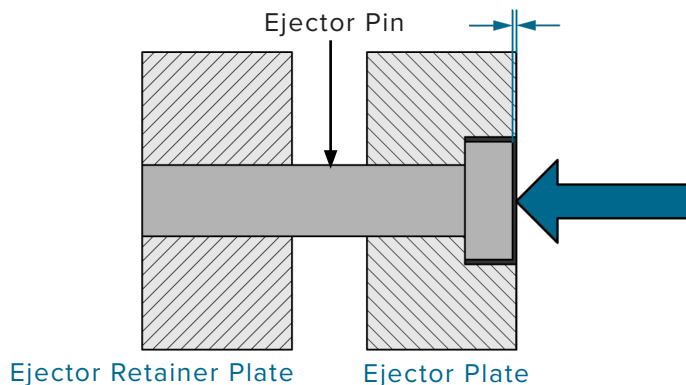
### SENSOR INSTALLATION CHECK—EJECTOR PLATE INSTALLATIONS

Verify that the each sensor, transfer pin, and ejector pin pocket is machined correctly.

#### PRE-ASSEMBLY CHECKS

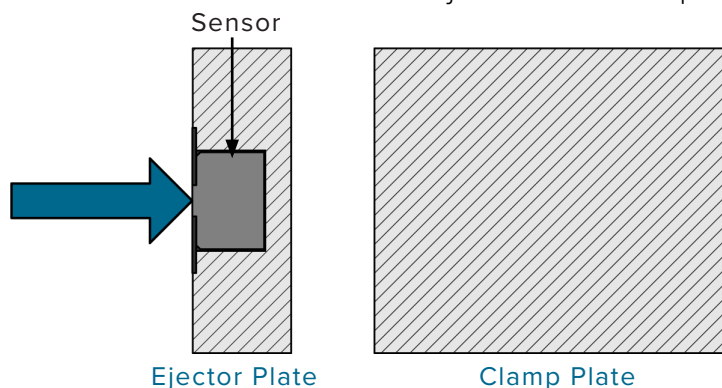
##### 1. Indentation Test (with Ejector Pin)

With the ejector pin installed, push on the ejector pin; verify the clearance of 0.012" (0,3 mm (or 1/5 part thickness)) exists between the bottom of the ejector pin head and the ejector plate surface.



##### 2. Flush Test (with Sensor)

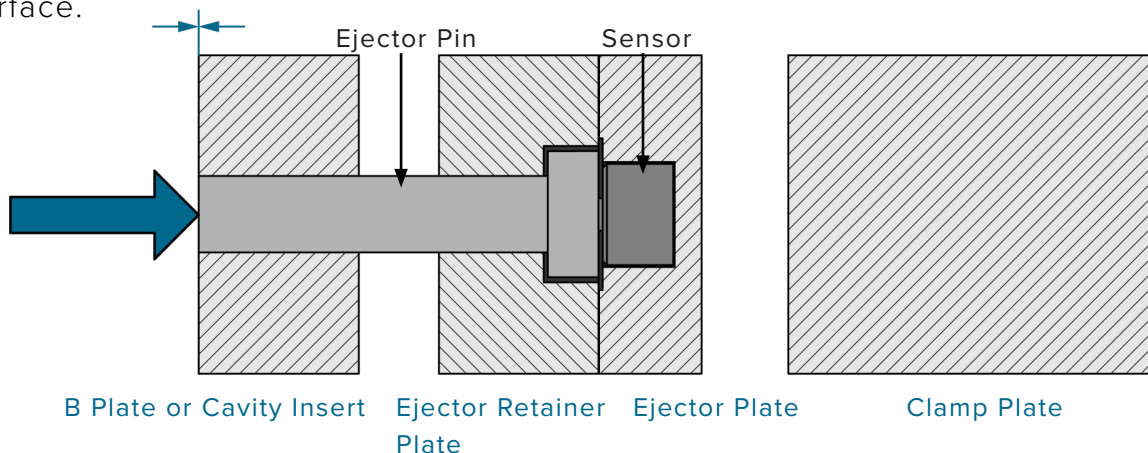
With the sensor installed in the ejector retainer plate, verify that the counterbore depth equals (0,5mm) (if needed) and the counterbore diameter is larger than the ejector pin head. The sensor head should be flush with the ejector retainer plate.



#### POST-ASSEMBLY CHECK

##### 1. Flush Test (Full Stack)

With the sensor and ejector pin installed, and the ejector plate in the injection position, fixed towards clamp plate, the ejector pin should be flush with the ejector plate/cavity surface.

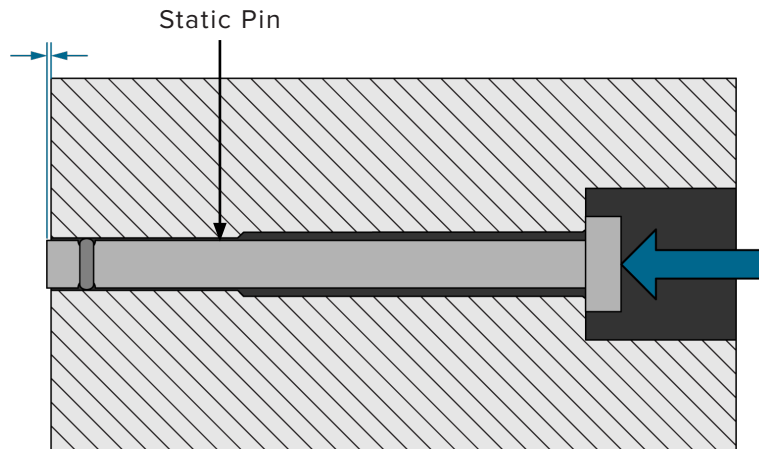


## SENSOR INSTALLATION CHECK—STATIC PIN INSTALLATIONS

Verify that the each sensor and static pin pocket is machined correctly.

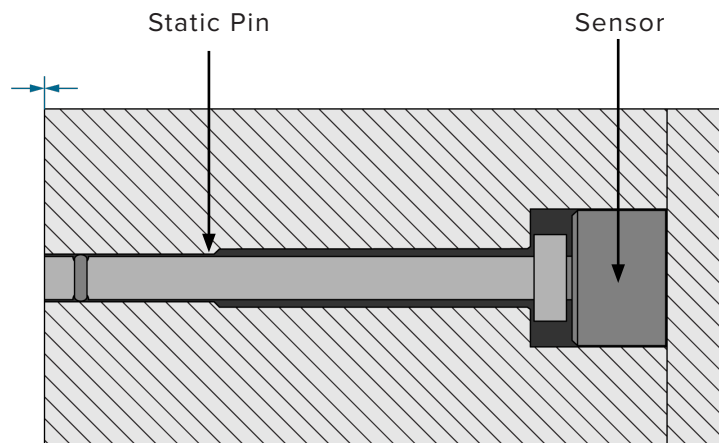
### 2. Protrusion Test (without sensor)

With only the static pin installed, push on the static pin; verify the pin protrudes clearance above the pin head equal to  $\frac{1}{5}$ th of the part thickness at pin location if part thickness is less than or equal to 0.06" (1,5 mm), or 0.012" (0,3 mm) if the part thickness at pin location is greater than 0.06" (1,5 mm).



### 3. Flush Test (with sensor)

With the plates disassembled, sensor and pin in place, and cover plate removed, the end of the static pin should be flush with the plate surface.





## MAINTENANCE

Strain gage sensors require little maintenance.

### CLEANING

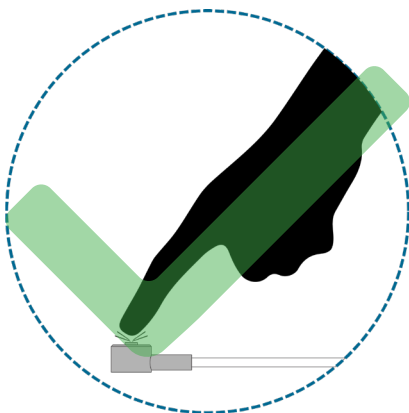
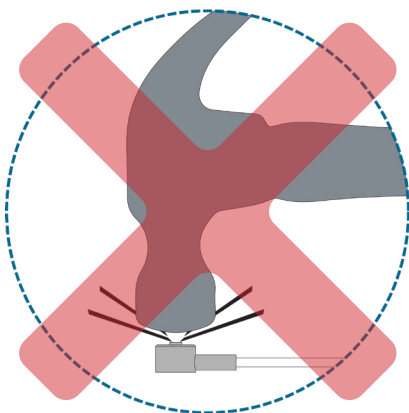
Pull sensors from the mold and clean out the pockets and channels when a mold is pulled for preventative maintenance. MCSG-50/250 sensors must be installed in pockets free from oil, dirt, grime, and grease.

### TESTING & CALIBRATION

#### TESTING SENSORS

Basic force tests are easily performed on the MCSG-50/250 sensor; a small, even amount of force applied to the sensor head loading nub is sufficient to determine if the sensor is correctly reading pressure.

**⚡ CAUTION** *NEVER strike the sensor head with excessive force; failure to comply will result in damage or destruction of sensor.*



RJG, Inc. offers the following tools to test sensors.

#### 1. Sensor PreCheck

The Sensor PreCheck provides diagnostics on typical sensor problems such as sensor drift, preload, and zero shift, and can also detect sensor installation errors caused by improper pocket dimensions, damaged wires, and damaged sensor heads. A test report with sensor configuration can be emailed or printed from the device. This device allows testing of up to thirty-two sensors at one time and can verify that a force was applied to the sensor.

#### 2. eDART Software—Raw Data Viewer

The eDART Raw Data Viewer displays the status of the sensor, either Valid, No Reply, Stale, or Invalid.

- A Valid sensor has raw counts that change when force is applied to the sensor; this indicates a properly working sensor.
- A No Reply sensor is not communicating with the eDART; the sensor may be unplugged.
- A Stale sensor indicates a sensor that is unused.
- An Invalid sensor will indicate a Failure of either Over-range (Ovrng) or Under-range (Undrng). The Ovrng indicates the sensor's calibration has changed too far in a positive direction, outside of the upper specification. The Undrng indicates that the sensor's calibration has changed too far in a negative direction, and the sensor may report a number below zero when load is applied.

### CALIBRATION

RJG's standard recommendation is that sensors be calibrated every year, but the need for regular calibration depends largely on the accuracy required for the application and the requirements of individual quality systems and industry regulations.

RJG sensors are designed to hold calibration for operating life. The vast majority stay within a 2% accuracy specification, which is sufficient for most customer applications.

### COMMON FACTORS AFFECTING SENSOR RECALIBRATION

#### 1. Required Application Accuracy

Some applications require more accuracy than others. If using cavity pressure control on a precise part with a narrow processing window, it may be important to maintain sensor calibration to within 1%.

If simply detecting short shots, calibration shifts of 5% or more may be tolerated. As a point of reference, a 2% calibration error means that a cavity pressure of 3,000 psi (207 bar) may read as low as 2,940 psi (203 bar), or as high as 3,060 psi (211 bar), which is insignificant in most applications. For most applications, calibration accuracy of 2% is more than sufficient, and is used by RJG as the specification for repaired sensors.

#### 2. Quality System Regulations

If US Food and Drug Administration (FDA) quality system requirements must be met, or those of other stringent quality systems, sensor calibration may be required. However, even in these cases, there is often flexibility to adjust guidelines to meet the needs of the application.

#### 3. Sensor Cycle Count

In the most aggressive environments, it takes at least 100,000 cycles for a sensor to show significant calibration errors. In more typical applications, calibration will remain stable for 500,000–1,000,000 cycles. Even then, many sensors in the field with multiple millions of cycles show little calibration shift. If a sensor is in a low volume mold that sees fewer cycles, the need for sensor recalibration is minimized.

#### 4. Sensor Load

The higher the peak load on the sensor, the more the loading nub can wear—and the higher the potential for calibration shift. Low force sensors show less calibration shift than high force sensors; sensors that run at the lower end of their force range (less than 40% of full scale) show less calibration shift than sensors that run at the high end of their range.



## TESTING & CALIBRATION *(continued)*

### 5. Sensor Operating Temperature

The higher the mold temperature, the greater the potential for calibration shift. Below 212 °F (100 °C), calibration usually remains stable. Sensors running at 300–400 °F (150–200 °C) have a greater potential for permanent calibration shift over time.

### 6. Visible Sensor Wear

It is normal for the loading nub to show some wear. However, if the wear pattern exceeds half the diameter of the loading nub, the sensor calibration is more likely to have shifted significantly.

### 7. Sensor Zero Offset Shift

The zero offset is the reading of the sensor with no load applied. While not directly related to the sensor calibration, the zero offset does provide indication that the sensor's calibration may be suspect.

### 8. Abnormal Readings

A sensor reading abnormally high or low relative to template or to other sensors can be an indication of a calibration shift. Before sending the sensor back, check for other more common causes of erroneous readings, such as incorrect sensor pocket dimensions, sensor preload, contamination in the sensor pocket, and binding ejector pin due to misalignment, debris/contamination, or galling.

## WARRANTY

### RJG, INC. STANDARD THREE-YEAR WARRANTY

RJG, Inc. is confident in the quality and robustness of the MCSG-50/250 cavity pressure sensors, and so are offering a three-year warranty on all RJG strain gage and piezoelectric cavity pressure sensors. RJG's cavity pressure sensors are guaranteed against defects in material and workmanship for three years from the original ship date. The warranty is void if it is determined that the sensor was subjected to abuse or neglect beyond the normal wear and tear of field use, or in the event the sensor has been opened by the customer. This new warranty policy is the most generous offered in the cavity pressure sensor industry, with one year being the most common.

### PRODUCT DISCLAIMER

RJG, Inc. is not responsible for the improper installation of this equipment, or any other equipment RJG manufactures.

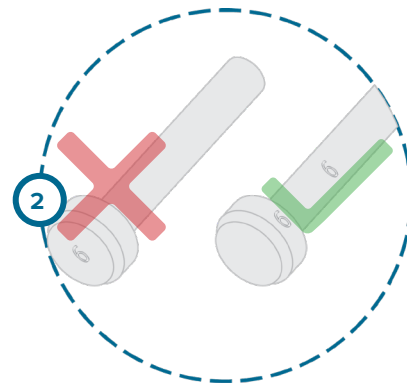
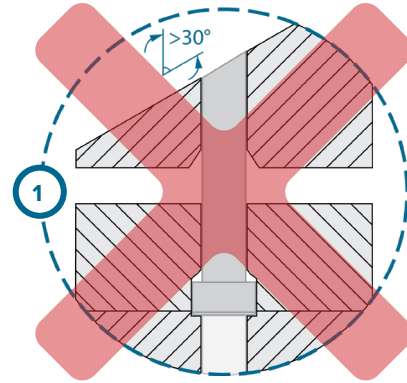
Proper RJG equipment installation does not interfere with original equipment safety features of the machine. Safety mechanisms on all machines should never be removed.

[illegible]

### INSTALLATION ERRORS

#### EJECTOR PIN ISSUES

1. Pin size, expected pressure, and/or expected temperature not appropriate for selected sensor.
  - Refer to “Sensor and Ejector Pin Size” on page 2.
2. Ejector pin is located behind mold surface with angle greater than  $30^\circ$  (1 at right).
  - Angles greater than  $30^\circ$  cause excessive side-load friction and influence sensor accuracy.
3. Pin is engraved on head (2 at right).
  - Pin heads must remain flat. Engrave pins on the side if necessary.

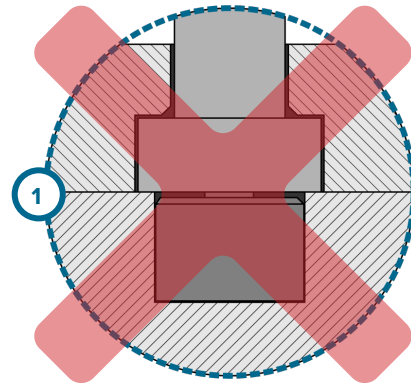


## INSTALLATION ERRORS (continued)

### SENSOR HEAD ISSUES

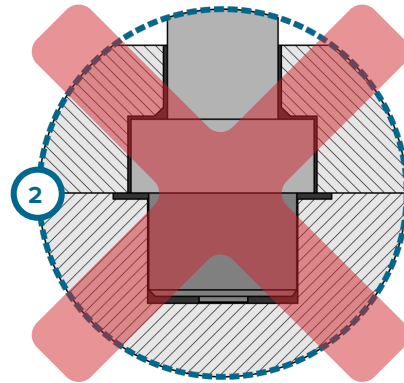
1. Ejector Pin head diameter is larger than sensor pocket diameter (1 at right).

- Counterbore the ejector plate, or chamfer the pin head to ensure that the pin rests only on the sensor nub.



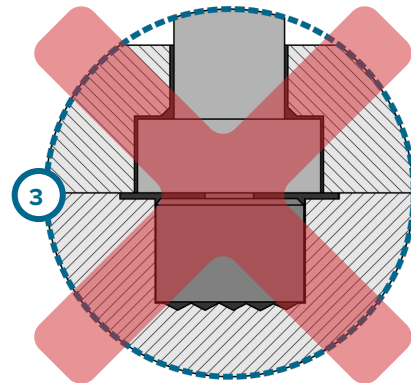
2. Sensor head is installed incorrectly (2 at right).

- The sensor nub must face the ejector pin. DO NOT install the sensor head upside-down.



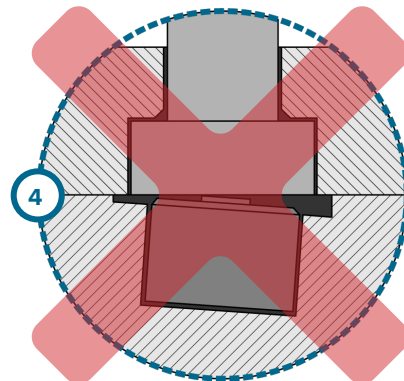
3. Sensor pocket surface is not smooth (3 at right).

- The mold surface must have a finish of  $\sqrt{32}$  or better; the sensor pocket must have a smooth surface.



4. Sensor and ejector pin are not perpendicular (4 at right).

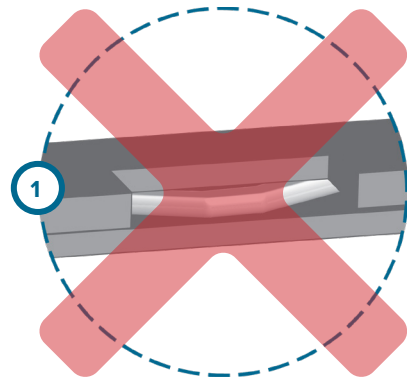
- The sensor and ejector pin must be perpendicular.



## INSTALLATION ERRORS *(continued)*

### CASE AND CABLE ISSUES

1. Sensor cable is pinched during mold assembly (1 at right).
2. Sensor case is mounted on surface that exceeds temperature rating.
  - Do not mount the Lynx case on surface that exceeds the recommended temperature rating. Contact RJG, Inc. Customer support for high-temperature applications.



CUSTOMER SUPPORT

Contact RJG’s Customer Support team by phone or email.

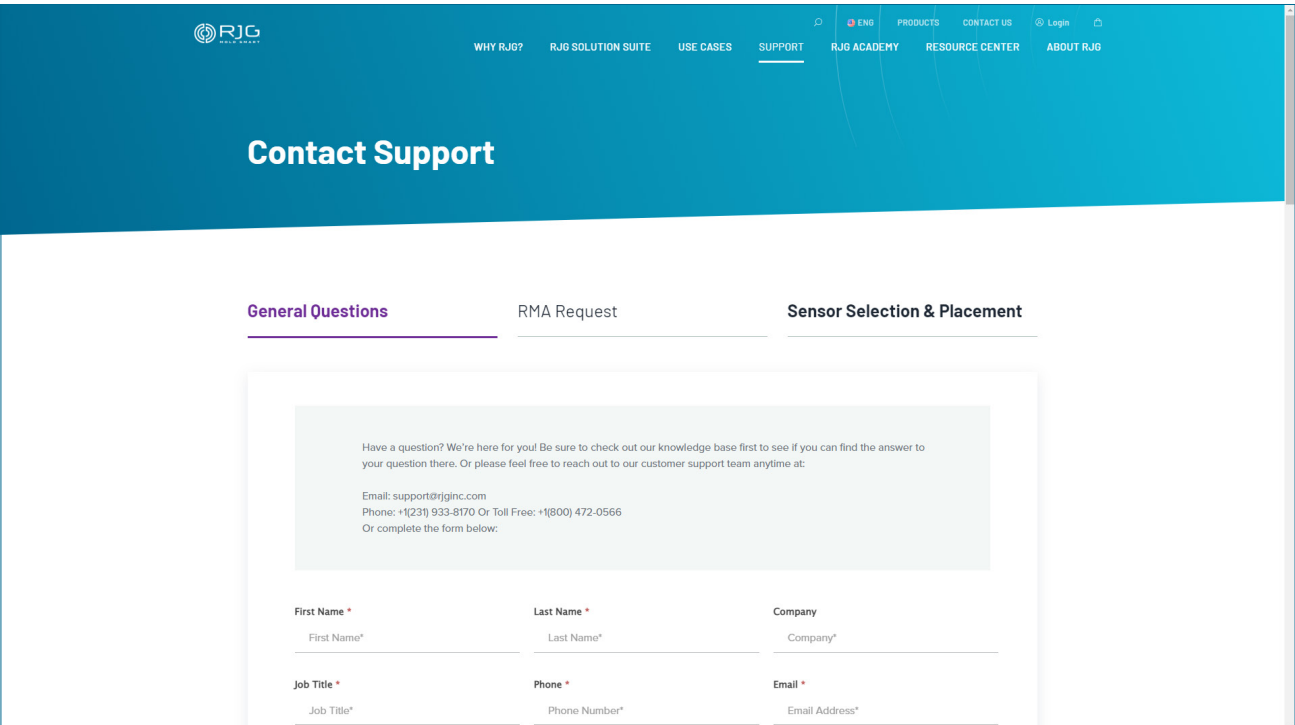
RJG, Inc. Customer Support

P: 800.472.0566 (Toll Free)

P: +1.231.933.8170

email: support@rjginc.com

[www.rjginc.com/support](http://www.rjginc.com/support)



## RELATED PRODUCTS

### COMPATIBLE PRODUCTS

The MCSG-50/250 are designed to be used as a system with the following RJG, Inc. products and the eDART or CoPilot process control and monitoring systems.

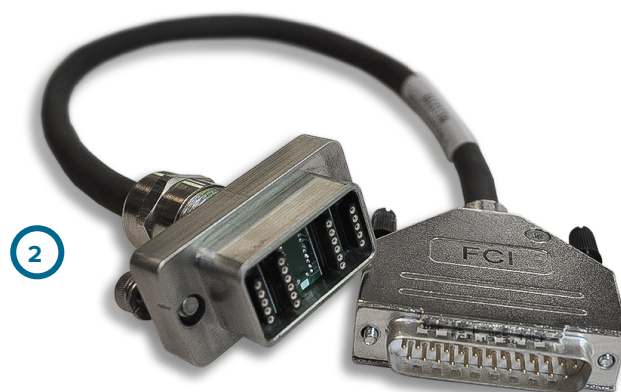
#### LYNX STRAIN GAGE EIGHT-CHANNEL SENSOR PLATE SG-8

The Lynx strain gage eight-channel sensor plate SG-8 (1 at right) mounts to the mold, providing a single connection from eight MCSG-50/250 sensors in the mold to the eDART or CoPilot systems.



#### C-SG/LX8-S-0.5/1M/2M

The Lynx strain gage eight-channel connection cable C-SG/LX8-S-0.5/1M/2M (2 at right) connects the Lynx strain gage eight-channel sensor plate SG-8 to the Lynx eight-channel strain gage adapter with mold ID SG/LX8-S-ID; available in 0,5, 1,0, and 2,0-meter (1.5, 3.0, and 6.0') lengths.



#### LYNX STRAIN GAGE EIGHT-CHANNEL ADAPTER WITH MOLD ID SG/LX8-S-ID

The Lynx eight-channel strain gage adapter with mold ID SG/LX8-S-ID (3 at right) interfaces the MCSG-50/250 line of sensors to the eDART or CoPilot systems.



### SIMILAR PRODUCTS



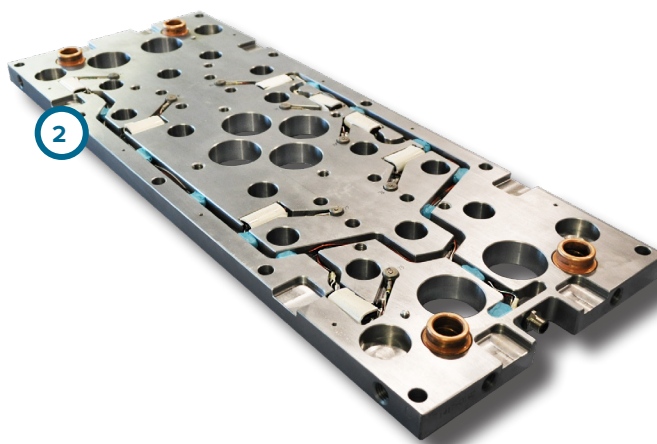
RJG, Inc. offers a wide array of cavity pressure sensors for each application—strain gage, single-channel, multi-channel, and digital.

## LYNX MULTI-CHANNEL STRAIN GAGE SENSORS

The Lynx multi-channel strain gage sensors MCSG-125/500/2000 (1 at right) provide the same strain gage technology and indirect installation as the MCSG-50/250 sensors, but with a 0.50" (12,7 mm) footprint and pressure thresholds of 125 lb. [0.56 kN], 500 lb. [2.22 kN], and 2,000 lb. [8.90 kN].

## LYNX EMBEDDED SENSORS

The Lynx embedded sensors (2 at right) LES-B-127-50/125/500/2000 electronics and heads are embedded into the clamp plate, eliminating outside cabling. Each plate includes a single connector that accommodates up to twenty-four sensors. Designed exclusively for use with the RJG eDART System, all sensors are fully functional and properly named with a single cable connection from the mold to the eDART process control and monitoring system.







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[www.caepero.co.kr](http://www.caepero.co.kr)