

# Western Instruments

Established 1965

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## Pit Gauges

March, 2007

We have Published information on the History of Pit Gauges, but this document will attempt to help Sales Personnel in the various applications for the 15 plus Models in Western Instruments' Pit Gauge Product Series. We offer so many different models that an inexperienced person may have trouble selecting the best one for a customer's application. This guide assumes the reader has already reviewed and understands the contents of the Operating Instructions.

### Tri-Gauge® (N88L-1)

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The **Tri-Gauge®** is simply the most basic Pit Gauge in the Product Series, and it is simple to use. **Tri-Gauge®** offers both Metric and Imperial Scales, so it is popular with domestic and international markets. Another unique feature of the **Tri-Gauge®**, is its patented *Pointer Offset Correction* for improved accuracy and repeatability. Detailed Operator Instructions are provided with each Tri-Gauge®, and merits a review. The **Tri-Gauge®** is a Lever Type Pit Gauge intended for the Evaluation of Corrosion, and not as an absolute measurement tool.

### Dial Indicator Pit Gauges

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#### Dial Indicators

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Western's exclusive **Push to Read** Dial Indicator Pit Gauge's are equipped with an Imperial Dial Indicator, however we offer options for Metric and Digital Indicators. If a Metric Dial Indicator is requested, there is an additional \$5.00 Charge. If a customer requests a Digital Indicator, there is an additional \$150 charge. Some end users may already have a Dial or Digital Indicator that they wish to use, and this is practical if the Stem Diameter is 3/8" (9.5mm or 0.375"). If requested, without a Dial Indicator, we supply a Pit Gauge Blade, Hardware, and a Carrying case for list price less \$45.00. The prices are applied before discounts.

The *Push to Read* feature, on all of our Dial and Digital Indicators, was specifically and exclusively developed by Western Instruments, for Pit Depth Measurement. This feature allows the operator to put a small amount of pressure on the Plunger, while sliding the blade across the surface of the item being inspected. This *scanning* feature allows the inspector to quickly identify the deepest point of corrosion. A standard Dial Indicator, without this feature, requires the contact point to be placed into the pit, before a measurement is taken. Competitors that have, or offer such a Dial Indicator simply don't understand Pit Depth Measurement.

#### Basic Pit Gauge (N88-2)

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The **Basic** Pit Gauge® is our most economical Dial Indicator Pit Gauge. The Knife Edge Blade is 2 ¼” long (57mm), with the Dial Indicator Installed in the Centre of the Blade. This model will often cover most inspectors’ needs when they are inspecting isolated pits. The Basic Pit Gauge conveniently fits into its carrying case, without disassembly, along with it’s hardware, extra contact point, and instructions.

The Basic Pit Gauge is also offered with a Composite Magnetic Blade, with a Part Number of N90-2. The Rare Earth Impregnated Magnets provide the operator the convenience of Magnetic Hold Downs, with excellent wear resistance.

### Basic + Pit Gauge (N88-3)

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The **Basic +**® Pit Gauge is similar to the Basic unit, however the Blade is 3 ¼” (83mm) long, again with the Dial Indicator Installed in the Centre of the Knife Edge Blade. The Basic + would be used on Pitting that is slightly larger than with the Basic unit, and will accommodate Weight Loss Corrosion that is up to about 2 ½” (64mm) in diameter. The Basic +® Pit Gauge is provided disassembled in its carry case, along with it’s hardware, extra contact point, and instructions.

The Basic +® Pit Gauge is also offered as the **Basic + Magnetic**® Pit Gauge (N88-3M) with Western’s exclusive adjustable Cartridge Magnets. It is not practical to retrofit a Basic + into a Basic Plus Magnetic, and must be treated as 2 completely different models. The Adjustable Magnetic Cartridges are located at each end of the Knife Edge Blade, and will fully support the Gauge when it is placed vertically or upside down. The Cartridges are adjusted in elevation, with the use of an Allan Key, to compensate for Concave, Flat, or Convex surfaces to ensure maximum holding strength. The Cartridges can be fully retracted, or removed, to allow Scanning through a Pit (See Operator Instructions).

The current form of the Basic + Magnetic Pit Gauge, with adjustable Cartridge Magnets, will be discontinued, in favor of a Composite Blade, with a Part Number of N90-3. The Rare Earth Impregnated Magnets provide the operator the convenience of Magnetic Hold Downs, with excellent wear resistance.

### Pocket Pit Gauge (N88-4)

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The **Pocket Pit Gauge**® was introduced in the spring of 1990, after receiving input from a Senior Vessel Inspector. The inspector wanted a small Dial Indicator, thus we introduced and standardized on our Current ADG Type 1 Dial Indicator (Digital Indicators are Sized as Type 2). The Inspector wanted a small Flat Base for Spot Checks, but also wanted 2 Contact Points for measuring the Knuckle Area of Vessel Heads. The resulting design was the Reversible Blade of the **Pocket Pit Gauge**®, which is now our most popular model, as it’s like 2 Pit Gauges in one.

The **Pocket Pit Gauge**® is very common in Corrosion Labs for use on Coupons, but also in process facilities where Corrosion is not limited to Piping, Vessels or Tanks, as it is used on Centrifugal Pump Bodies and Impellers! The Pocket Pit Gauge is also supplied to Turbine Service Companies, where it is used to measure pitting on the high pressure blades of a PT6, right up to Low Pressure Blades on 1 Megawatt Steam

Turbines. Thus, when in question, suggest the Pocket Pit Gauge®, because of its versatility, for 3 years Western only offered our Bridging Pit Gauge and the Pocket Pit Gauge.

The Pocket Pit Gauge® conveniently fits into its carrying case, without disassembly, along with it's hardware, extra contact point, and instructions.

## Reaching Pit Gauge (N88-5)

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The *Reaching Pit Gauge*® is Western's basic unit for dealing with areas of Weight Loss Corrosion, as the Blade is 4 ¾" (121mm) long. The Dial Indicator is installed as close as possible to the end of the Knife Edge Blade, to permit the unit to reach into areas of Weight Loss Corrosion. Furthermore, this end of the blade has a 1.5" (37mm) long 'Cut-a-way Nose', which facilitates measurements in and around welds or next to gussets/re-pads/flanges and other obstructions. The Nose also permits the *Reaching Pit Gauge*® to be used for Hi-Lo Measurement on Process Piping or other fabrication fit-ups. The *Reaching Pit Gauge*® can accommodate areas of Weight Loss Corrosion up to about 6" (150mm) in diameter, if it can be approached from all sides. The Reaching Pit Gauge is provided assembled in its carry case, along with it's hardware, extra contact point, and instructions.

The *Reaching Pit Gauge*® is also offered as the *Reaching Magnetic* Pit Gauge (N88-5M) with Western's exclusive adjustable Cartridge Magnets. Again, it is not practical to retrofit a Reaching Pit Gauge into a Reaching Magnetic unit, and must be treated as 2 completely different models. The Adjustable Magnetic Cartridges are located adjacent to the Cut-a-way Nose, as well as at the end of the Knife Edge Blade, and will fully support the Gauge when it is placed vertically or upside down. The Cartridges are adjusted in elevation, with the use of an Allan Key, to compensate for Concave, Flat, or Convex surfaces to ensure maximum holding strength. The Cartridges can be fully retracted, or removed, to allow Scanning through a Pit (See Operator Instructions).

The current form of the Reaching Magnetic Pit Gauge, with adjustable Cartridge Magnets, will be discontinued, in favor of a Composite Blade, with a Part Number of N90-5. The Rare Earth Impregnated Magnets provide the operator the convenience of Magnetic Hold Downs, with excellent wear resistance.

## Reaching + Pit Gauge (N88-6)

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The *Reaching + Pit Gauge*® is Western's next step-up (from the Reaching Pit Gauge) for dealing with areas of Weight Loss Corrosion, as the Blade is a full 6" (152mm) long. Like the Reaching Pit Gauge, the Dial Indicator is installed as close as possible to the end of the Knife Edge Blade, to permit the unit to reach into areas of Weight Loss Corrosion, with the same benefits of the 'Cut-a-way Nose'. The *Reaching + Pit Gauge*® can accommodate areas of Weight Loss Corrosion up to about 9" (150mm) in diameter, if it can be approached from all sides. The *Reaching + Pit Gauge*® conveniently fits into its carrying case, without disassembly, along with it's hardware, extra contact point, and instructions.

The *Reaching + Pit Gauge*® is also offered as the *Reaching +Magnetic* Pit Gauge (N88-6M) with Western's exclusive adjustable Cartridge Magnets. Again, retrofit of a *Reaching + Pit Gauge* into a *Reaching + Magnetic* is not practical. The Adjustable Magnetic Cartridges are similarly positioned to the Reaching Pit Gauge, with similar benefits (see Reaching Magnetic description).

The current form of the Reaching + Magnetic Pit Gauge, with adjustable Cartridge Magnets, will be discontinued, in favor of a Composite Blade, with a Part Number of N90-6. The Rare Earth Impregnated Magnets provide the operator the convenience of Magnetic Hold Downs, with excellent wear resistance.

## **Bridge Type Pit Gauges**

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Western's advanced *Bridging Pit Gauge System*® and our new *Jr. Bridging Pit Gauge*® take over, where the capabilities of standard Pit Gauges fall short, for evaluating large areas of Weightloss Corrosion. These *Bridging Bar* type Pit Gauges can also be used to measure Dents and Buckles on Pipelines, Shell Settlement on Storage Tanks, etc. All of these *Bridging Bars* can be used with any of our Dial Indicators (Imperial, Metric, or Digital), and any of our Contact Points.

There are several important features to a *Segmented Bridge*, where the different parts (Blades and Tee's) are assembled to form a *Bridging Bar*. Firstly, they can be assembled to follow the contour of a slightly irregular surface. This contouring feature is important for Pipeline, Storage Tank, and Pressure Vessel inspections, where 'hills and valleys' always exist. Secondly, the models listed below are of a given length, however the different units can be added to increase their over all length.

As illustrated, these units can be assembled in Spanning or Cantilevering configurations. All parts for the *Junior's* and the full *Bridging Pit Gauge*, can be interchanged, as all fasteners and bolting patterns are the same. Finally, the Main Blade (*Bridging* or *Junior*) can be used by itself for isolated or cone type Pitting.

### **Jr. Bridging Pit Gauge (N88-11) – formally the Span Gauge**

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The *Jr. Bridging Pit Gauge*® was simply introduced to provide a lower priced "Bridging Bar" as an alternative to some of the *Johnny Come Lately* (or *copycat*) products out on the Market. The *Jr. Bridging Pit Gauge*®, like competitive units does not have a 'Vee' or Knife Edge, which is one of the items used to reduce the manufacturing costs. The *Jr. Bridging Pit Gauge*®, like competitive units, simply does not offer the benefits of Western's unique *Bridging Pit Gauge*® System.

When quoting in a "competitive" situation, a distributor must quote the *Jr. Bridging Pit Gauge*® in it's three forms (Jr., Plus, and Super), noting that the standard Kit (N88-11) is "the same as" the competitive (*Johnny Come Lately*) units, and that the Plus and Super are superior to others.

The following is a list of components for the 3 models of ***Jr. Bridging Pit Gauge*®**. These units are provided disassembled in a carry case, along with it's hardware, extra contact point, and instructions, with the following components;

Jr. Bridging Pit Gauge® (N88-11) - Assembles to 13 ½" long.

- Magnetic Main Blade and Dial Indicator
- 2 Extender T's
- 2 End Blades

Jr. Bridging Pit Gauge Plus® (N88-11P) - Assembles to 15 ½" long.

- Magnetic Main Blade and Dial Indicator
- 2 Extender T's
- Magnetic Connector Blade
- 2 End Blades (second can be used as a Slider Blade)

Jr. Bridging Pit Gauge Super® (N88-11S) - Assembles to 27" long.

- Magnetic Main Blade and Dial Indicator
- 4 Extender T's
- 3 Magnetic Connector Blades
- 2 End Blades (second can be used as a Slider Blade)

The following is a description and function of each component;

### **Main Blade and Dial Indicator**

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This assembly can be used as a stand alone Pit Gauge, and will meet most of an Inspector's needs. The Main Blade is 5.5" (140mm) long, with Dial Indicator Mounts being located at; one end, with a Cut-a-Way Nose, and in the middle of the Blade. The Main Blade is fitted with 2 very strong magnets, which are mounted flush to the Blades contact surface.

Unlike our Standard Pit Gauges, were the Dial Indicator is secured by a set screw, the Main Blade Clamps the Dial Indicator into position. The Clamp results from a slot, running the length of all the Blades, used on the Jr. *Bridging Pit Gauges*® with the mounting holes for the Extender T's. When the Jr. *Bridging Pit Gauge*® is assembled, all of the Blades and Extender T's are fastened and clamped together.

Every Inspector knows that any structure, be it is a Vessel or a Pipe, is not round or straight. Because of the multiple components, and flexibility of the mounting/clamping, the Jr. *Bridging Pit Gauge*® can be assembled to conform to the natural shape of a workpiece. This illustrates that manufacturers of competitive units, with their Rigid Arms and adapted Dial Indicators, simply don't understand Pit Depth Measurement, and why we refer to them as *Copycat* and *Johnny Come Lately!*

### **Extender T's**

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Extender T's, when paired with Connector Blades simply extend the reach or span of the Jr. *Bridging Pit Gauge*® *Plus* and *Super*, to cover even greater areas of Weight Loss Corrosion. The standard Jr. *Bridging Pit Gauge*® Kit assembles to over 13½" (340mm) long in its Spanning Configuration. The Jr. *Bridging Pit Gauge Plus*® can be assembled in either Spanning or Cantilevering Configurations up to 15 ½" (394mm) long. While the Jr. *Bridging Pit Gauge Super*® is also assembled in both Spanning or Cantilevering Configurations, up to 27" (685mm) long.

## **Connector Blade**

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As explained above, Connector Blades are used to couple Extender T's Together on the Plus and Super models. However, when a *Jr. Bridging Pit Gauge Plus®* is assembled in Spanning Mode, the Connector Blade can be used either as an End Blade or as a longer Slider Blade, whichever the inspector decides. The Connector Blade is fitted with a powerful magnet which is mounted flush to the Blade's contact surface.

When an Inspector wants a longer *Jr. Bridging Pit Gauge®*, he simple orders *Jr. Bridging Pit Gauge Plus®* or a *Jr. Bridging Pit Gauge Super®*

## **End Blade**

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The End Blade is simple used at the end of an Extender T, as a contact point for the assembly. The End Blade can also be used as a Slider Blade as an adjustable point of Contact to parent material (or an un-corroded area), which often occurs in large areas of Weight Loss Corrosion. The Slider Blade is clamped to an Extender T, with Nylon fasteners, and is easily moved during an inspection.

## ***Bridging Pit Gauge® System*** (N88-9)

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The *Bridging Pit Gauge®* was Western Instruments first Dial Indicator Pit Gauge, and was introduced in the Winter of 1987/88, after a year of development and testing of 4 Beta units by; Pressure Equipment Inspectors, Pipeline Inspectors, Tank Inspectors, and Bridge Inspectors. This guide assumes the reader has fully reviewed the Operation Instructions, as well as the History article written about Pit Gauges.

The *Bridging Pit Gauge®* is assembled from these listed Components;

- Main Blade and Dial Indicator
- Extender T's (2)
- Connector Blade
- End Blade
- Slider Blade
- Magnetic Hold Downs (Optional)

The following is a description and function of each component;

### **Main Blade and Dial Indicator**

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This assembly constitutes the Basic Bridging Kit, and as a stand alone Pit Gauge, can be used for most of an Inspector's needs. The Main Blade is 5.5" (140mm) long, with Dial Indicator Mounts being located at; one end, with a Cut-a-Way Nose, and in the middle of the Blade.

Unlike our Standard Pit Gauges, were the Dial Indicator is secured by a set screw, the Main Blade Clamps the Dial Indicator into position. The Clamp results from a slot, running the length of all the Blades, used on the *Bridging Pit Gauge®*, with the mounting holes for the Extender T's. Therefore, when the *Bridging Pit Gauge®* is assembled, all of the Blades and Extender T's are fastened and clamped together.

Every Inspector knows that any structure, whether it is a Vessel or a Pipe, is not round or straight. Because of the multiple components, and flexibility of the mounting/clamping, the *Bridging Pit Gauge*® can be assembled to conform to the natural shape of a workpiece. This illustrates that manufacturers of competitive units, with their Rigid Arms and adapted Dial Indicators, simply don't understand Pit Depth Measurement, and why we refer to them as *Copycat* and *Johnny Come Lately!*

Lastly, the incredibly powerful *Magnetic Hold Downs*, of the *Bridging Pit Gauge*®, set it apart from any competitive unit. While the magnets firmly holding the *Bridging Pit Gauge*® to any surface, the operator can freely Scan through an area of Corrosion.

### **Extender T's**

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Extender T's, when paired with Connector Blades simply extend the reach or span of the *Bridging Pit Gauge*®, to cover even greater areas of Weight Loss Corrosion. Extender T's are equipped with Western's exclusive Metric/Imperial Scales, which help operators increment the *Bridging Pit Gauge*® during a Scan, for plotting the cross Section of Pitting. The standard *Bridging Pit Gauge*® Kit assembles to over 28" (710mm) long, in either Spanning or Cantilevering Configurations, the record is over 6 ½ feet (2 meters)!

### **Connector Blade**

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As explained above, Connector Blades are used to couple Extender T's together. However, when a *Bridging Pit Gauge*® is assembled in Spanning Mode, the Connector Blade can be used either as an End Blade or as a long Slider Blade, whichever the inspector decides. When an Inspector wants a longer *Bridging Pit Gauge*®, he simple adds an Extender 'T' and Connector Blade for each foot (300mm) he wants to extend it.

### **End Blade**

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The End Blade is simple used at the end of an Extender T, as a contact point for the assembly. The End Blade is virtually identical to the Slider Blade, and they can be used interchangeably.

### **Slider Blade**

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The Slider Blade is intended to be used as an adjustable point of Contact to parent material (or an un-corroded area), which often occurs in large areas of Weight Loss Corrosion. The Slider Blade is clamped to an Extender T, with Nylon fasteners, and is easily moved during an inspection. As the Slider Blade is virtually identical to the End Blade, with the exception of the Finger Grooves, they can be used interchangeably.

### **Magnetic Hold Downs (N88-9-6P)**

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The Optional Magnetic Hold Downs provide the inspector with increased mobility, as he doesn't have to support the gauge, but more importantly they permit Scanning through an area of Weight Loss Corrosion. Magnetic Hold Downs have gone through several revisions. The original units were

*Adjustable Magnetic Hold Downs*, and they have been replaced by the improved *Basic Magnetic Hold Downs*. Any Service Company that purchases a *Bridging Pit Gauge*®, should equip it with Magnetic Hold Downs. Furthermore, inspectors using the *Bridging Pit Gauge*® on Pipeline Excavations should also purchase a set.

## Specialty Pit Gauges

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### Reference Gauge (N88-12)

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The **Reference Gauge**® was originally designed to measure Reference Indications (Holes or Notches) which are machined into *Calibration Standards* for various types of Non-Destructive Testing Equipment (Ultrasonics, Eddy Current, Flux Leakage, etc.). The *Reference Gauge*® easily measures the depth of these indications, as its contact blade is equipped with an *Inverted 'V' Edge* and magnetic Hold Downs, so it self aligns to convex surfaces, such as various diameters of Tube and Pipe.

The general design of the *Reference Gauge*® is identical to the Main Blade of the Bridging Pit Gauge, however it is double the width to accommodate the Inverted 'V' Edge. Due to Inspector input, the Center mounting Position of the Dial Indicator is equipped with a large 1 ½" (38mm) Cut-a-way, to permit further positioning of the blade.



The *Reference Gauge*® is the one Pit Gauge that will often satisfy those unusual requests, as the Blade width is double that of our other Pit Gauge Models. It is obvious when the Inverted 'V' Edge is not aligned to a convex surface, as it will rock, while a Knife Edge is more forgiving to misalignment. As the Blade of the *Reference Gauge*® is fashioned after the Main Blade of the Bridging Pit Gauge, they are interchangeable. Furthermore if an inspector wants an Inverted 'V' Edge *Bridging Pit Gauge*® System, offer it to them, as the N88-9IV is in stock.

The DH Pit Gauge is simply intended to be used to obtain "blind" measurements in difficult to access areas.

### Tube Sheet Pit Gauge (or ID Pit Gauge) (To be released 2<sup>nd</sup> quarter 2007)

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The *Tube Sheet Pit Gauge*® is designed to fit inside ¾" (0.750" or 19mm) OD Boiler Tube, where the resulting Inside Diameter is just over ½" (0.50" or 12.7mm). The overall length of the *Tube Sheet Pit Gauge*® is 15", thus it can reach up to 9" past the outermost point of the Tube Sheet. However, 'Specials' can be ordered to reach into tubes much farther, within practical limits. The Axially Mounted Dial Indicator is able to rotate through 360°, thus the Barrel of the Pit Gauge can rotate to any position to measure Pits, allowing the operator to have a clear view the Dial face.



The Contact Surface, from where the Contact Point extends from the Barrel, is held up against the target point by a leaf spring, extending for the opposite side of the Barrel. The Hold Down Spring is changed to compensate for larger sizes of tube, with the practical limit being 3" (76mm). The *Tube Sheet Pit Gauge*® has a measurement range of 0.150" (3.8mm).