Honeywell

2213 Contacting Caliper

Applications Manual

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2213 Contacting Caliper Applications

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Introduction

This manual provides a better understanding of the 2213 Caliper product line by describing each caliper configuration and giving some application advice to assist in making good decisions when ordering parts.

The recommendations work for the majority of mills, but there are always exceptions. In some instances, it may be necessary to deviate from these recommendations to find something that works best for your process.

Audience

This manual is intended for use by Honeywell process technicians and service staff and assumes that the reader has some knowledge of the operation of a paper machine.

Related reading

The following documents contain related reading material.

Honeywell P/N	Document Title / Description
44081300	*Model 2213-XX Bellows Caliper Sensor Manual* (MXOpen)
46000180	*2213 Unifoil Caliper Sensor User's Manual*
46020201	*Precision Caliper Sensor User's Manual* (Da Vinci)

Model 2213-XX Bellows Caliper Sensor Manual (p/n 44081300) is the manual for the original round-button 2213 contacting caliper sensor released in the

late 1980s. It has in-depth sections on operation, calibration, and maintenance as it applies to installation in an MXOpen system.

Unifoil (Precision) square-button 2213 caliper was released in the 1990s. *2213 Unifoil Caliper Sensor User's Manual* (p/n 46000180) is the reference for this version of caliper. Round-button and square button caliper operation is very similar. This manual is supplementary to 44081300.

Precision Caliper Sensor User's Manual (p/n 46020201) describes the use of 2213 caliper in a Da Vinci system. It does not contain much information about physical operation or maintenance.

Conventions

The following conventions are used in this manual:

NOTE: Text may appear in uppercase or lowercase except as specified in these conventions.

`Boldface` `Special Type`	Boldface characters in this special type indicate your input. Characters in this special type that are not boldfaced indicate system prompts, responses, messages, or characters that appear on displays, keypads, or as menu selections.
Italics	In a command line or error message, words and numbers shown in italics represent filenames, words, or numbers that can vary; for example, filename represents any filename. In text, words shown in italics are manual titles, key terms, notes, cautions, or warnings.
Boldface	Boldface characters in this special type indicate button names, button menus, fields on a display, parameters, or commands that must be entered exactly as they appear.
lowercase	In an error message, words in lowercase are filenames or words that can vary. In a command line, words in lowercase indicate variable input.
Type	Type means to type the text on a keypad or keyboard.
Press	Press means to press a key or a button.

[ENTER] or **[RETURN]**	**[ENTER]** is the key you press to enter characters or commands into the system, or to accept a default option. In a command line, square brackets are included; for example: **SXDEF 1 [ENTER]**
[CTRL]	**[CTRL]** is the key you press simultaneously with another key. This key is called different names on different systems; for example, **[CONTROL]**, or **[CTL]**.
[KEY-1]-KEY-2	Connected keys indicate that you must press the keys simultaneously; for example, **[CTRL]-C**.
Click	Click means to position the mouse pointer on an item, then quickly depress and release the mouse button. This action highlights or "selects," the item clicked.
Double-click	Double-click means to position the mouse pointer on an item, then click the item twice in rapid succession. This action selects the item "double-clicked."
Drag X	Drag X means to move the mouse pointer to X, then press the mouse button and hold it down, while keeping the button down, move the mouse pointer.
Press X	Press X means to move the mouse pointer to the X button, then press the mouse button and hold it down.
	The information icon appears beside a note box containing information that is important.
	The caution icon appears beside a note box containing information that cautions you about potential equipment or material damage.
	The warning icon appears beside a note box containing information that warns you about potential bodily harm or catastrophic equipment damage.

Honeywell, Vancouver Operations part numbers

Honeywell, Vancouver Operations assigns a part number to every manual. Sample part numbers are as follows:

6510020004

6510020048 Rev 02

The first two digits of the part number are the same for all Honeywell, Vancouver Operations products. The next four digits identify part type. Type numbers 1002 designates technical publications. The next four digits identify the manual. These digits remain the same for all rewrites and revision packages of the manual for a particular product. Revision numbers are indicated after the Rev.

1. Caliper Configurations

1.1. Round button

The round-button caliper is the oldest version of this sensor and was released in the 1980s (see Figure 1-1). It is identified by a round button attached to a metal arm (or ski). The U-core is always oriented in the machine direction (MD).

Figure 1-1 Round-Button Caliper Barrel (Upper)

When ordering this caliper assembly, there are several options available.

1.1.1. Hard or soft bellow

Two versions of bellow exist for this assembly. Both are made of a nitrile rubber and the difference is the thickness of the rubber walls. The soft bellows are more flexible, the hard bellows are more rigid. The choice in bellow type depends on your process.

- Soft bellows will be more responsive to perturbations in the paper but may not provide adequate lateral stability while scanning.
- Hard bellows are less responsive, but offer improved lateral stability and are more rugged due to their thicker walls.

1.1.2. Bare or sapphire layered lower ferrite button

The button on a 2213 upper caliper assembly is always made of sapphire. The lower button is made of a ceramic ferrite. There are two options for the lower button:

- Bare Ferrite
- Bare Ferrite with a layer of sapphire on top

Bare ferrite is applicable to non-abrasive product.

When a thin piece of sapphire is glued onto the ferrite it provides a surface that is more resistant to abrasion and also has a lower coefficient of friction than bare ferrite (that is less buildup).

The choice is entirely a matter of life span. Use bare ferrite whenever possible because bare ferrite has higher measurement sensitivity than the sapphire-layered ferrite. See Figure 1-2. The caliper sensor generates an oscillation frequency that increases with thickness. For thin product, the slope of the response curve is high which means that small changes in product thickness result in large changes in oscillation frequency. As the product thickness increases, however, the slope of this curve decreases and the sensor becomes less sensitive. The presence of sapphire on the lower button means the sensor starts at a less sensitive section of the curve. For a typical sapphire thickness of 0.010”, caliper sensitivity is reduced by a factor of six compared to bare ferrite.

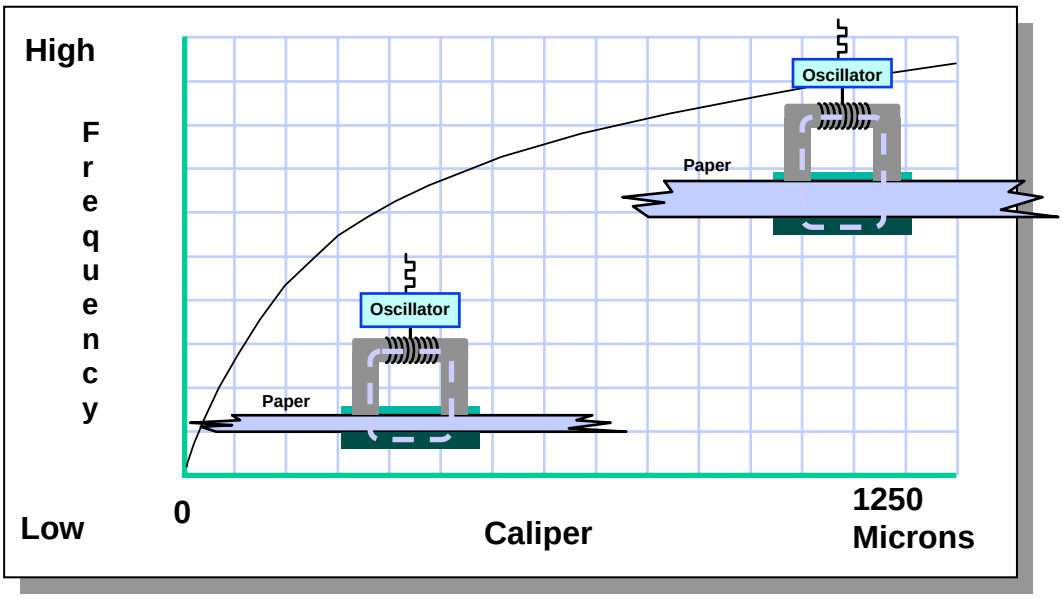


Figure 1-2 Caliper Sensitivity vs. Thickness

1.1.3. Protector ring

In some variations of the round-button caliper, there is a protector ring (see Figure 1-3) on the arm assembly that helps shield the bellows from situations where the paper may come in contact and be damaged due to sheet curl or other perturbations.

Figure 1-3 Round-button lower caliper barrel with protector ring

1.1.4. Fixed upper

In a small subset of applications, you may prefer a fixed upper assembly in which there is no arm or bellow (Figure 1-4). This type of configuration is normally applied to heavy board recycled products. If you order a Model 2213-08 sensor, the upper button is fixed rather than actuated and the lower arm can be actuated at much higher pressures than for the standard sensor as it contains a higher pressure regulator and a high pressure gauge. Large actuation pressure is used to self clean the buttons.

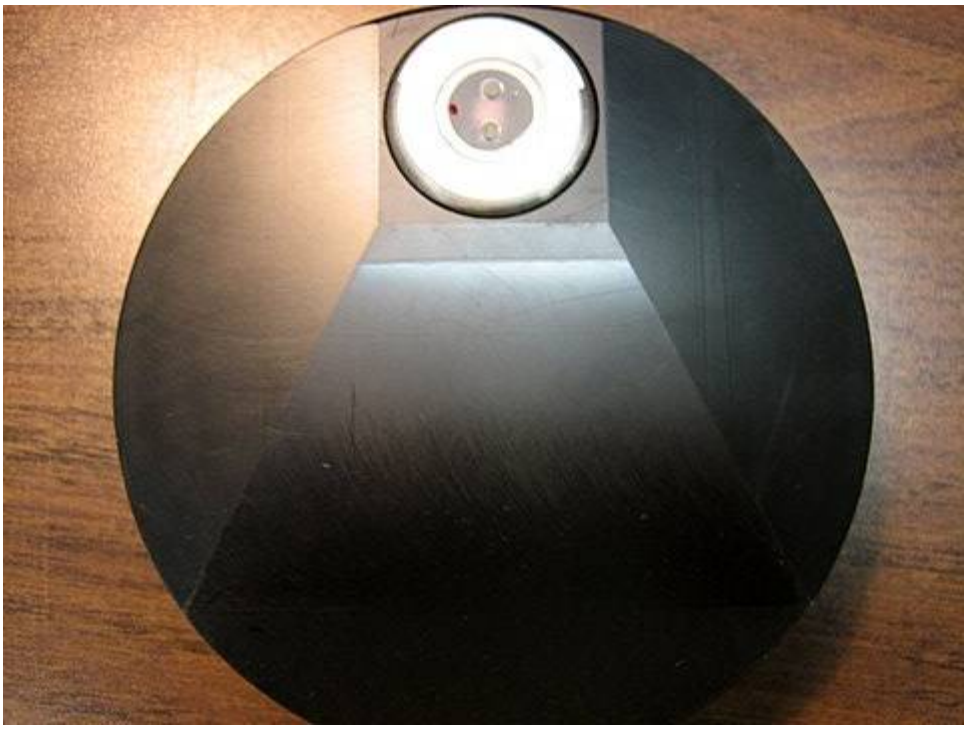


Figure 1-4 Fixed round-button barrel assembly (upper)

1.2. Unifoil

The Unifoil version of the 2213 contacting caliper sensor was released in 1990 (see Figure 1-5). It is identified by a square button in the upper and lower assemblies, attached to Mylar arms (or skis). The upper button has an aerodynamic groove in the middle that works to keep the button firmly against the paper during measurement.

Figure 1-5 Unifoil Caliper Barrel (Upper)

When ordering this caliper assembly, there are several options available.

1.2.1. Hard or soft bellow

The options for bellow type are the same as for the round-button caliper. See Subsection 1.1.1 for more details.

1.2.2. Bare ferrite or sapphire layered lower ferrite button

Similar to the round-button caliper, you have an option to use bare ferrite for the lower button, or to have a layer of sapphire on top of the ferrite surface. The benefits of each option are the same as the round-button caliper. See Subsection 1.1.2.

1.2.3. MD or CD U-core orientation

Unlike the round-button caliper whose U-core orientation is always in the MD direction, the Unifoil provides both options (MD or CD).

- CD U-core orientation has the highest sensitivity for caliper measurement. It is also slightly more sensitive to XY misalignment (due to the poles being close to the edge of the lower ferrite button) and slightly more susceptible to buildup and sheet damage due to the exposed pole pieces.

- MD U-core orientation means the poles are recessed inside the aerodynamic groove of the button. This reduces measurement sensitivity by a factor of three, but is less sensitive to XY misalignment, buildup, and sheet damage.

In most case, CD U-core orientation is preferred, due to its higher sensitivity.

1.3. Released specials

There are a number of released caliper specials that have been developed to address unique field issues.

1.3.1. Grounded upper caliper barrel (Unifoil)

The grounded upper caliper barrel is used for applications where static at the sheet is affecting the caliper measurement. A precursor to using this gauge is to implement proper static drain wires up sheet from the scanner. If these static drains do not eliminate the caliper measurement issue, then a grounded barrel may help.

The grounded barrel attaches a Litz wire from the U-core electrical windings to a small spring loaded stainless steel ball that is located on the outer circumference of the barrel (see Figure 1-6). This ball makes contact with the scanner sheet guide and provides a grounding path for the U-core.

NOTE: Shave off the anodization on the sheet guide where the ball plunger comes in contact. Anodization acts as an electrical insulator and the grounding will not work.

Figure 1-6 Grounded Caliper Barrel with spring loaded ball bearing (upper)

1.3.2. Diamonex coated lower ferrite button (Unifoil)

For applications where extreme buildup is an issue, a Diamonex-coated lower button assembly is available (upper buttons are always sapphire). This coating is only several microns in thickness. While it offers a lower coefficient of friction and a slightly higher hardness rating compared to sapphire, it will not last nearly as long when measuring abrasive product. Figure 1-7 illustrates the relative hardness of bare ferrite, sapphire, and Diamonex.

- Diamonex-coated assemblies are ideal for non-abrasive products where buildup is an issue.
- Both hard and soft bellow options are available.

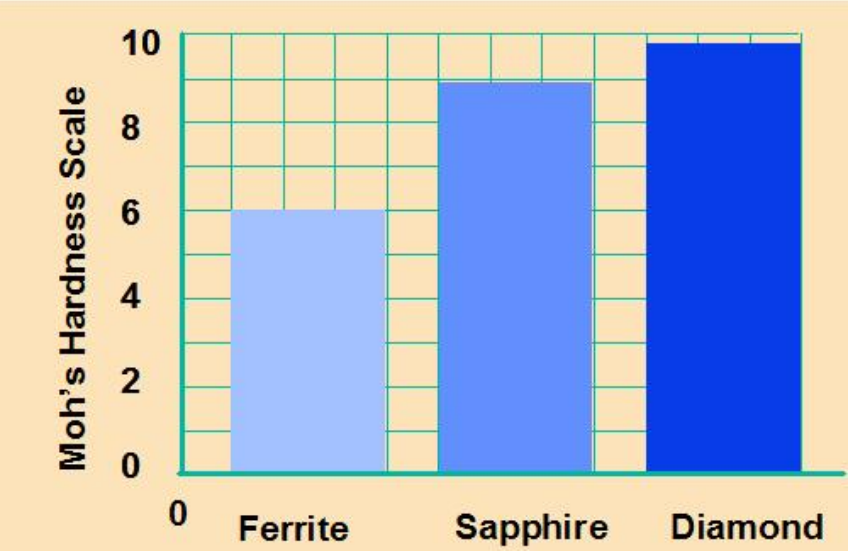


Figure 1-7 Hardness of Ferrite, Sapphire, and Diamonex

1.3.3. Tunnel caliper (round button)

The tunnel caliper has a very light touch and is designed for delicate sheets. It is a round-button caliper with oversized button and soft lead-in, along with a plastic interface between the arm and the bellow (see Figure 1-8, item 9) that has an aerodynamic tunnel to provide stability. The disadvantage is that in some instances the caliper is so light it gives erroneous readings. This is not a good option other than for exceptional circumstances. The plastic tunnel interface is available in both the upper and lower arm assemblies.

To further lessen the impact onsheet, you have the option of a U-core assembly in which the poles are flush with the sapphire surface, or to have the U-core recessed 0.010" (sapphire covers the U-core poles) that provides a uniform and smooth sapphire surface on the upper button to minimize sheet damage and dirt build up. In most cases, a recessed version of this assembly is recommended.

Hard bellow is the only option for this special.

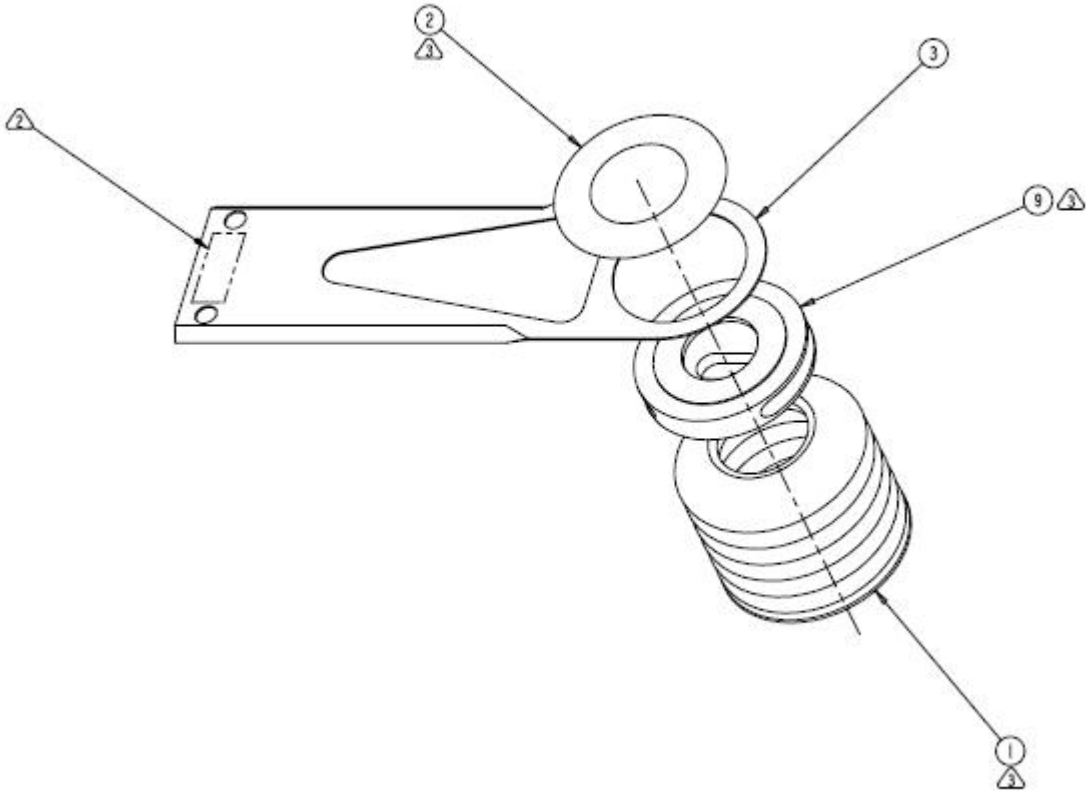


Figure 1-8 Arm assembly for a tunnel caliper

1.3.4. Fastback caliper (modified round-button)

The fastback caliper is used to minimize buildup on the sensor surface and is designed to operate at high pressures on recycled Kraft product. It has a smaller button area and modified shape that aids in the self cleaning of the buttons, especially when dirt tails begin to build upstream of the caliper button.

Both recessed and flush U-core versions are available (same option as the Tunnel caliper). This can only be used with hard bellows and the recessed U-core option is almost always preferred. Figure 1-9 illustrates the specially-designed button shape for this assembly.

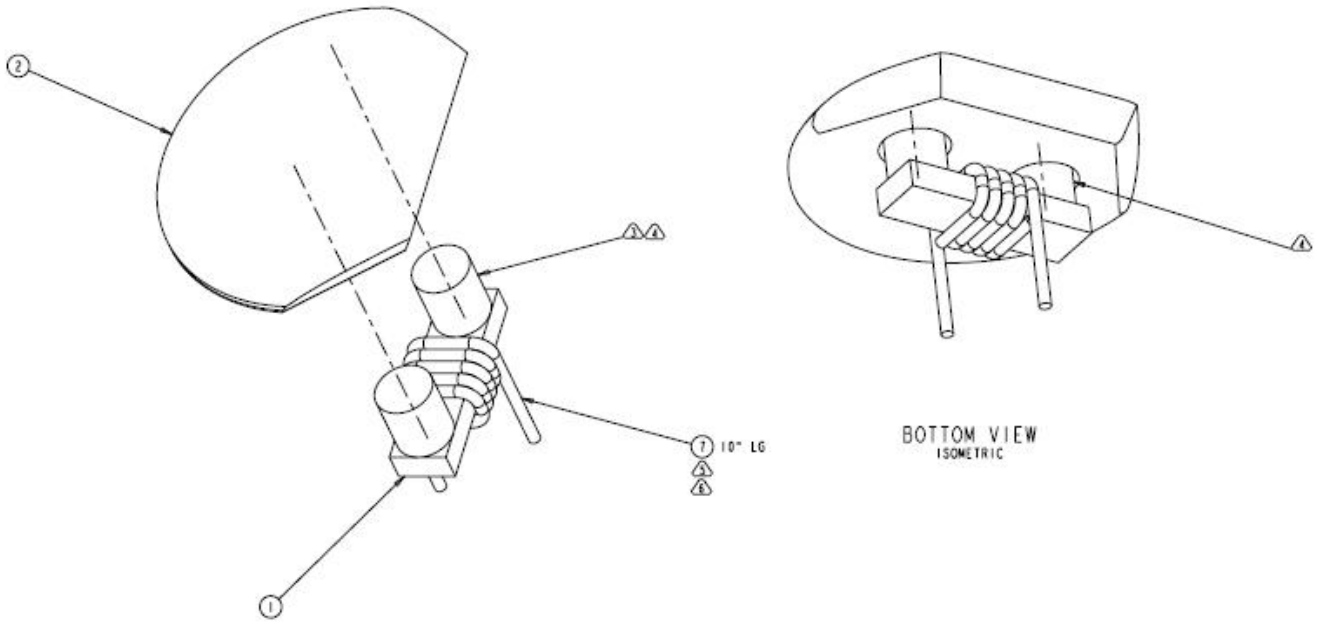


Figure 1-9 Fastback caliper button design

1.3.5. EPDM and HNBR bellows

Model 2213 caliper bellow lifetime, in most environments, is expected to be longer than one year. In some cases, premature failure may occur. This could be due to a number of reasons. Follow the troubleshooting steps as outlined in Chapter 3. If you follow the troubleshooting steps and still suffer from bellow failures, there are two additional bellow materials available that could improve longevity.

1.3.5.1. EPDM

EPDM was the material used for the 2213 caliper bellow prior to the solvent-resist version that came out several years ago. It is made of a slightly softer Nitrile rubber than the current material. EPDM bellows are recommended for mills that notice their current bellows getting hard and/or brittle in certain locations, eventually leading to cracking and the creation of holes. EPDM bellows are *not* recommended for sites that use a caliper cleaner because of frequent and large scale exposure to kerosene. EPDM bellows are offered in both soft and hard versions and can operate up to a temperature of 120° C.

1.3.5.2. HNBR

HNBR is a new material that offers a higher maximum temperature specification (up to 150° C) and greater resistance to chemical exposure compared to EPDM or the current material. The rubber is slightly stiffer than the current bellow and is only offered in the soft version. Expect a soft HNBR bellow to behave like a hard bellow made from the current solvent-resist material.

EPDM and HNBR bellows are only available for a limited number of arm and barrel assemblies. If your assembly is not listed in Chapter 2, order it through Honeywell Specials. Specify the original 08 part number and indicate which bellow material you would like to use

- Soft EPDM → Honeywell p/n 6553200008
- Hard EPDM → Honeywell p/n 6553200007
- Soft HNBR → Honeywell p/n 6553200009.

Due to variable conditions at the mill, try both types of bellow material to see which type performs better.

2. Assembly Numbers

2.1. Round-button caliper

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Button	Lower Button
09221302	General Purpose - Hard Bellows - No Sapphire (lower)	08388901	08389001	08505102	08505103	08346800	08345400
09221304	General Purpose - Hard Bellows - 0.02” Sapphire (lower)	08388901	08436700	08505102	08505105	08346800	08435700
09221305	- Hard Bellows - 0.02” Sapphire (lower) - Protect Ring (upper / lower)	08436400	08436500	08505107	08505106	08435400	08435500
09221308	High Pressure Caliper - Fixed Upper - Protect ring (lower) - Hard Bellows (lower) - 0.01” Sapphire (lower)	08500301	08650800	08500501	08543100	08500601	08543200
09221309	General Purpose - Protect Ring (upper / lower) - Hard Bellows (upper / lower) - 0.01” Sapphire (lower)	08542600	08543000	08542800	08543100	08542900	08543200

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Button	Lower Button
09221310	General Purpose - Soft Bellows (upper / lower) - No Sapphire (lower)	08542601	08389000	08505100	08505101	08346800	08345400

Note: The part numbers in the columns labeled Upper and Lower caliper will include all the actuation, electronics, air regulators, and mounting chassis for that upper or lower assembly. To order the entire sensor (both upper and lower) you would use the Sensor part number 092213XX.
Note: When ordering the lower or upper round button assemblies, you don't receive the metal arm. You need to order an entire barrel assembly to get this.

2.2. Unifoil caliper

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm
09221311	General Purpose - Soft Bellows (upper / lower) - No Sapphire (lower) - CD U-Core	08542602	08543001	08713500	08713200	08713700	08713100
09221312	General Purpose - Hard Bellows (upper / lower) - No Sapphire (lower) - CD U-Core	08542603	08543004	08713501	08713201	08713701	08713101
09221313	General Purpose - Soft Bellows (upper / lower) - 0.01" sapphire (lower) - CD U-Core	08542602	08543003	08713500	08713202	08713700	08713102
09221314	General Purpose - Hard Bellows (upper / lower) - 0.01" sapphire (lower) - CD U-Core	08542603	08543002	08713501	08713203	08713701	08713103
09221315	General Purpose - Soft Bellows (upper / lower) - No sapphire (lower) - MD U-Core	08649900	08543001	08713600	08713200	08713800	08713100
09221316	General Purpose - Hard Bellows (upper / lower) - No sapphire (lower) - MD U-Core	08649901	08543004	08713601	08713201	08713801	08713101

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm
09221317	General Purpose - Soft Bellows (upper / lower) - 0.01” sapphire (lower) - MD U-Core	08649900	08543003	08713600	08713202	08713800	08713102
09221318	General Purpose - Hard Bellows (upper / lower) - 0.01” sapphire (lower) - MD U-Core	08649901	08543002	08713601	08713203	08713801	08713103

2.3. Released specials

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm	Application
Unifoil	Grounded Upper Barrel - CD U-Core - Soft Bellows			08713502		08737200		Static Issues
Unifoil	Grounded Upper Barrel - CD U-Core - Hard Bellows			08713503		08737201		Static Issues
Unifoil	Grounded Upper Barrel - MD U-Core - Soft bellows			08713602		08737300		Static Issues
Unifoil	Grounded Upper Barrel - MD U-Core - Hard Bellows			08713603		08737301		Static Issues
Round Button	Grounded Upper Barrel U-Core Flush Soft Bellows			08759000		08758900		Static Issues
Round Button	Grounded Upper Barrel U-Core Flush Hard Bellows			08759001		08758901		Static Issues

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm	Application
Round Button	Grounded Upper Barrel U-Core Recessed Soft Bellows			08759002		08758902		Static Issues
Round Button	Grounded Upper Barrel U-Core Recessed Hard Bellows			08759003		08758903		Static Issues
Unifoil	Diamonex Coated Lwr - Soft Bellows				08713204		08713104	Extreme Buildup Non Abrasive Sheet
Unifoil	Diamonex Coated Lwr - Hard Bellows				08713205		08713105	Extreme Buildup Non Abrasive Sheet
Round Button	Fixed Lower - No Sapphire				08741101		08741001	- Reduction in tearing (when used with upper tunnel caliper). - Normal Configuration
Round Button	Fixed Lower - 0.01" Sapphire				08741100		08741000	- Reduction in tearing (when used with upper tunnel caliper). - Rare Configuration
Round Button	Tunnel Caliper - Hard Bellows - No Sapphire (Lower) - U-Core Recessed			08738800	08738600	08738700	08738500	- Light Touch - Delicate Sheet - Normal Configuration

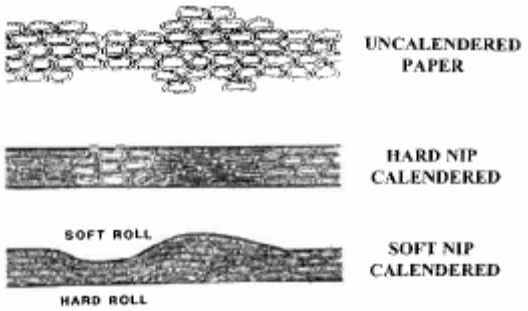
Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm	Application
Round Button	Tunnel Caliper - Hard Bellows - No Sapphire (Lower) - U-Core Flush			08738801		08738701		- Light Touch - Delicate Sheet - Rare Configuration
Modified Round	Fastback Caliper - Hard Bellows - 0.01" sapphire (lower) - U-Core Recessed			08740900	08740500	08740800	08740300	- Recycled Kraft - Normal Configuration
Modified Round	Fastback Caliper - Hard Bellows - No Sapphire (lower) - U-Core Flush			08740901	08740501	08740801	08740301	- Dirt Tails, Build Up - Recycled Kraft - Normal configuration
Unifoil	- 08713502 upper barrel with soft HNBR - 08737200 upper arm with soft HNBR			6581800125		6581800109		Bellow Failures
Unifoil	- 08713502 upper barrel with soft EPDM - 08737200 upper arm with soft EPDM			6581800124		6581800120		Bellow Failures

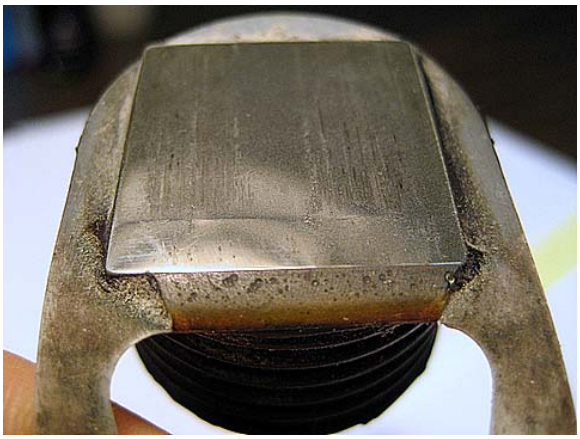
Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm	Application
Unifoil	08713102 lower arm with soft HNBR bellow						6581800110	Bellow Failures
Unifoil	08713102 lower arm with soft EPDM bellow						6581800122	Bellow Failures
Unifoil	08713104 lower arm with soft HNBR bellow						6581800119	Bellow Failures
Unifoil	08713104 lower arm with soft EPDM bellow						6581800121	Bellow Failures
Unifoil	- 08713602 upper barrel with soft HNBR - 08737300 upper arm with soft HNBR			6581800111		6581800112		Bellow Failures
Unifoil	- 08713602 upper barrel with soft EPDM - 08737300 upper arm with soft EPDM			6581800115		6581800116		Bellow Failures
Unifoil	- 08713500 upper barrel with soft HNBR - 08713700 upper arm with soft HNBR			6581800113		6581800114		Bellow Failures
Unifoil	- 08713500 upper barrel with soft EPDM - 08713700 upper arm with soft EPDM			6581800117		6581800118		Bellow Failures

Sensor	Description	Upper Caliper Assy	Lower Caliper Assy	Upper Barrel	Lower Barrel	Upper Arm	Lower Arm	Application
Unifoil	- 08713601 upper barrel with hard EPDM - 08713801 upper arm with hard EPDM			6581800126		6581800123		Bellow Failures
Unifoil	- 08713100 lower arm with soft HNBR						6581800131	Bellow Failures
Unifoil	- 08713100 lower arm with soft EPDM						6581800132	Bellow Failures

3. Troubleshooting

Problem	Resolution
Pinholes or slices are appearing in 2213 caliper rubber bellows that lead to reduction in actuation pressure and force replacement of an arm or barrel replacement.	• Honeywell (Measurex) Bulletin 235 issued in Feb 2003 indicates a supply problem related to the rubber bellows. If you have any stock prior to this date, follow the inspection procedure before installing this part into your system. • Examine the retraction of the arm assembly into the barrel. In some cases, poor quality air can clog the 2213 vacuum mechanics over time and prevent the arm assembly from fully retracting into the barrel. When the scanner goes onsheet, the paper can catch the bellow and slice it open. If this is the case, clean or replace the vacuum mechanics and put a filter on your air line prior to the caliper gauge. • Use only kerosene to clean the caliper buttons. Other solvents may act to degrade the bellows material to the point of failure. • Examine sheet curl near the edges. Extreme curl can often catch the caliper bellow as it goes off sheet. Install a stabilizer bar at the sheet ends to prevent this from happening. • If you are still experiencing bellows problems, examine your process to determine if sheet temperature, new product type, or chemical exposure has changed. Special types of bellow material are available for instances like this (that is HNBR and EPDM). See Honeywell Technical Bulletins 6510491119 issued January 2007 and 6510491123 issued March 2007.
Caliper gauge is producing erroneous caliper readings, either locally along the profile or across the entire sheet.	If this problem has just started, examine your machine's process and any recent changes you have made to hardware or software that could explain the sudden shift in measurement quality. • Make sure electrical connections on both the gauge and to boards in the main scanner head are firmly in place. • Inspect the upper and lower buttons for build up. If necessary, manually clean the upper and lower caliper buttons with kerosene. If there is extreme buildup, or a situation where manual cleaning is no longer adequate: - Consider a different caliper configuration. See Chapter 1 for details. - Consider a caliper cleaner (09827102 or 09827103) • Actuate the caliper and record the pressure reading on the pressure dial. The standard pressure for a 2213 caliper is six inches of water. If

Problem	Resolution
	your caliper is reading less than this, adjust the upper and lower regulators on the gauge until it reads six inches. Make sure the caliper buttons line up in the middle of the scanner gap when you do this. Note that in some instances, six inches of water is not enough to firmly clamp the paper between the two caliper buttons. In this case, gradually increase the actuation pressure to see if this helps solve the problem. Do not exceed ten inches of water for soft bellow assemblies, or twelve inches of water for hard bellows. • Examine the alignment of your scanner. Plot caliper readings against X, Y, and Z profiles to see if there are correlations. If there are, you may have a scanner misalignment issue. XY sensitivity is typically three microns thickness change for ± 1mm head displacement. Z or pass line changes typically have negligible affect on caliper. • The 2213 contacting caliper has a maximum ambient temperature of 100°C (212°F) when the gauge is located within a temperature-controlled sensor enclosure (main scanner head), but only 65°C (150°F) in ambient temperature (outboard). Check to make sure you are operating within temperature specifications. • Soft-nip calendaring can be a problem for accurate 2213 caliper measurement. High basis weight areas in a sheet pass through a soft-nip calendar without being crushed, and become visible as thickness variations (as opposed to hard-nip calendaring where basis weight variations also become density variations – see figure below). High frequency changes in thickness can result in the caliper flying over the peaks of a soft-nip calendered sheet, resulting in high readings. The amount of flying will depend on local basis weight variations. The lab will typically read lower than 2213 caliper in these instances because the actuation pressure of a lab caliper gauge is much higher than what is done onsheet. 
The lower ferrite has cracked and has forced an arm assembly replacement. This is occurring on a regular basis.	• In almost all cases, cracking of the ferrite is due to thermal shock. This is most often seen in mills that use a caliper cleaner on a frequent basis. The caliper heats up to the sheet temperature, and then is cooled down by room temperature kerosene used in the caliper cleaner. If you have this configuration, there are a few options.

Problem	Resolution
	- Add a delay between when the caliper comes off sheet and when the cleaning process begins. 30 seconds is sufficient. - Heat the cleaning solution to reduce the thermal shock on the ceramic ferrite. Kerosene has a very low flash point and cannot be heated. Instead, use Safety-Kleen Premium Gold Solvent (MSDS 82658/82774). It has a flash point of 140° F. • If you are not using a caliper cleaner, examine your system to determine if there are instances when the caliper ferrite could experience rapid changes in temperature. When you are cleaning the caliper, let it cool down for a couple minutes beforehand.
Model 2213 caliper is causing micro-tears in the sheet.	• Check the actuation pressure. In some instances, it is permissible to run the Model 2213 caliper below six inches of water; but it is recommended not to go below three inches of water. Check to see if micro-tearing has gone away. Also make sure reduction of pressure has not compromised the caliper measurement. • If using a round-button caliper, be aware that the Unifoil button shape has a softer lead in which may reduce sheet tears. • Try a tunnel caliper configuration. Certain configurations work better than others depending on the product, scanner configuration, and other variables. - Tunnel caliper upper and lower. Bare ferrite is normally chosen for the lower unless your product is abrasive or there is a build up issue. - Tunnel caliper upper and Unifoil lower. The Unifoil lower acts as an anvil for the upper to ride on. - Tunnel upper and fixed lower. This configuration has also been shown to reduce tearing • Further soften the lead-in of a Unifoil caliper by adding a ramp of epoxy going from the Mylar arm to the ferrite button. In this way, stickies and other particulated experience a less abrupt interface when coming in contact with the caliper. Use Emerson and Cuming 2741LV epoxy with 15LV catalyst. The mix ratio is 1:1 and cure is room temperature for 24 hours. This product can be acquired at a local epoxy distributor. 

Problem	Resolution