Universal Gauge Measuring System

USERS MANUAL

CHIEF™
automotive technologies

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I. Introduction

Chief's Universal Gauge Measuring System provides a simple yet highly practical technology to auto body repair, one that can be applied to any type of vehicle whether it be of "unitized body construction" (with or without struts) or "perimeter frame construction." It works equally well on pickup trucks, vans and all other utility vehicles.

The system is used to locate and evaluate all structural damage from minor to major misalignment. Because of the lightweight, intricate design of many of today's vehicles, even minor collisions — those occurring at 5 miles per hour (8 kilometers per hour) or less — may result in structural damage. A visual examination is not appropriate in these cases as damage is often complex and hidden from view. Because of the system's set up time, gauging all collision-damaged vehicles becomes practical and efficient.

The system's six gauges install easily and are read quickly to determine the squareness of the vehicle. In addition to the "direct damage," the gauges also show the resulting "indirect damage" in the other sections of the vehicle. The damage analysis obtained from reading gauges becomes the basis for the repair plan.

Once installed, gauges show misalignment relating to the vehicle's Centerline/Plane and Datum Line/Plane. (See Figure 1.) The Centerline/Plane is a vertical plane that divides a structure in half lengthwise. It is referred to when determining lateral misalignment. The Datum Line/Plane is a horizontal plane located a specified distance below the structure. It is used when determining vertical misalignment of the end sections of the vehicle.

In addition to detecting misalignment, the Gauge Measuring equipment has measuring capabilities. It also remains on the structure as a direct guide for the repair.

The Universal Gauge Measuring System includes five Precision Datum/Centerline Gauges, a Strut Tower/Upper Body Gauge, Tram Gauge, Crossmember Pin, an assortment of attachments, scales and pointers for use with the gauges and a display board.

This manual describes the equipment in the system and outlines its use. It also provides maintenance tips and parts information.

This manual is written to familiarize technicians with the operation of the Universal Gauge Measuring System. It is not intended to replace Chief's Training Classes. For maximum productivity and equipment utilization, it is recommended that each person operating this system receive Chief Training. In addition to providing information on gauge reading, measuring and damage analysis, the schools also expose technicians to a wide variety of repair techniques.

For more information concerning class locations and dates, contact Chief Automotive Technologies, Inc., 1924 E. Fourth Street, Grand Island, NE 68802, 308-384-9747, Attention Training Department School Coordinator, or your local Chief representative.

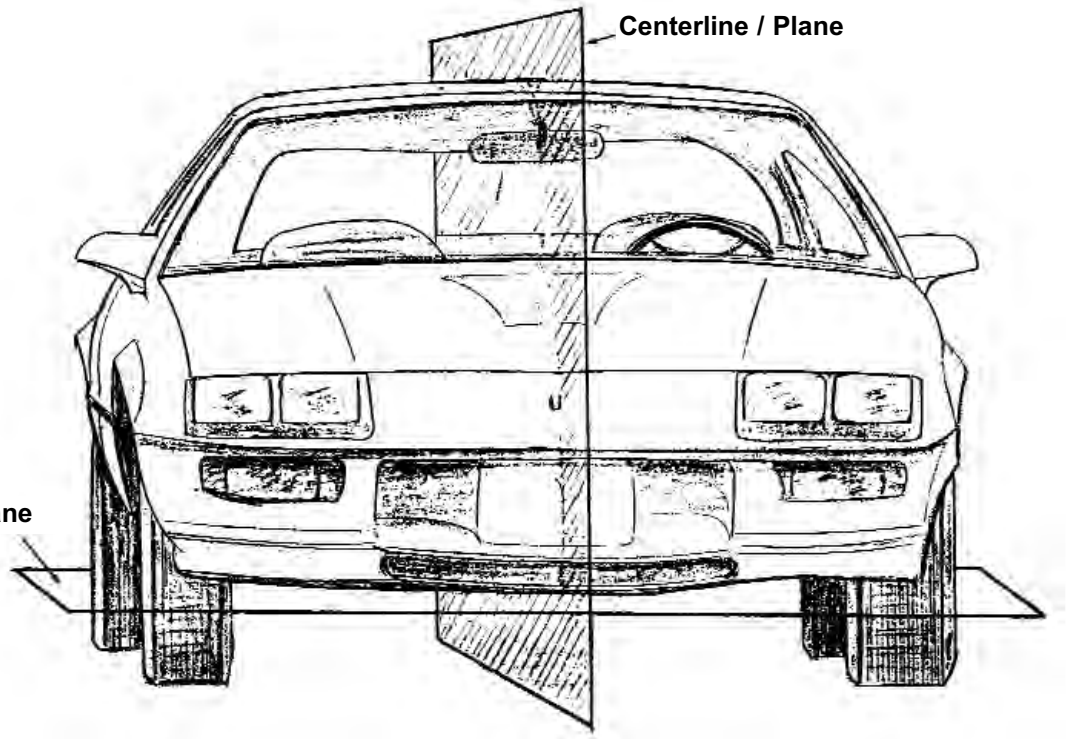


Figure 1

III. Universal Gauge Measuring System Components Terminology

The equipment in Chief's Universal Gauge Measuring System (see Figure 2) is easy to use and features measuring capabilities.

The system includes:

- Five Precision Datum/Centerline Gauges (1) with Scales (2) — seven different lengths, and Attachments including Adjustable Pin (3), Notched (4), Fixed Pin (5), Magnetic (6) and Offset — not shown in illustration.
- Strut Tower/Upper Body Gauge (7) with Pointer Housings (8), Pointers (9), and Scales (10).
- Tram Gauge (11) with Telescoping Bar (12) and Pointers (13). Tram Extension Bar (not shown in illustration).
- Crossmember Pin (not shown in illustration.)
- Display Board (not shown in illustration.

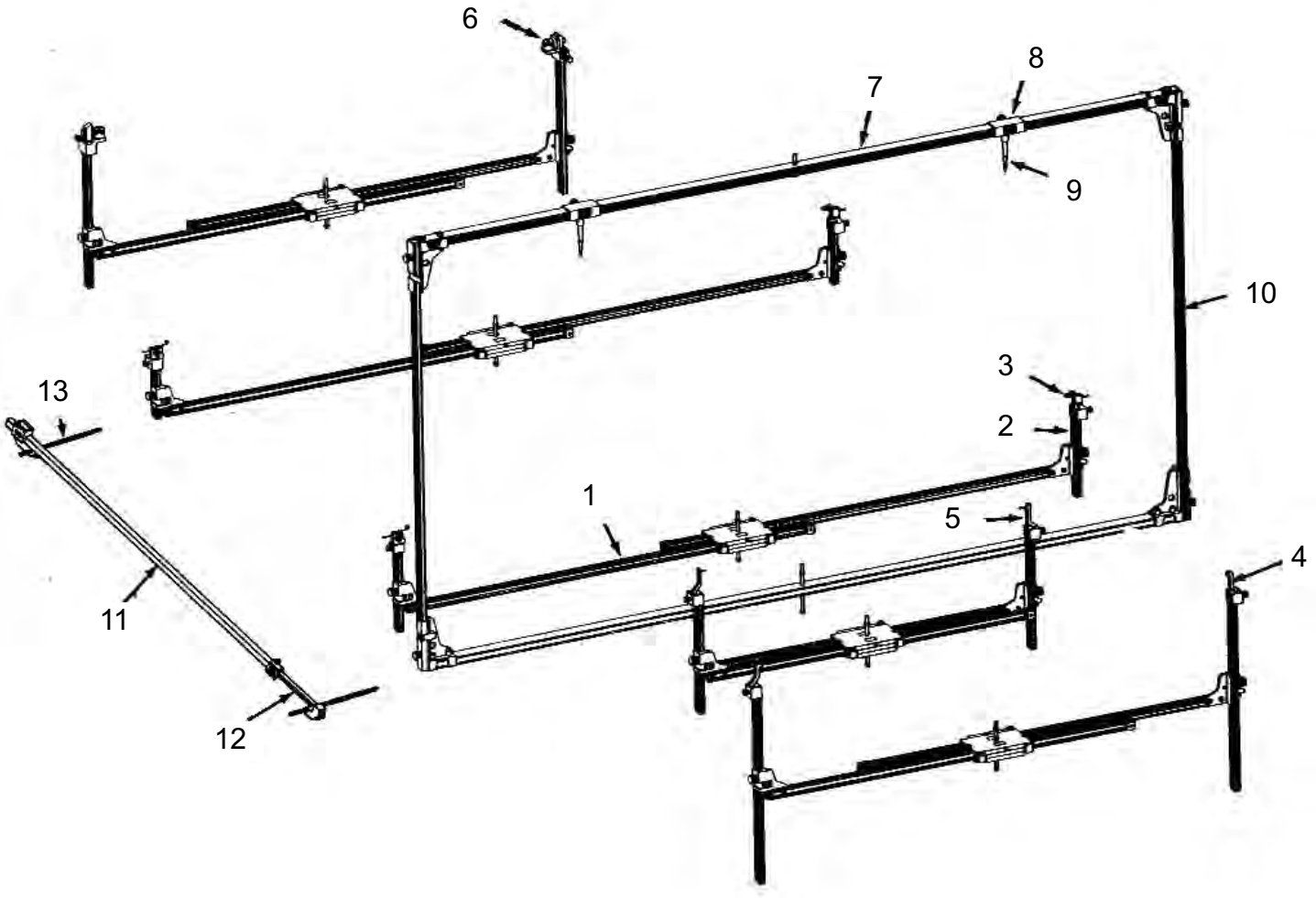


Figure 2

Precision Datum/Centerline Gauges

Precision Datum/Centerline Gauges are used to project control points of a structure into a line of sight below the vehicle where they are "read" by the technician. Gauges show the extent of damage and verify its correction during the repair.

Two 1015mm (40 inch), two 915mm (36 inch), and one 815mm (32 inch) gauge are provided. (See Figure 3.) These gauges, plus the Strut Tower/Upper Body Gauge (see Strut Tower/Upper Body Gauge — pages 8 and 9), are attached to the vehicle at various points to locate and measure structural misalignment. (See Section IV - Installation, for suggested locations — pages 16-28.)

1. 1,015mm (40") Gauge
2. 915mm (36") Gauge
3. 815mm (32") Gauge

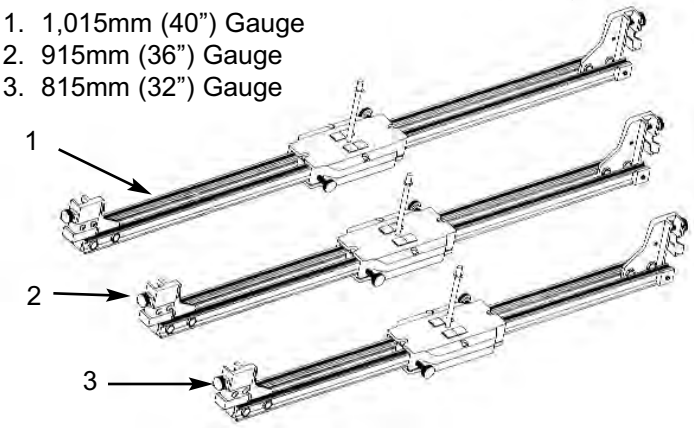


Figure 3

Each gauge has two horizontal bars which remain parallel as they move through a center pin housing. This allows for a range of width adjustments.

Scales and their attachments are used to install gauges on a vehicle. (See Figure 4.)

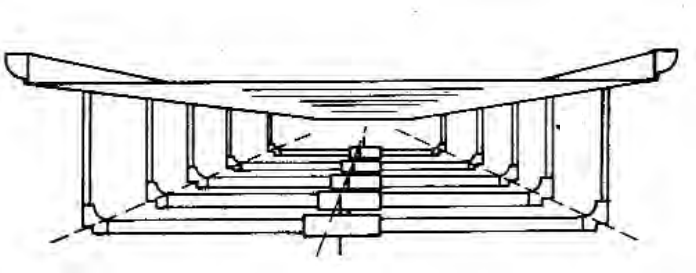


Figure 4

The scales attach to the scale housings at the ends of the gauge. (See Figure 5.) Each housing features a scale retaining spring to hold the scale in place and a thumb screw to prevent unwanted movement after the scale has been adjusted to the desired setting.

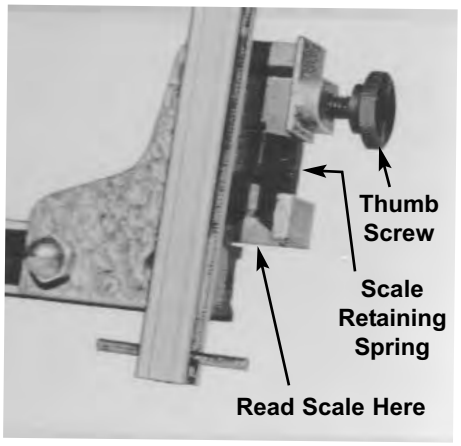


Figure 5

The center pin housing of each gauge (see Figure 6) features a center pin, two thumb screws to prevent unwanted movement of the horizontal bars, and two lenses in which to view width measurements.

The center pin remains in the middle of the gauge as the ends of the gauge are extended for installation. When the gauges are installed, the pins allow a centerline reading through the length of the vehicle.

The two thumb screws, one for each horizontal bar, are tightened to hold the gauge in position.

Gauges measure width from centerline out to the points where they attach to the vehicle. Tapes on the horizontal bars are calibrated in both metric and US measure. Measurements appearing in the lenses of the center pin housing (see inset-Figure 6) are the distance from the center pin to the inside edges of the scales in the scale housings. (See page Figure 12 — page 5.)

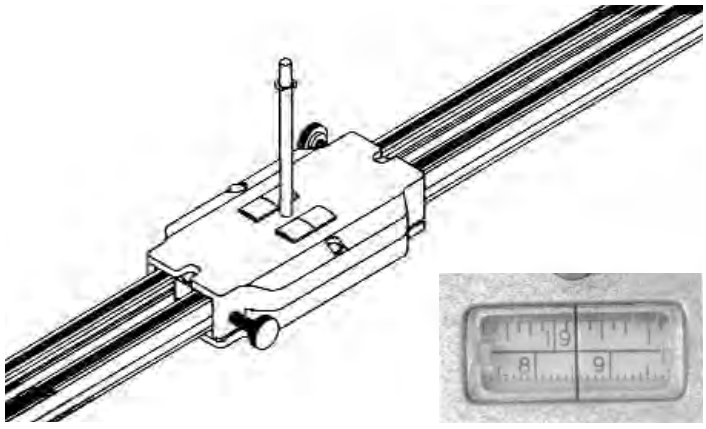


Figure 6

When a gauge is mounted to non-symmetrical components (mounting locations not equal distance from vehicle's centerline), it can be adjusted to compensate for this variance. For example, if one mounting location is 381mm (15 inches) from centerline and the other is 483mm (19 inches), a 102mm (4 inch) adjustment is needed.

Bring the scale housings tight against the center pin housing. Hold one scale housing tight against the center pin housing and bring the other out until the scale readings in the lenses show a 102mm (4 inch) difference. (See Figures 7 and 8.) One lens shows a 178mm (7 inch) reading and the other a 280mm (11 inch) reading.

Extend the scale housings out and install the gauge.

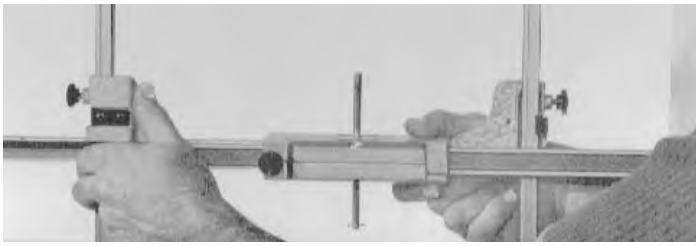


Figure 7

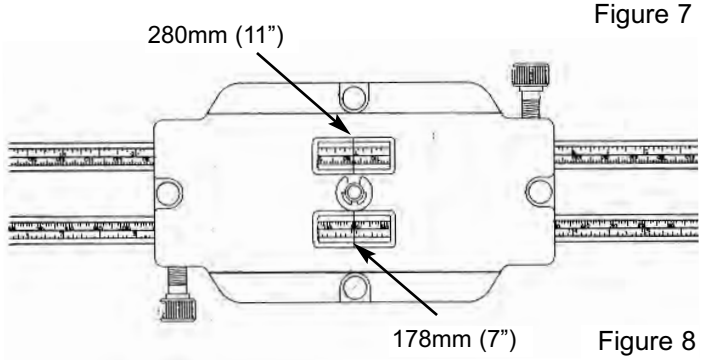


Figure 8

Scales

Scales ranging in length from 152 to 560mm (6 to 22 inches) position gauges at a specified datum height below a vehicle. Seven different lengths are provided. The 13mm (1/2 inch) square scales fasten in the housings at the ends of each gauge by means of a scale retaining spring and thumb screw.

Each scale is calibrated on two sides — yellow tape on one side and white tape on the opposite side. The two tapes read in opposite directions and each features metric and US measure. (See Figure 9.

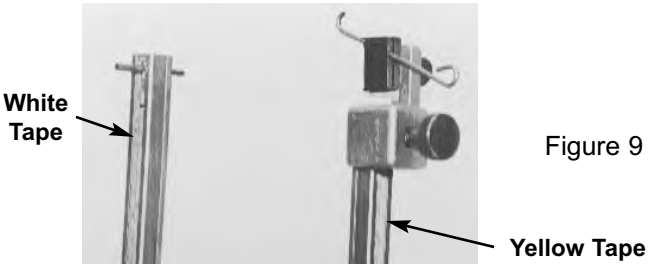


Figure 9

The yellow tape's calibration is based on a mounting attachment being used. The white tape is used when the roll pin on the end of the scale is used to install the gauge. The white tape's calibration begins at the bottom edge of the roll pin. (See Figure 10.)

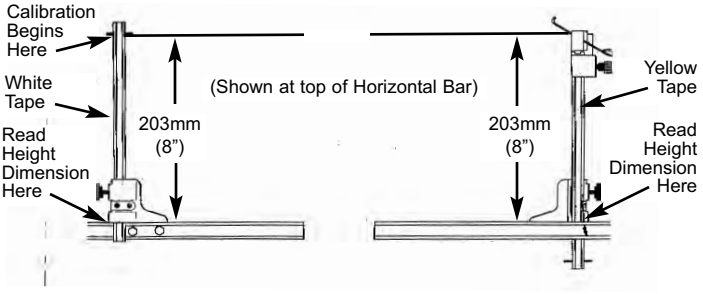


Figure 10

The tape to be used should face away from the side of the vehicle. Scales, like the one shown in Figure 11, are provided in the following quantities and lengths: two 560mm (22 inch); two - 480mm (19 inch); two - 420mm (16 1/2 inch); two - 355mm (14 inch); four - 290mm (11 1/2 inch); four - 215mm (8 1/2 inch); and, four - 152mm (6 inch).

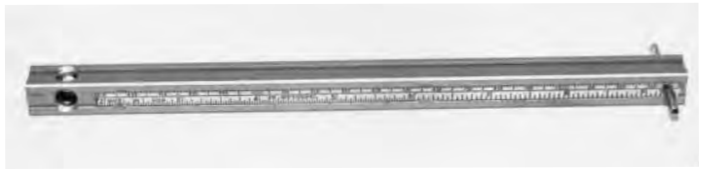


Figure 11

Attachments

Five types of attachments are provided to mount gauges to the lower structure. Each attachment fits on the end of a scale and is fastened there by a spring-loaded plunger.

When possible, an attachment should point toward the vehicle's centerline thereby aligning its vertical surface (at point of attachment) with the inside edge of the scale. The width measurement shown in the lens of the center pin housing is the distance from the center pin to the inside edge of the scale. (See Figure 12.)

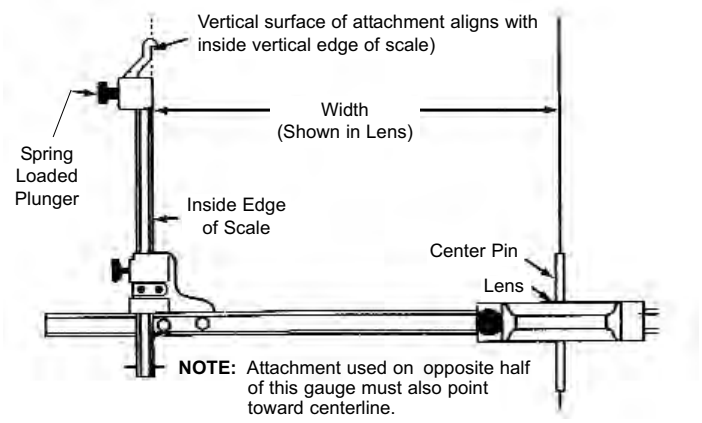


Figure 12

When an attachment points away from centerline, its vertical surface (at point of attachment) aligns with the out-

side edge of the scale. (See Figure 13.) The distance from the center pin to the outside edge of the scale is the measurement shown in the lens plus the 13mm (1/2 inch) width of the scale.

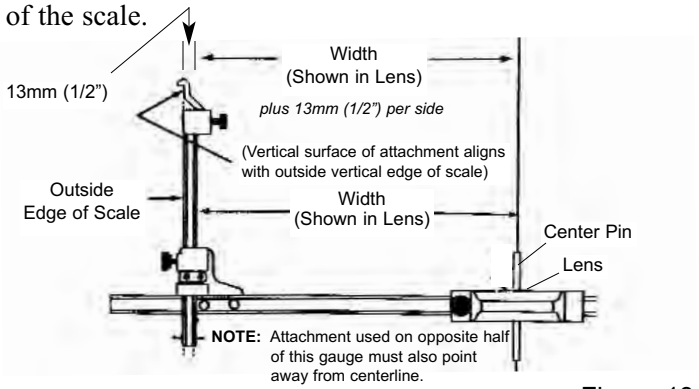


Figure 13

Notched Attachment

The Notched Attachment (see Figure 14 A, B, C and D) is used to suspend gauges from reference holes on the bottom surface of a structure. With the vertical edge of the attachment flush against the inside edge of the reference hole, the measurement shown in the lens of the gauge is the distance from the center pin to the inside edge of the hole.

The mounting edge of the Attachment is 1.5 mm (1/16 inch) higher than the scale indicates. This design allows for the average thickness of the structural member it mounts to. Most are 1.5mm (1/16 inch) thick. This design allows the scale reading at the horizontal bar of the gauge to show the distance from the top of the horizontal bar to the bottom surface of the structural member.

NOTE: Should the thickness of the structural member be more or less than 1.5mm (1/16 inch), adjust the height of the gauge by that amount.

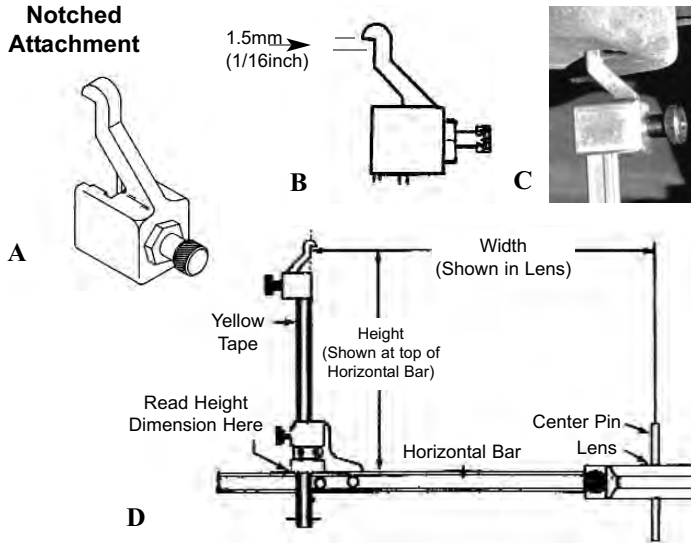


Figure 14

Magnetic Attachment

The Magnetic Attachment (See Figure 15) is used on the bottom of structural members when reference holes or other mounting locations are not available.

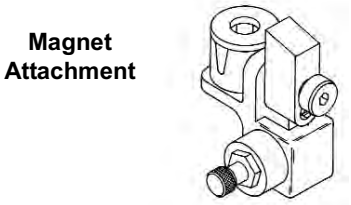


Figure 15

The attachment should be positioned so the vertical surface of the centering riser is flush with the vertical surface of the structural member. The measurement shown in the lens of the gauge is the distance from the center pin to the vertical surface of the centering riser. (See Figure 16.)

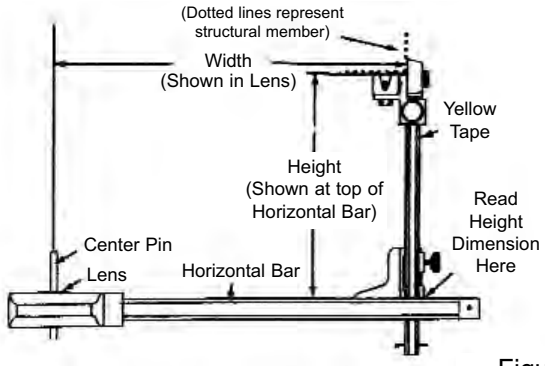


Figure 16

The scale reading at the horizontal bar of the gauge shows the distance from the top of the horizontal bar to the spot where the Magnetic Attachment fastens to the bottom of the structural member.

The Magnetic Attachment can also be used to reference the height of structural or non-structural members such as floor and trunk compartments when centerline dimensioning is not needed. (See Figure 17.) In order to secure the attachment to such a surface, its centering riser must be pivoted to a horizontal position.

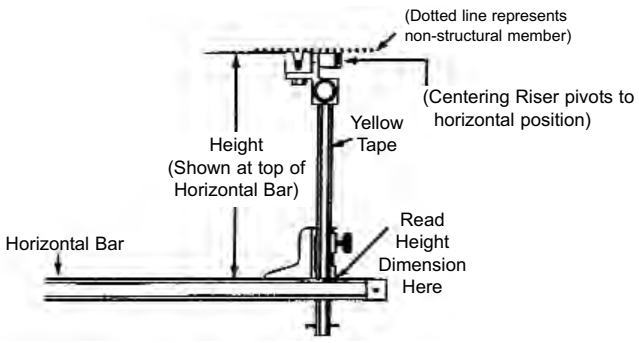


Figure 17

Adjustable Pin Attachment

The Adjustable Pin Attachment (See Figure 18) is used primarily to mount gauges to the top outside edge of rocker panels. The pin, which should protrude 6.5 to 9.5mm (1/4 to 3/8 inch) to be effective, adjusts to five different angles so it will rest on the top surface of rocker panels. The angles of this surface vary from vehicle to vehicle.

Adjustable Pin Attachment

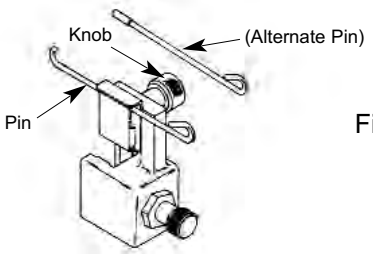


Figure 18

The scale reading at the horizontal bar shows the distance from the top of that bar to the point where the adjustable pin attachment rests on the rocker panel. (See Figure 19.)

The measurement shown in the lens is the distance from the center pin to the outer edge of the rocker panel.

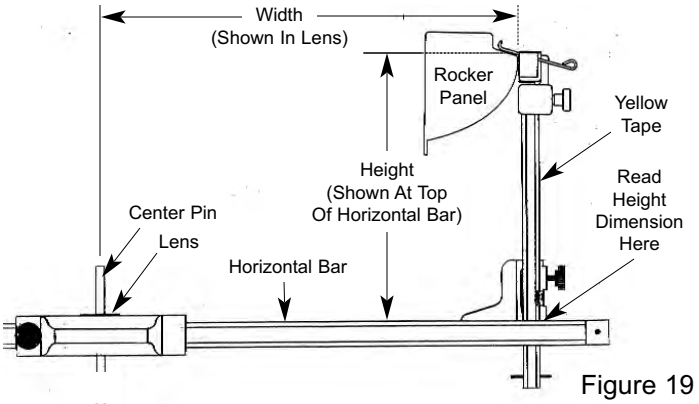


Figure 19

Fixed Pin Attachment

The Fixed Pin Attachment (see Figure 20) is useful when tight quarters prevent the positioning of other attachments in a reference hole on the side of a structural member.

The Fixed Pin is 25mm (1 inch) taller than the other attachments allowing it to reach some of the hard-to-get-at reference points (holes) on the side of structural members. When using this attachment add 25mm (1 inch) to the scale reading at the top of the horizontal bar. (See Figure 21.)

Fixed Pin Attachment

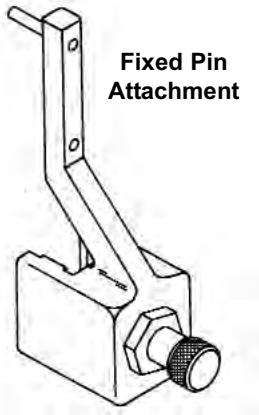


Figure 20

The measurement shown in the lens of the gauge is the distance from the center pin to the vertical surface of the structure the attachment mounts to.

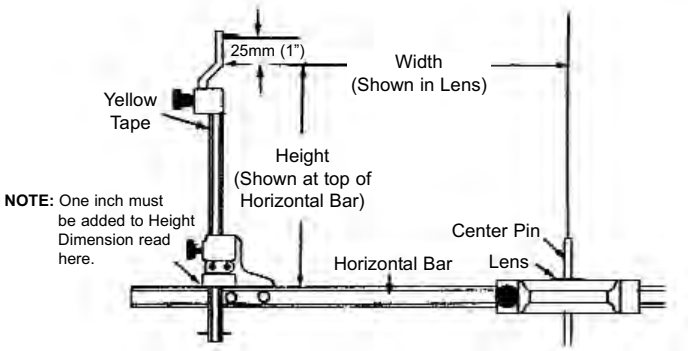


Figure 21

Offset Attachment

The Offset Attachment (see Figure 22) extends or shortens the width of a gauge by 76mm (3 inches) on each side. This attachment is needed when obstacles such as exhaust systems, suspension components, etc. are in the way. All the other attachments fasten to the Offset Attachment in the same way they attach to a scale.

Offset Attachment

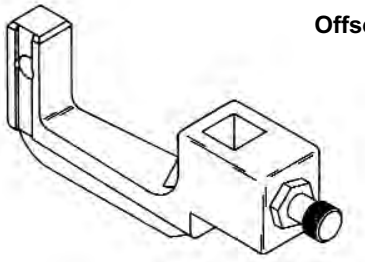


Figure 22

To determine the distance from the center pin to the vertical edge of the attachment used with the Offset Attachment, read the measurement in the lens of the gauge and add or subtract 76 mm (3 inches) per side depending on how the Offset Attachment is used. (See Figure 23 below and Figure 24 - page 8.)

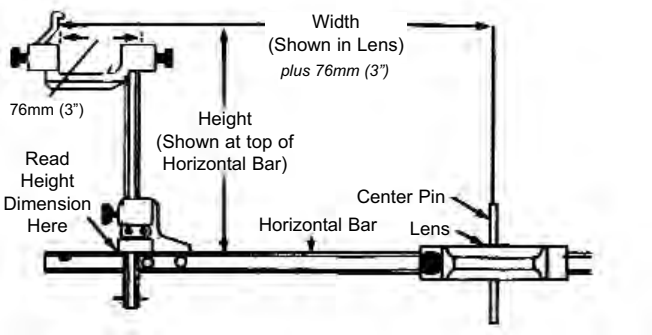


Figure 23

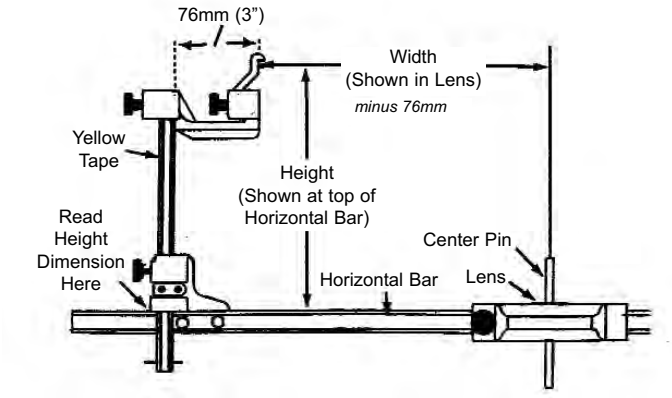


Figure 24

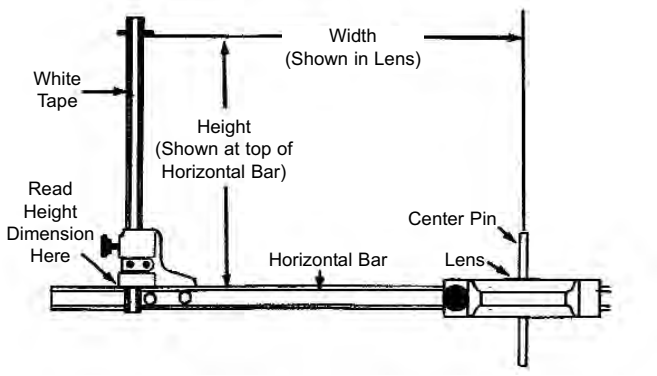


Figure 26

Roll Pin (End of Scale)

As noted in the description of the scales, one end of each scale features a roll pin. (See Figures 25 and 26.) This roll pin is used when tight quarters prohibit use of attachments.

The slender scale allows installation of a gauge in hard-to-reach places. When the scale is used in this fashion, the measurement shown in the lens of the gauge is the distance from the center pin to the inside edge of the scale.

The scale reading on the white tape at the horizontal bar of the gauge is the distance from the top of that bar to the bottom edge of the scale's roll pin.

Figure 25

Crossmember Pin

The Crossmember Pin (see Figure 27) is installed in reference holes along a structure's natural centerline. These reference holes are often located on the bottom surface of the vehicle's main crossmember. The spring clips allow placement of the sighting pin directly below the center of the reference hole. (See Section IV — Pages 21, 25 and 27.)

The sighting pin is then compared to the center pins of the gauges to determine if the crossmember is laterally aligned.

Figure 27

Strut Tower/Upper Body Gauge

The Strut Tower/Upper Body Gauge is used with the Precision Datum/Centerline Gauges. It shows misalignment of strut tower/upper body parts in relation to the structure's centerline/plane and datum line/plane.

The gauge features an upper and lower horizontal bar, each with a center pin. The upper bar is calibrated from the center out. (See Figure 28 - page 9.)

Pointers, positioned in adjustable housings on the upper horizontal bar (see Figure 29 A, B, C and D - page 9) are used to mount the gauge to strut tower/upper body locations. Two types of pointers are provided: 'cone' and 'reverse cone'. The 102mm (4 inch) reverse cone is notched to provide additional means of mounting on the vehicle, e.g. ridged surfaces. Each pointer is held in the housing by means of the lower thumb screw. Each housing is secured to the horizontal bar by means of the top thumb screw.

In addition to the standard 102mm (4 inch) length, 178mm (7 inch) pointers are provided for situations when more length is needed to position the gauge. (The 178mm reverse cone is not notched.) When using the 178mm pointers to mount the gauge, remember they change the scale reading by 76mm (3 inches).

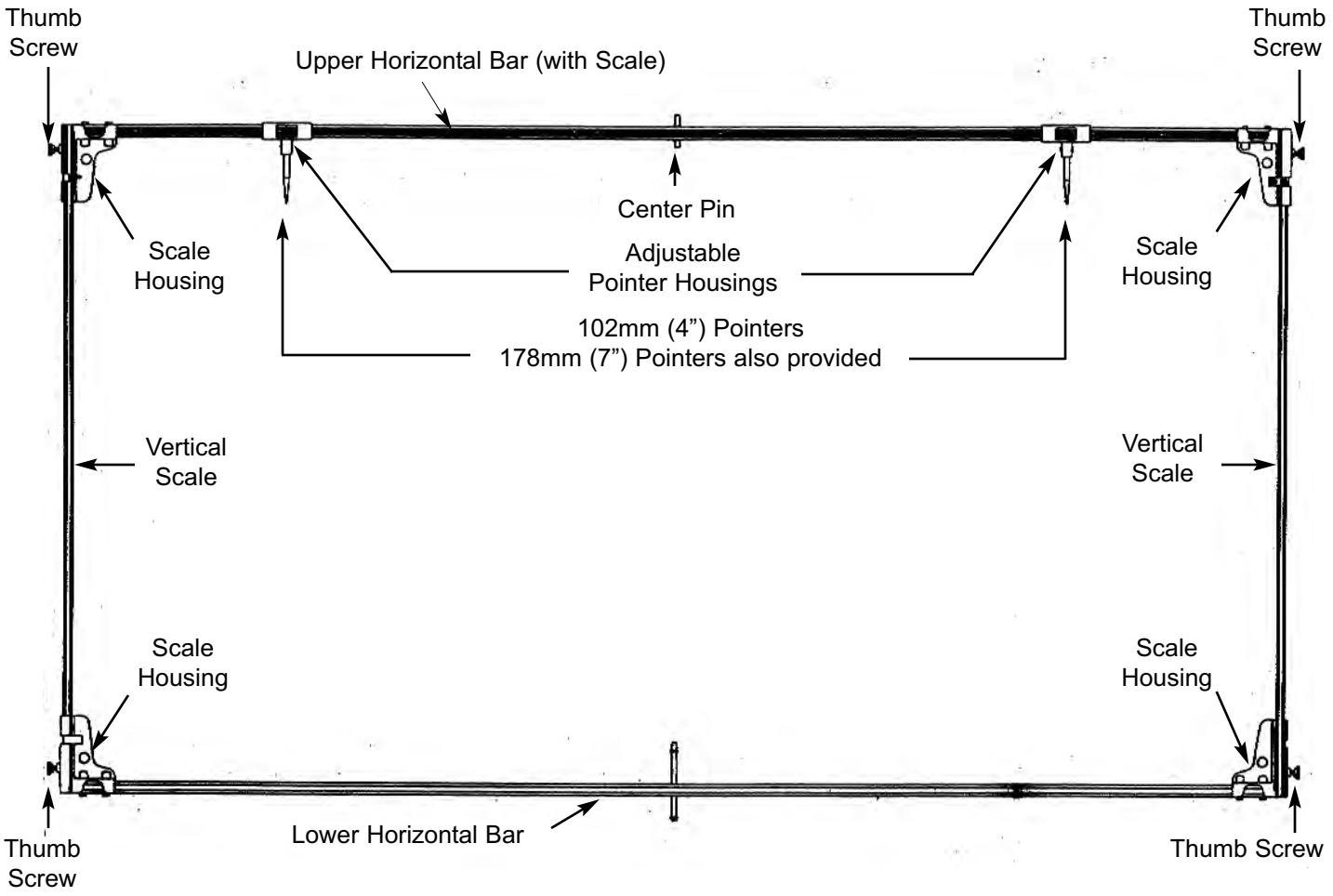


Figure 28

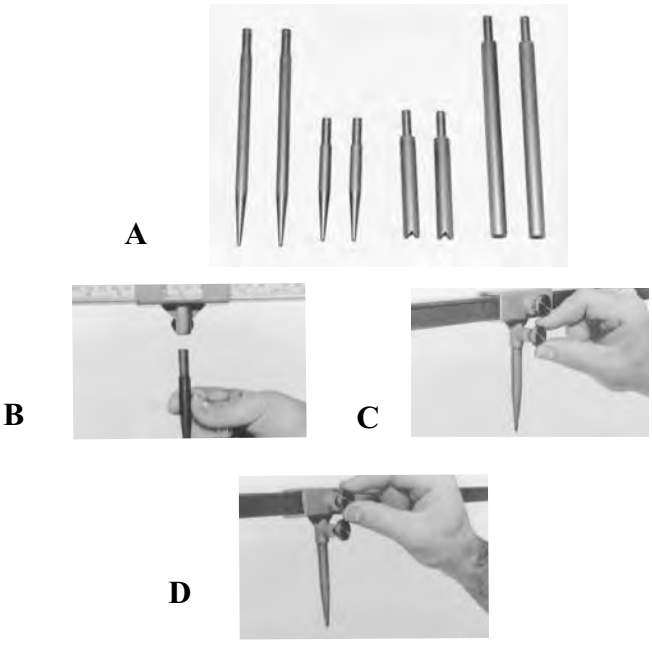


Figure 29

The vertical scales that link the upper and lower horizontal bars are used to set the lower bar at the appropriate datum height. The scales fasten in the housing at the ends of the horizontal bars. (See Figures 30 and 31.) Height adjustments are made at the housing of the upper horizontal bar.

The Strut Tower/Upper Body Gauge is used most often to detect misalignment of strut towers; however, it can also be used to detect misalignment of a radiator support, center pillar, cowl, quarter panel, etc.

Figure 30

Figure 31

Tram Gauge

The Chief Tram Gauge (see Figure 32) is used for point-to-point measurements. A point-to-point measurement is the shortest distance between any two reference points.

In most cases, point-to-point measuring is accomplished by setting a dimension on the Tram Gauge and comparing it to two reference points on the vehicle; or, aligning the Tram Gauge with two reference points on the vehicle and reading the dimension on the gauge.

Assembly

914mm (36 inch) and 1524mm (60 inch) Tram Gauge

The 1524mm (60 inch) tram gauge is pre-assembled. To assembly the 914mm (36 inch) tram gauge or re-assemble the 1524mm (60 inch) tram gauge, insert the inner tram into the outer tram aligning the inner tram's thumb screw in the slot on the rear side of the outer tram. The outer tram pointer housing must be positioned on the same side of the tram as the inner tram pointer housing so that dimensions appear in its window.

2438mm (96 inch) Tram Gauge

The 2438mm (96 inch) tram gauge is formed by joining the 1524mm (60 inch) assembled tram with the 914mm (36 inch) outer tram. A 305mm (12 inch) connector is used to join the components.

The connector slides inside the ends of the two sections. When the sections are butted together, the thumb screws on the connector are tightened to secure the assembly.

NOTE: The connector has the dimensions '1524' and '60' stamped on its face. If reading in millimeters, slide the connector into the 1524mm (60 inch) tram so the dimension '1524' will appear in the window of the 914mm (36 inch) outer tram. If reading in inches, slide the connector into the 1524mm (60 inch) tram so dimension '60' will appear in the window of the 914mm (36 inch) outer tram.

CAUTION: To avoid eye injury, always wear safety glasses.

Tram Gauge

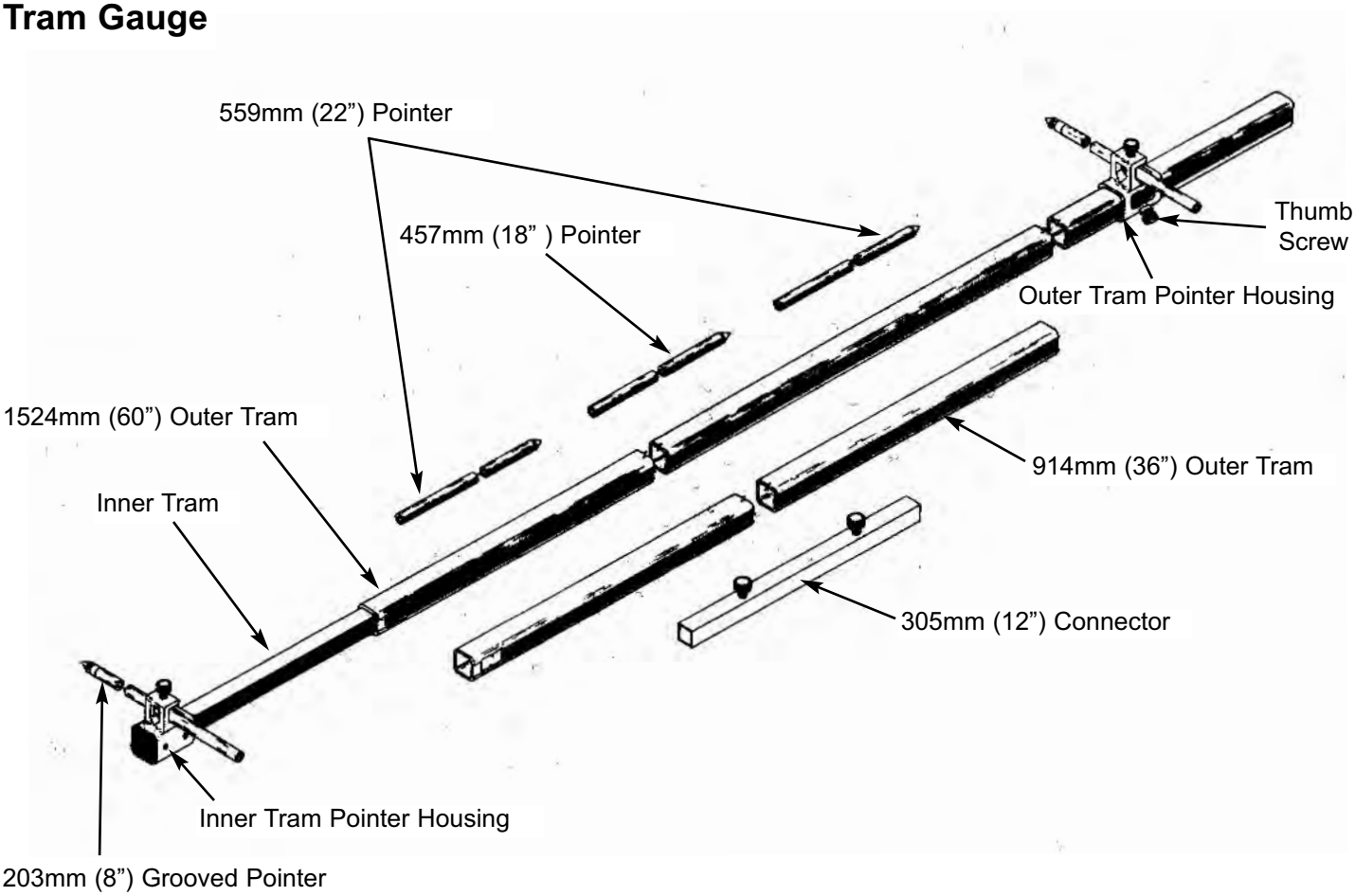


Figure 32

Point-To-Point Measuring

Equal Length Pointers

With the tram's pointers set at equal lengths, the distance between the tips of the pointers equals the sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing.

For example — see Figure 33. Set each pointer at 100mm (3 15/16 inches) at top of its pointer housing. Set the outer tram pointer housing at an even dimension, for example, 1400mm (55 1/8 inches), and the inner tram at 200mm (7 7/8 inches). The sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing is 1600 mm (63inches). Measuring the distance between the tips of the two pointers with a tape measure shows the distance is 1600mm (63 inches).

NOTE: When using the 2438mm (96 inch) tram gauge, add the dimensions shown in all three windows.

Unequal Length Pointers

When it is not possible to set both pointers at equal lengths, for example — when measuring around an obstruction, the distance between the tips of the two pointers will be greater than the sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing.

When the obstructions prevent the use of equal length pointers, adjust the pointers to lengths that allow them to reach the reference points being measured. Next, adjust the length of the tram gauge so the distance between the tips of the pointers (using a tape measure) is the dimension to be transferred to the vehicle. Tighten the thumb screws on the tram and compare this dimension to the reference points.

For example — see Figure 34. Set one pointer at 300 mm (11 13/16 inches) and the other at 100 mm (3 15/16 inches). Set the outer tram pointer housing at 1400 mm (55 1/8 inches) and the inner tram at 200mm (7 7/8 inches). A tape measure shows the distance between the tips of the pointers to be 1612mm (63 15/32 inches).

NOTE: The sum of the dimensions in the windows of the outer tram and outer tram pointer housing is 1600mm (63 inches), and should not be used.

203mm (8 inch) Grooved Pointers

The 203mm (8 inch) pointers feature grooves (near their tip) which allow the technician to hook them in a reference hole. This feature makes it easier for one person to make a measurement.

When using a grooved pointer, insert it in the outer tram pointer housing and adjust it to be 16mm (5/8 inch) longer than the pointer in the inner tram pointer housing. (See Figure 35.)

Set the outer tram pointer housing at an even dimension (millimeters or inches).

Hook the outer tram pointer into a reference hole and adjust the inner tram so the tip of its pointer is at the closest edge of the other reference hole. Tighten the thumb screws on the tram to secure the assembly at this length.

The distance between the closest edges of the two reference holes is the sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing, minus 3mm (1/8 inch). The subtraction of the 3mm (1/8 inch) figure represents the radius of the pointer (grooved portion) that is hooked in the reference hole.

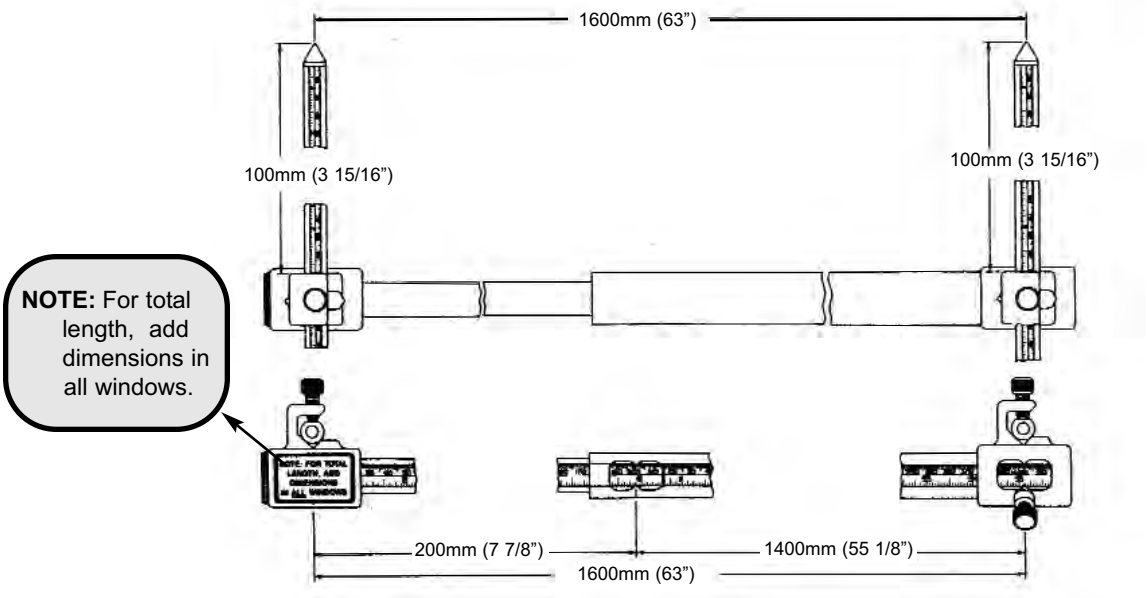


Figure 33

For example — see Figure 35. Set the length of the pointer in the outer tram pointer housing at 100mm (3 15/16 inches) and the length of the pointer in the inner tram pointer housing at 84mm (3 15/16 inches). Set the outer tram pointer housing at 1400mm (55 1/8 inches) and the inner tram at 203mm (8 inches). The distance between the closest edges of the two reference holes is the sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing, minus 3mm (1/8 inch).

203mm + 1400mm = 1603mm - 3mm = 1600mm
(8" + 55 1/8" = 63 1/8" - 1/8" = 63")

NOTE: When using the 2438 mm (96 inch) tram gauge, add the dimensions shown in all three windows and subtract 3mm (1/8 inch).

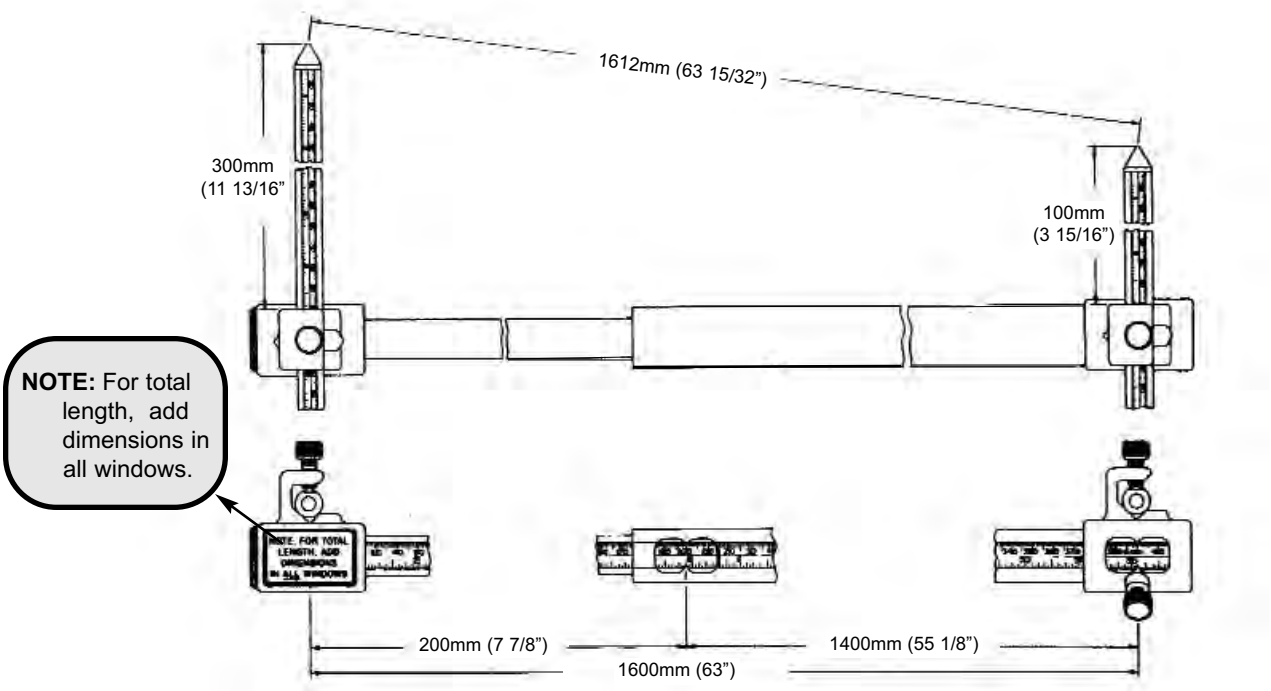


Figure 34

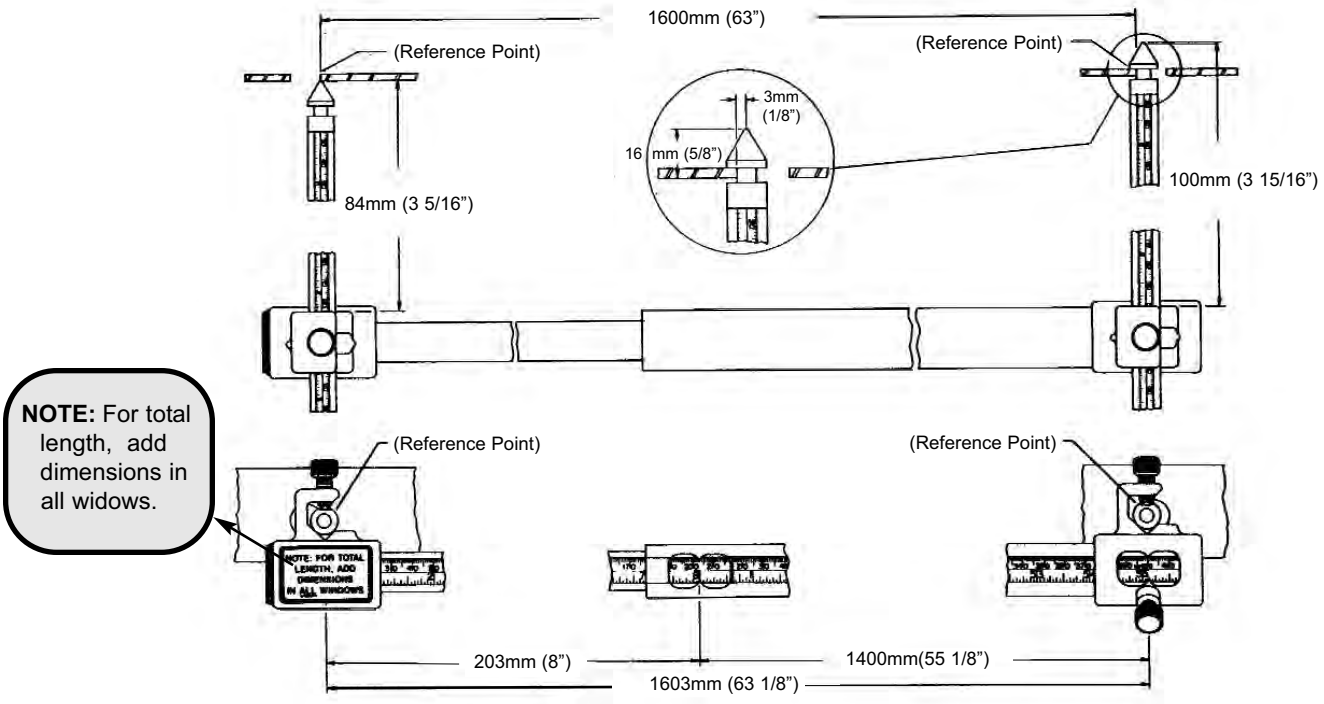


Figure 35

Inside Measuring

To make an inside measurement, for example — a windshield opening, insert pointers in the pointer housings so they are longitudinal (parallel) with the tram gauge. Pointers should project beyond the ends of the tram and be secured at an even dimension (millimeter or inch mark). Dimensions are set at the edge of the pointer housing as shown in Figure 36.

Secure the outer tram pointer housing at an even dimension (millimeter mark or inch mark). Extend the inner tram until the tips of the pointers contact the two reference points being measured. Add the dimensions of the two pointers and the dimensions shown in the windows of the outer tram and outer tram pointer housing to obtain the distance between the two reference points.

For example, see Figure 36. Set one pointer at 100mm (3 15/16 inches) and the other at 200mm (7 7/8 inches). Set the outer tram pointer housing at 1400mm (55 1/8 inches) and the inner tram at 200mm (7 7/8 inches). The distance between the tips of the pointers is the sum of the pointer lengths and the sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing.

100mm + 200mm + 1400mm + 200mm = 1900mm
(3 15/16" + 7 7/8" + 55 1/8" + 7 7/8" = 74 13/16")

NOTE: When using the 2438mm (96 inch) tram gauge add the dimensions in all three windows and add the sum to the length of the pointers.

IMPORTANT: Dimension publishers print dimensions in a variety of ways, some of which may not be applicable for these instructions. When using Chief Dimension Manuals, the point-to-point dimensions shown in the views entitled "Under Hood View" and "Bottom View" are applicable for the Chief Tram Gauge. The length dimensions along the "Datum Line" are applicable "only" for Chief's Universal Measuring System.

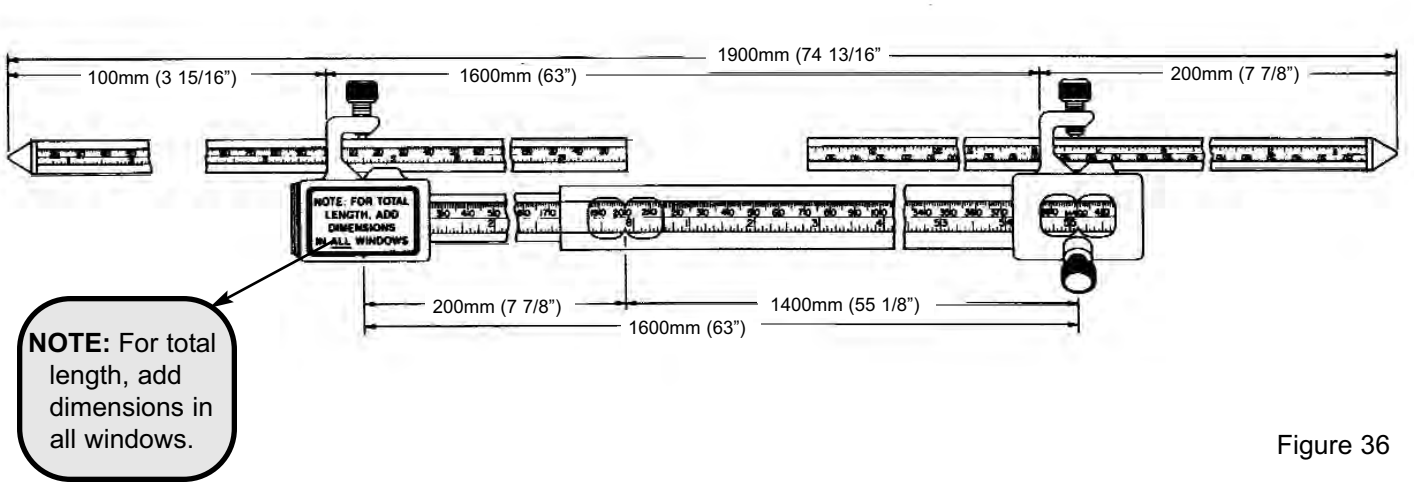


Figure 36

Dimension Manuals (Optional)

Chief's Dimension Manuals (See Figure 37) provide technicians with dimensions for structural repair. (They show an under hood view, bottom view and side view of vehicles. (See example pages — Figures 38, 39 and 40.)

The dimension manuals contain numerous point-to-point measurements: width measurements (from centerline), datum height measurements, various length measurements, diagonal measurements and alignment specifications.

Additional information on the appropriate use of measurements appears in the "Procedure Explanation Section" of each Dimension Manual.

NOTE:

1. When measuring length with Chief's Universal Gauge Measuring System use the point-to-point measurements in the Bottom View drawings.
2. When using Chief's Universal Measuring System, use the datum length measurements shown in the Side View drawings.

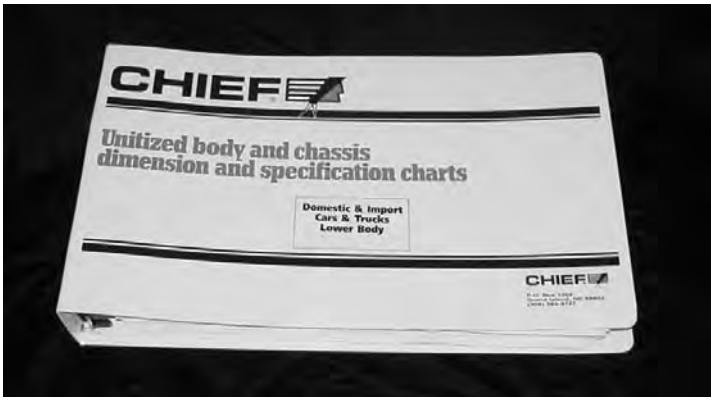


Figure 37

Example — Unitized Body Vehicle

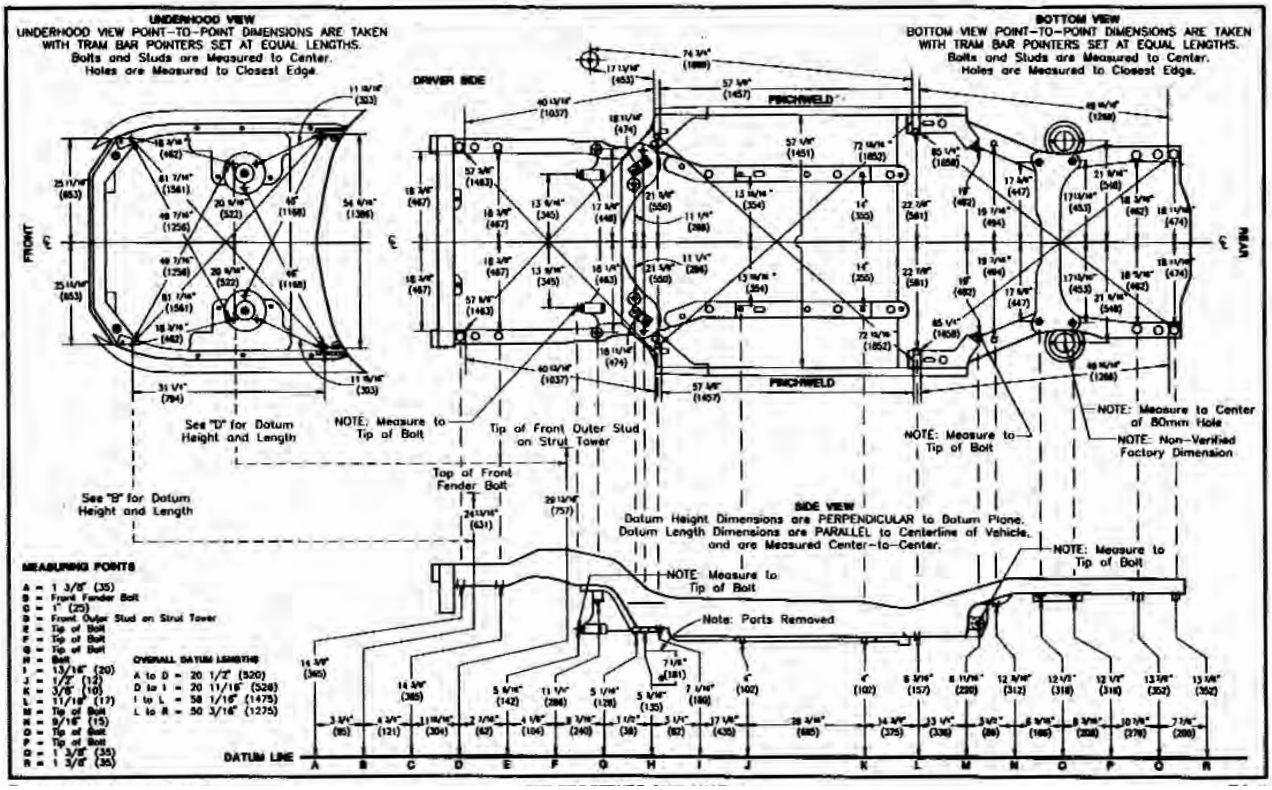


Figure 38

Example — Conventional Frame Vehicle

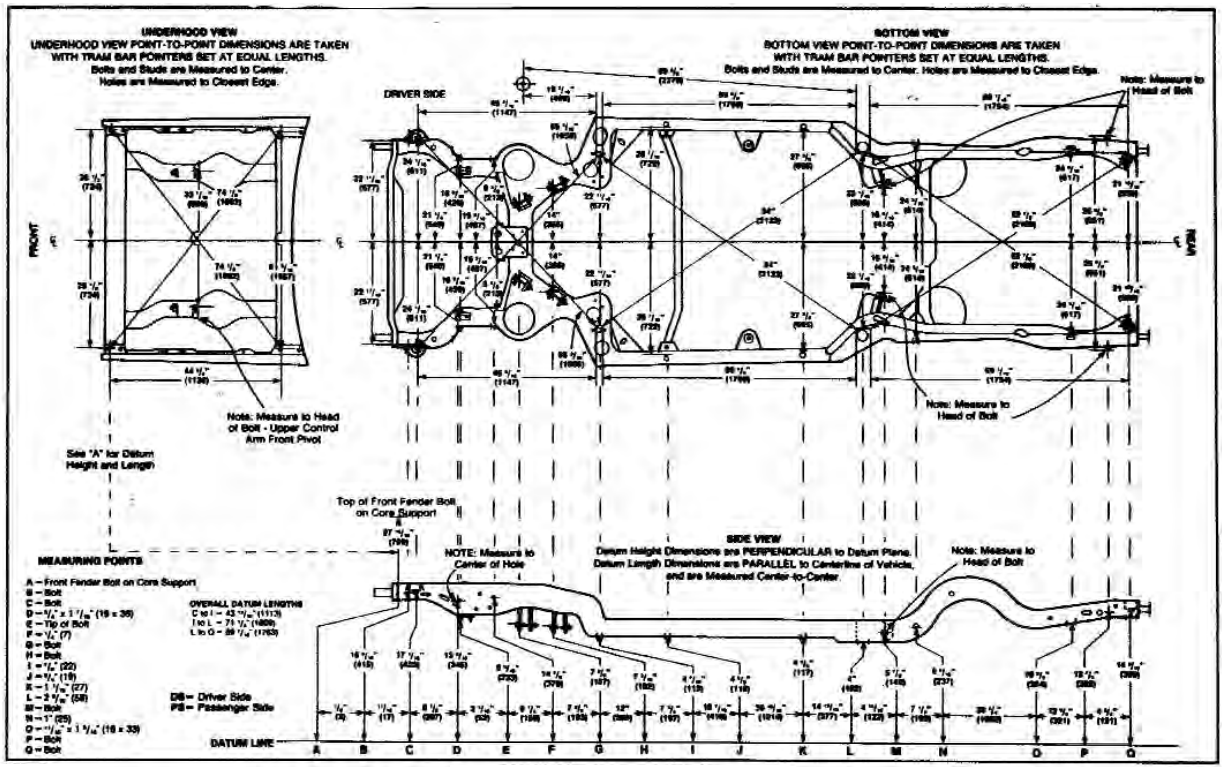


Figure 39

Example — Pickup Truck

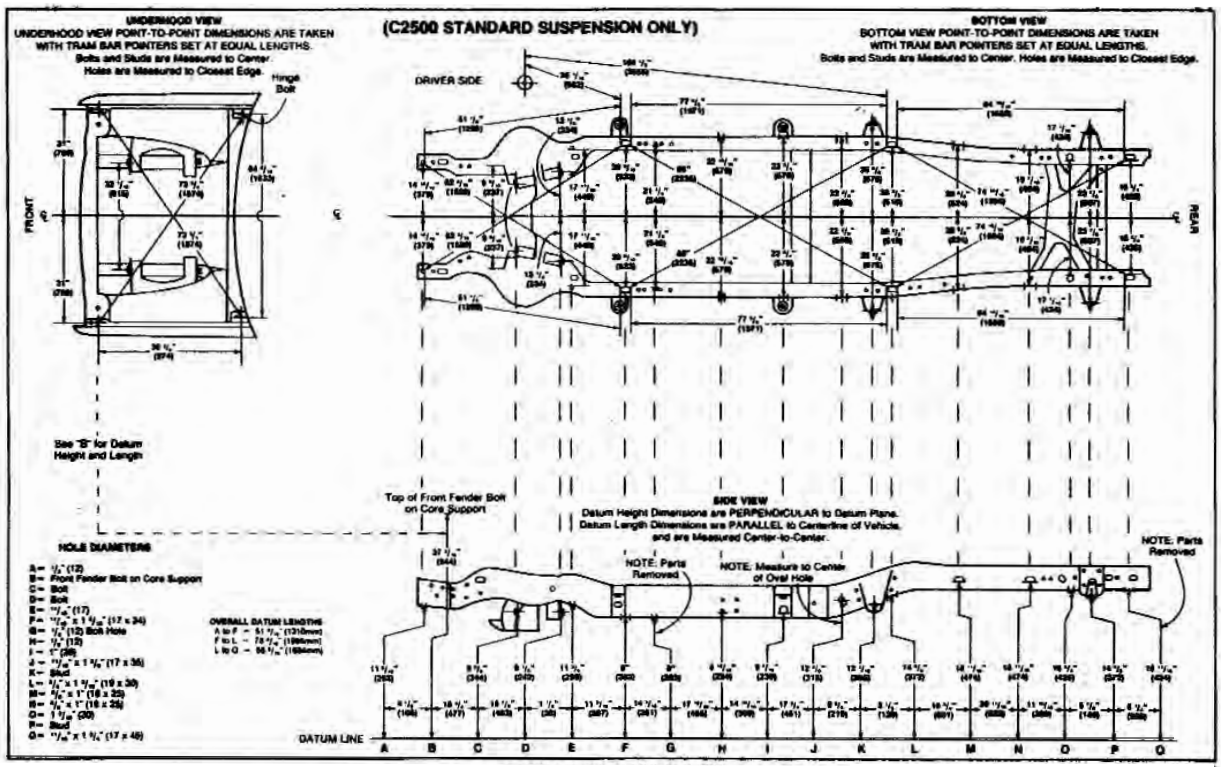


Figure 40

IV. Installation

The initial steps in gauging a vehicle's structure include: 1) dividing it into three sections; 2) locating its control points; and, 3) establishing a base for the gauging process.

The exact location of gauges on a structure will vary from vehicle to vehicle; however, they will always divide it into three basic sections: front, center and rear. (See Figure 41 — bottom view and side view.)

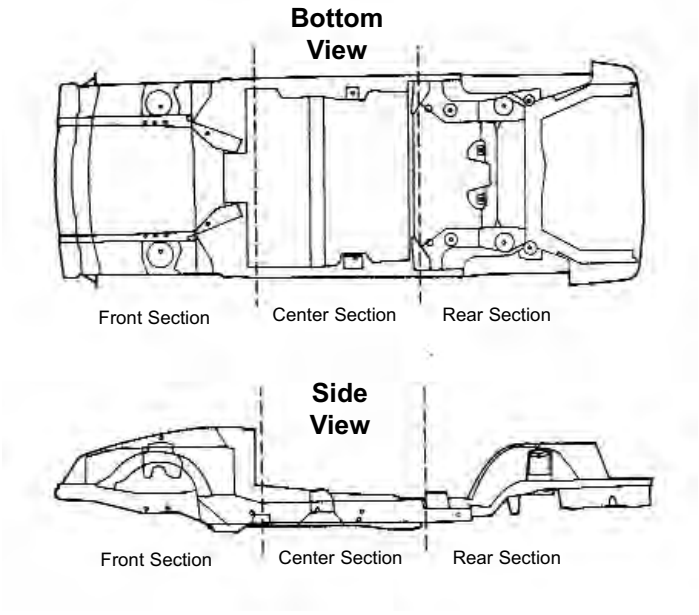


Figure 41

Gauges must be installed at the control points of the vehicle to check the alignment of the structure, suspension and steering. (See Figure 42 — bottom view and side view.) Gauges must also be installed at locations between the control points when there is either obvious or suspected misalignment.

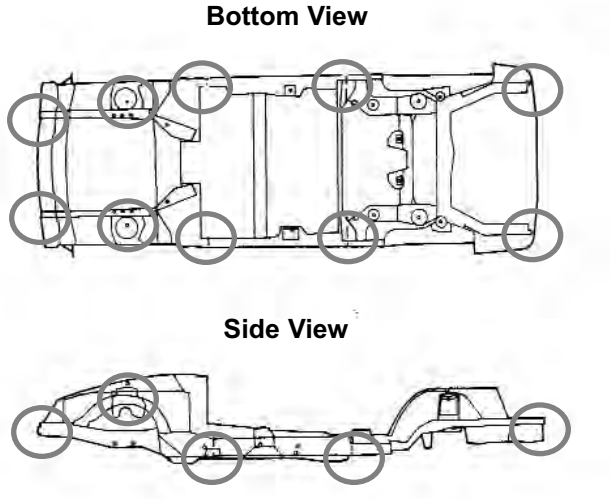


Figure 42

A relationship always exists between the location of misalignment, location of gauges and the points for holding, blocking and pulling.

The number of control points and their location will vary from one type of vehicle to another. In general, they exist in the four corners of the vehicle's center section, wherever a crossmember joins a rail or subrail, and where suspension and steering components are attached.

The center section of the vehicle is the "base" from which gauging starts. Installing Precision Datum/Centerline Gauges at the front and rear of the center section and at the front and rear of the vehicle divides the structure into its three basic sections. (See Figure 43.) Positioning the horizontal bars of each gauge at datum height shows the condition of each section relative to the datum plane.

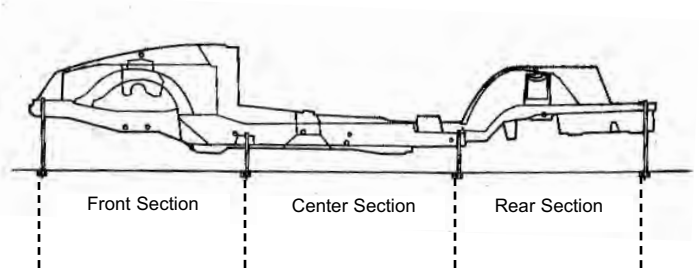


Figure 43

Revise Datum Height When Needed

When datum height specifications position gauges either too close to a vehicle's structure or too far away, revise the datum height up or down to a more convenient height. (See Figure 44.)

NOTE: If datum height is revised, adjust all gauges by the same amount.

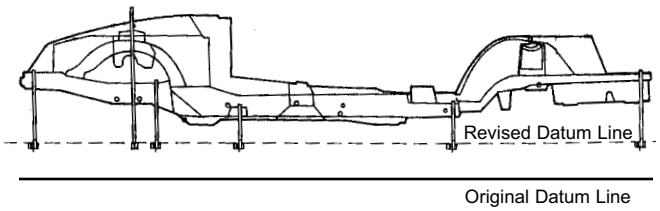


Figure 44

NOTE: The following segment of this manual addresses installation of gauges on a unitized body vehicle. Installation of gauges on conventional frame vehicles (including pickup trucks) is similar. Differences exist, however, regarding methods of attachment. Such differences are illustrated on the pages at the conclusion of this section.

CAUTION:
- To avoid eye injury always wear safety glasses.
- Set the emergency brake and block the wheels before raising the vehicle.

Unitized Body Vehicles

Because of the way some unitized body vehicles misalign during the collision, and because of variances (tolerances) in the location of factory reference points built into such vehicles, the most practical place to install gauges in the center section is on the top of the rocker panels. (See Figure 45.)

Generally, the tops of the rocker panels are positioned parallel to each other when the vehicle is built and thus provide the best mounting points for the gauges in the center section of the vehicle. Each vehicle, however, must be evaluated to determine the best place for positioning and referencing gauges.

Figure 45

Gauging from factory reference points in the center section of many unitized body vehicles can be misleading due to the way the factory reference points are misaligned from the collision.

NOTE: On some unitized body vehicles, reference points (holes) are located at the corners of the vehicle's center section, either in front of or behind the rocker panels. (See Figure 46.) Occasionally, damage to the structure may necessitate mounting one of the base gauges to this type of reference point (hole) while mounting the other to the top outside edge of the rocker panels.

Figure 46

Installation Procedures

If a diamond condition is suspected, diagonally measure the vehicle's center section with a Tram Gauge (see Figure 47) prior to installing base gauges. If diamond goes undetected, a false analysis of the damage will be made.

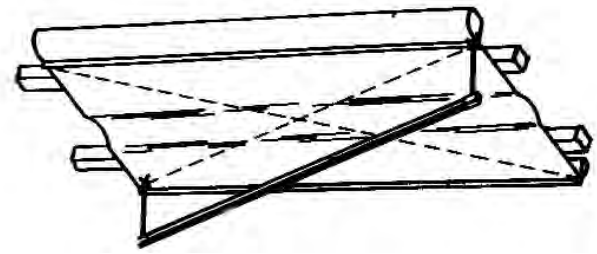


Figure 47

The vehicle's weight should be on its suspension during the gauging process. If the vehicle is supported by an anchoring system during gauging, and the front and rear suspensions are not loaded, the end sections of the vehicle will droop. This must be considered when making the damage analysis.

Installing Base Gauges

1. Select a 1015mm (40 inch) gauge to use at the front of the center section. (Refer to this gauge as the No. 2 Gauge.)
2. Select two attachments to use with the gauge. Adjustable Pin Attachments are used to mount the base gauges to rocker Panels. Notched Attachments are usually used to mount gauges to factory reference points (holes — see Figure 46). (See Section III — pages 5 - 8 for additional attachment information.
3. Select scales that will position the horizontal bars of the gauge at datum height or at a convenient reading height - approximately 102mm (4 inches) below the vehicle.
   NOTE: Use the shortest length scales that will do the job.
4. Assemble the gauge:
   a) Fasten an attachment to the end of each scale. The attachment's spring loaded plunger fits in a hole on the end of the scale. (See Figure 48 A, B and C.)

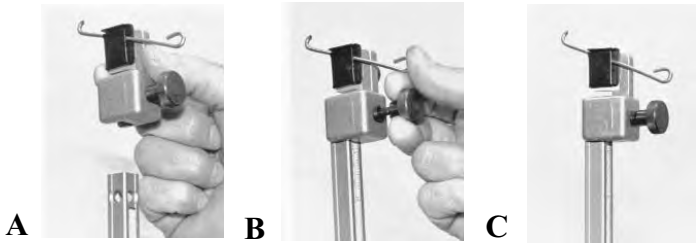


Figure 48

NOTE: Remember, attachments should point toward centerline and yellow tape should face away from the vehicle. (See additional information and illustration - Section III — pages 5 - 8.)

IMPORTANT: When using Adjustable Pin Attachments, adjust angle of pin to match top surface of rocker panel. (See Figure 49.) The Adjustable Pin Attachment used on the opposite side of the vehicle must be set at the same pitch. Also, the pins should extend 6.5 to 9.5mm (1/4 to 3/8 inch) to be effective.

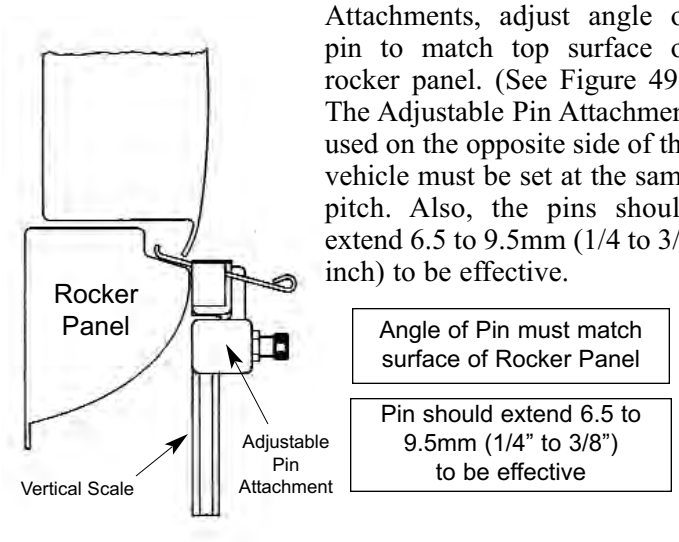


Figure 49

b) Fasten the scale/attachment assemblies in the scale housings of the gauge. (See Figures 50 and 51.) Position the scale so the horizontal bar of the gauge will hang at datum height or at a convenient reading height below the vehicle if datum is not used — approximately 102mm (4 inches), and tighten the scale housing's thumb screw.

Figure 50

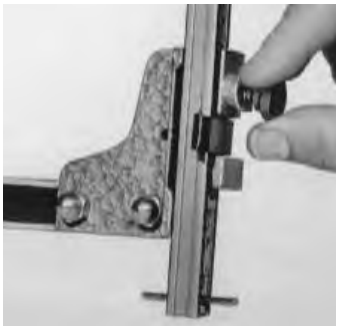


Figure 51

c) Bring the scale housings of the gauge tight against the center pin assembly to ensure the gauge is centered. Bring the scale housings out to install the gauge. (See Figures 52 and 53.) When mounting the gauge to rocker panels, position it at the front of the rocker panels. (See Figure 54.)

Figure 52

Figure 53

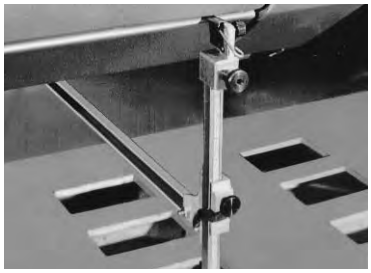


Figure 54

d) After installing the gauge, pull it inward so the inside vertical edge of the Adjustable Pin Attachment is flush with the top of the rocker panel. To prevent movement during the repair, tighten the thumb screws on the center pin assembly. (See Figure 55 and 56.)

NOTE: If the structural member the gauge mounts to will move during the repair, don't tighten the thumb screws at the center pin assembly. This will enable the gauge to move with the repair.

Figure 55

Figure 56

5. Select another 1015mm (40 inch) gauge with scales and attachments to use at the rear of the center section. (Refer to this gauge as the No. 3 Gauge.) Assemble this gauge and install it in the same manner as the No. 2 Gauge. When mounting this gauge to rocker panels position it at the rear of the rocker panels.

Adjusting Base Gauges To Datum Height When Mounted To Rocker Panels

Gauges mounted to rocker panels are adjusted to datum height either directly or by transferring datum.

When the horizontal bar of a base gauge is under a datum reference point, the top of the bar is adjusted to the datum reference point. A tape measure (see Figure 57) is used in the process.

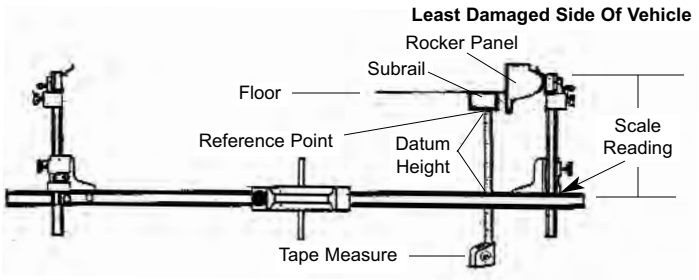


Figure 57

If the reference point is too far forward or rearward of the gauge, then use the tram gauge bar (in addition to a tape measure) to transfer the datum height of the reference point to the top of the horizontal bar of the gauge. (See Figure 58.)

Figure 58

IMPORTANT: When setting the base gauges at datum height, either directly or by transferring datum, start on the least damaged side of the vehicle.

Direct Adjustment To Datum Height

1. With the horizontal bar of a base gauge under a datum reference point, use a tape measure to adjust the top of the horizontal bar to the specified datum height. (See Figure 59.)
   NOTE: This process is simplified by starting with the horizontal bar of the gauge parallel to the rocker panels (identical scale settings) and as close as possible to datum height.

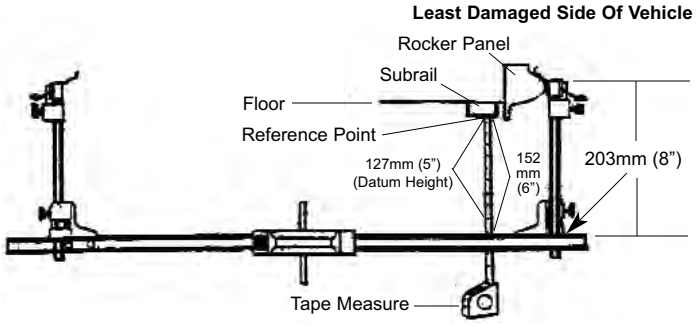


Figure 59

NOTE: Be aware of the vehicle's undercoating and compensate for its thickness when reading the tape measure.

2. Read the tape measure and note the distance the top of the horizontal bar is from the reference point. As shown in Figure 59, the distance is 152mm (6 inches).
   NOTE: Measure from a reference point on the least damaged side of the vehicle. DO NOT measure from a reference point on the most damaged side as it may be out of position.
3. Determine how much the bar must be raised or lowered so the top of the bar will be at the datum height. In this example, the datum height is 127mm (5 inches) and the bar must be raised 25mm (1 inch) to be at datum height.
4. Raise the bar on the least damaged side of the vehicle 25mm (1 inch) and tighten the thumb screw on the scale housing. (See Figure 60.)

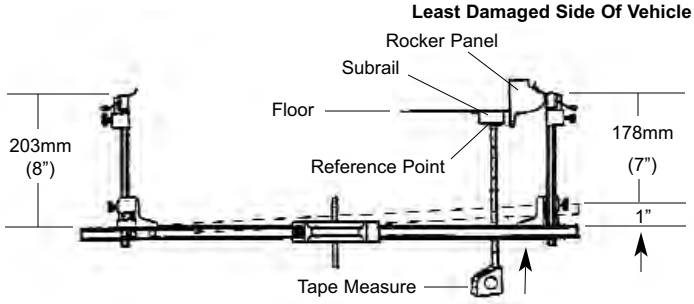


Figure 60

5. Raise the bar on the most damaged side of the vehicle 25mm (1 inch) and tighten the thumb screw on the scale housing. (See Figure 61.)

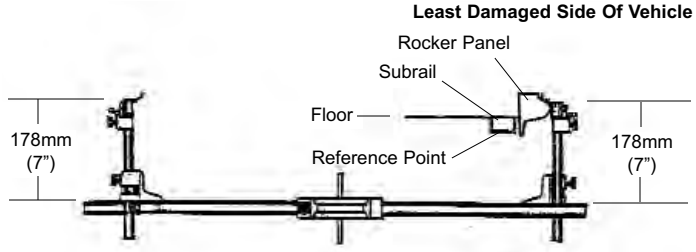


Figure 61

6. Remeasure the distance from the reference point on the least damaged side of the vehicle to the top of the horizontal bar. (See Figure 62.) If the top of the bar is not at datum height — in this example 127mm (5 inches), repeat the procedure until the desired datum height is achieved and the height of each gauge scale is equal.

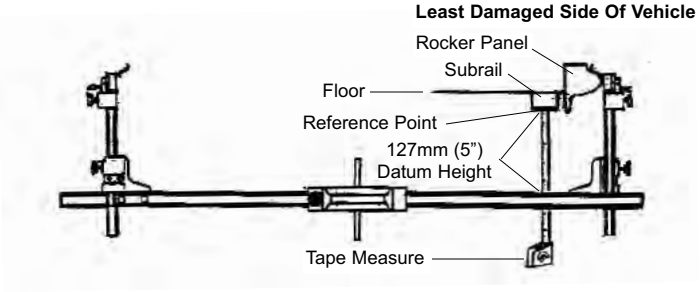


Figure 62

Transfer Datum

If the horizontal bar of the other base gauge is not under a datum reference point, it will be necessary to transfer datum.

1. Extend tram gauge bar across two base gauges making certain it passes under a datum reference point on least damaged side of vehicle near the horizontal bar.
2. Measure from reference point to bottom edge of tram gauge bar. (See Figure 63.) Bottom edge of tram gauge bar corresponds with top of horizontal bar of the gauge.

Figure 63

3. Raise or lower the horizontal bar until bottom of tram gauge bar is at the datum height of the reference point. Tighten the thumb screw on the scale housing and note the scale reading. (See Figure 64.)

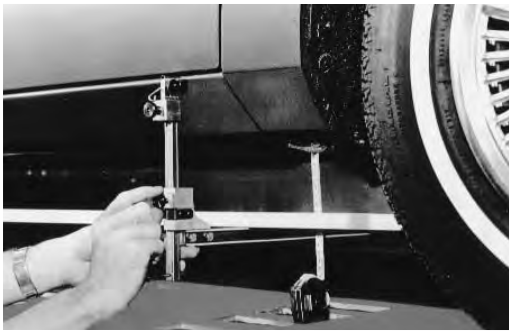


Figure 64

4. Move to the damaged side of the vehicle, adjust the top of the horizontal bar to the same scale reading and tighten the thumb screw on the scale housing.
   NOTE: DO NOT transfer datum from a reference point on damaged side of vehicle as the reference point may be out of position from the collision.
5. Return to the least damaged side of the vehicle and remeasure the distance from the reference point to the bottom of the tram gauge bar. The adjustment to the horizontal bar of the gauge on the damaged side of the vehicle may have changed this distance.
6. If the measurement shows the distance has been altered, repeat the outlined procedure until the datum height is set.

Transfer Datum (Both Gauges)

On some vehicles, it may be necessary to transfer datum height to both base gauges.

The procedure for each gauge is the same as just outlined; however, additional remeasuring and adjusting may be needed to position both gauges at datum height. This is because the distance a gauge lies below a reference point (on least damaged side of vehicle) is affected not only by adjustments to that gauge but by adjustments made to the other base gauge.

Installing End Section Gauges

1. Select 915mm (36 inch) gauges for installation at the ends of the vehicle; and, an 815mm (32 inch) gauge for installation in the suspension area of the vehicle. For example, the front crossmember, suspension mounting members, engine cradle, or at intermediate points along the subrails. Select the Strut Tower/Upper Body Gauge for positioning on strut tower or other upper body locations. Refer to the gauges as they are numbered. (See Figure 22 below and Figure 23 on next page.)

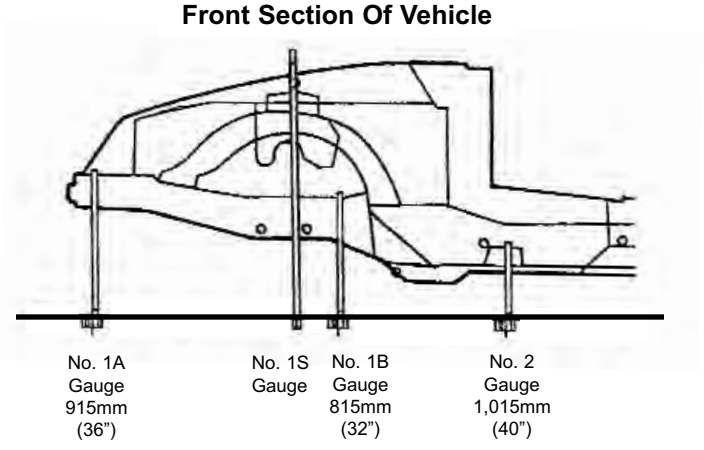


Figure 65

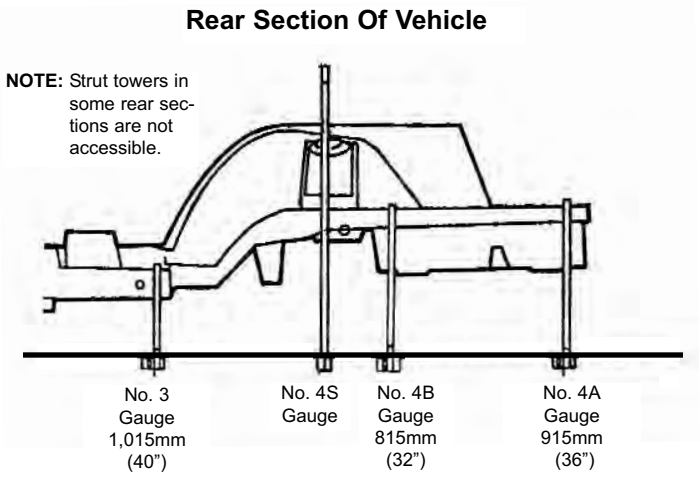


Figure 66

NOTE: The Strut Tower/Upper Body Gauge and the 815mm (32 inch) gauge are used in either the front or rear sections of the vehicle depending on where they are needed. They are referred to as the No. 1S and No. 1B Gauges if used in the front section and as the No. 4S and No. 4B Gauges if used in the rear section.

2. Select attachments suited for the reference points (holes) each gauge will mount to. Commonly used attachments are the Notched, Magnetic, and Fixed Pin. Also used is the roll pin on the end of each scale. If using this roll pin, turn the scale so the white measuring tape faces away from the side of the vehicle. (See Figure 67.) Its calibration begins at the bottom edge of the roll pin. (See additional information — Page 8.)

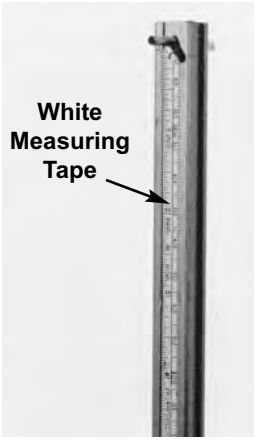


Figure 67

3. Select two scales for each gauge that will allow positioning of the horizontal bars of the gauge at the datum height.

4. Assemble the scales and attachments to each gauge. If a gauge is to mount to reference points (holes), preset the gauge at datum height. When it can't be mounted to reference points (holes), install it near reference points and adjust the horizontal bar to datum height using a tape measure extended from the reference points to the top of the horizontal bar. (See sequence for Direct Adjustment to Datum Height — pages 19 and 20.)

5. In addition to the Precision Datum/Centerline Gauges used in the end sections, a Crossmember Pin can be used to detect lateral misalignment of some crossmembers. The pin (see Figures 68 and 69) is installed in a reference hole in the middle of a crossmember. A spring clip is used to position the pin and hold the assembly in place.

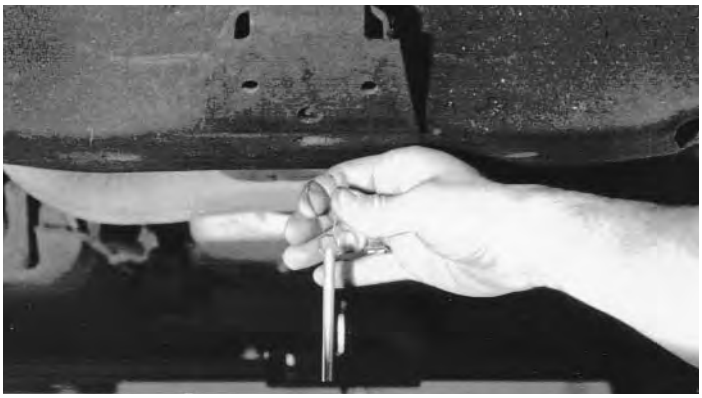


Figure 68

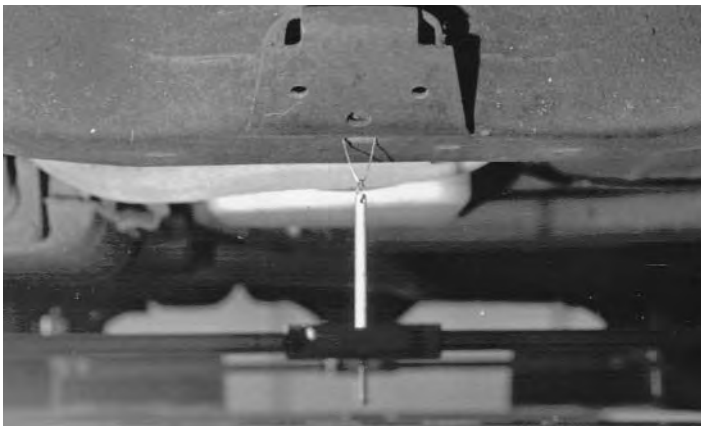


Figure 69

Strut Tower/Upper Body Gauge

The Strut Tower/Upper Body Gauge is used to measure the vehicle's strut towers. In addition, it can also be used for other upper body dimensioning.

Installation Procedures

1. When gauging a vehicle's strut towers (front or rear), remove the wheels at that end of the vehicle. Wheel stands, which bolt to each hub, should be positioned at the same height from the machine as the original wheels to duplicate the original riding height of the vehicle. (See Figure 70 — next page.)

Figure 70

2. Select a pair of mounting pointers to match the strut tower reference points. 'Cone" and 'Reverse Cone" are provided in 102mm (4 inch) and 178mm (7 inch) lengths.

   NOTE: The reference points are usually the strut mounting bolts or strut rods on the top of the strut towers. (See dimension manuals for identification of the reference points and their specifications.)

3. Install each pointer in a housing on the upper horizontal bar of the gauge and secure it by tightening the housing's lower thumb screw. (See Figures 71 and 72.)

Figure 71

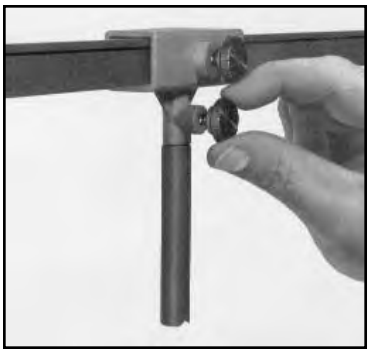


Figure 72

4. Set each pointer housing at its specified width dimension and tighten the housing's upper thumb screw to secure it to the horizontal bar. (See Figures 73 and 74.)

Figure 73

Figure 74

5. Place the upper horizontal bar across the strut towers and position the pointers on the strut tower reference points. (See Figures 75 and 76.)

Figure 75

Figure 76

NOTE: If a strut mounting bolt is the specified reference point but it has been removed from the strut tower, replace it with a bolt of the same size and adjust it to the same height as the reference bolt on the other strut tower.

If both pointers can not be positioned on the reference points at the same time, due to misalignment, loosen the pointer housing on the most damaged side of the vehicle and position that pointer on its reference point. It is not necessary to retighten the housings thumb screw at this time.

NOTE: This will allow the center sighting pin on the lower horizontal bar of the gauge (when installed) to show the position of the strut tower on the least damaged side relative to the centerline of the vehicle. The misalignment of the other strut tower can then be determined.

6. Fasten the vertical scales in the scale housings of the upper horizontal bar and adjust each so the lower horizontal bar (when installed) will be at datum height or at a convenient reading height. Scales are held in the scale housings of the upper horizontal bar by scale retaining springs and thumb screws. (See Figure 77.)

Figure 77

Read the scale at the bottom of the upper horizontal bar scale housing. This reading will be the distance from the tip of the mounting pin to the top of the lower horizontal bar (when the bar is installed). (See Figure 78.)

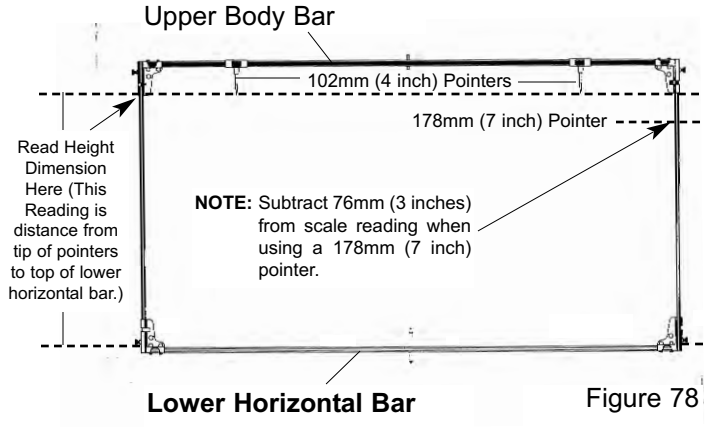


Figure 78

7. Fasten the lower end of each vertical scale in the scale housings of the lower horizontal bar. The scales are held in the housings by means of a thumb screw that fits in a hole on the scale. (See Figure 79 — arrow points out hole in scale.)

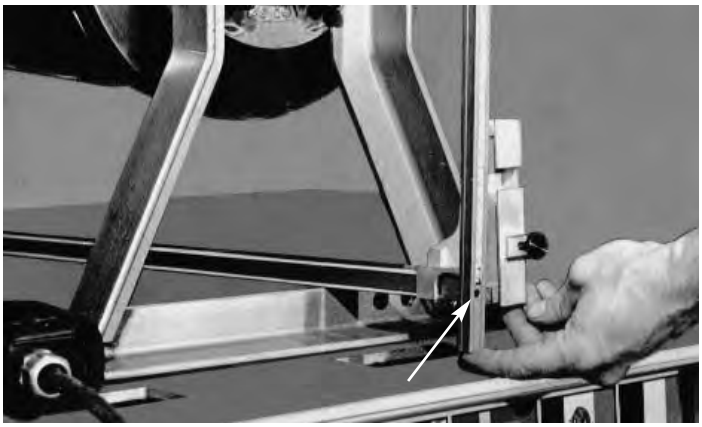


Figure 79

IMPORTANT: For correct installation, the thumb screw must align with and fit into the hole on the bottom of the scale. (See Figure 80.)

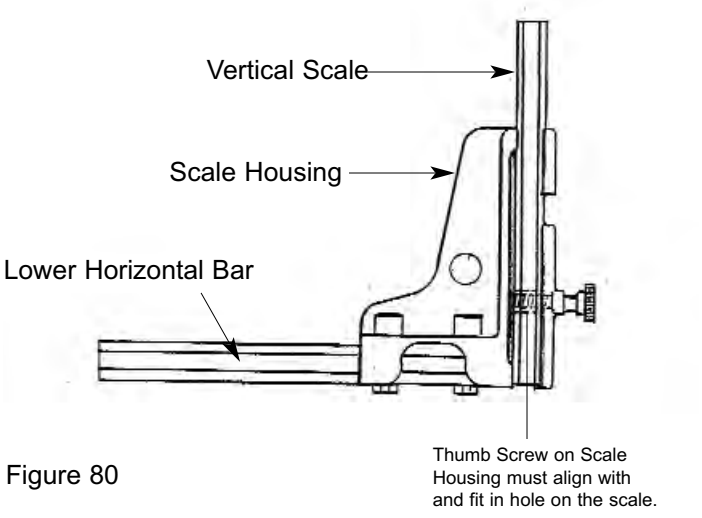


Figure 80

Strut Tower/Upper Body Gauge Usage

The Strut Tower/Upper Body Gauge is used to determine the strut tower width and is also compared to the base gauges for level, datum height (if needed), and centerline/plane misalignment. (See Figure 81.) The Tram Gauge (or tape measure) is used to measure the forward position of each strut tower relative to reference points at the cowl.

1. Read the dimensions on the upper horizontal bar of the Strut Tower/Upper Body Gauge to determine the correct width of the strut towers.
2. Compare the center pin of the lower horizontal bar of the Strut Tower/Upper Body Gauge to the center pins of the No. 2 and No. 3 Base Gauges to detect any centerline misalignment.
   NOTE: If the height of one or both strut towers is misaligned, the center pin reading on the lower horizontal bar of the gauge is altered by a pendulum effect.
3. Compare lower horizontal bar of the Strut Tower/Upper Body Gauge to the No. 2 Base Gauge for level and to the No. 2 and No. 3 Base Gauges to determine datum.
4. To measure the forward position of a strut tower relative to reference points at the cowl, extend a Tram Gauge (or tape measure) from a reference point at the cowl to the strut tower reference point. (See Figure 82.)

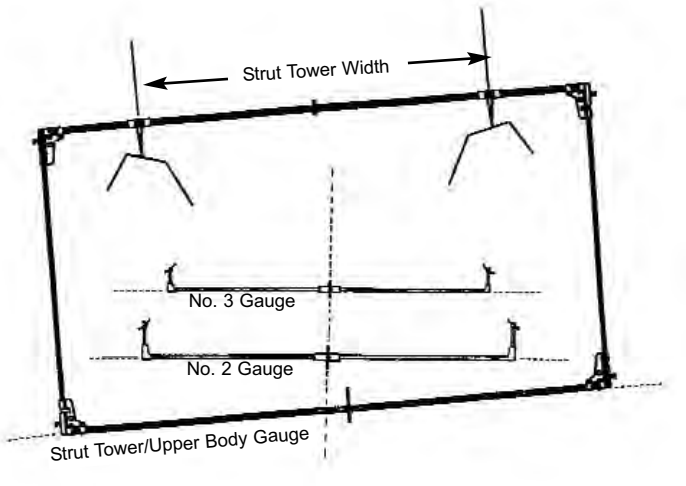


Figure 81

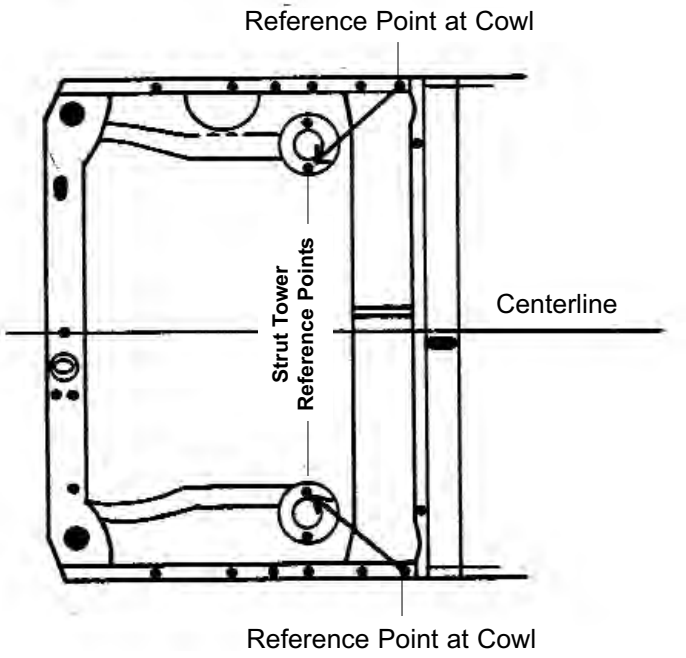


Figure 82

Other Uses

In addition to showing misalignment of strut towers, the Strut Tower/Upper Body Gauge shows misalignment of other upper body locations such as radiator support, cowl, quarter panel, etc.

Although specifications for these locations are not always available, the gauge will allow comparison of these areas to the base gauges for level and centerline.

Centering the gauge on upper body locations (radiator support, cowl, quarter panel, etc.) allows sighting these areas relative to the vehicle's datum plane and centerline plane.

NOTE: When installing the Strut Tower/Upper Body Gauge at locations other than strut towers, position the lower horizontal bar at a convenient reading height below the vehicle (as close as possible to the datum plane).

Conventional Frame Vehicle

Figure 83 *Gauges installed on conventional frame vehicle.*

The installation of Precision Datum/Centerline Gauges on conventional frame vehicles is similar to installation on unitized body vehicles. A few differences exist, however, regarding methods of attachment.

The photos on this page and the next illustrate some of the ways Precision Datum/Centerline Gauges can be positioned on conventional frame vehicles.

Figure 84 *Gauges installed in front section of vehicle.*

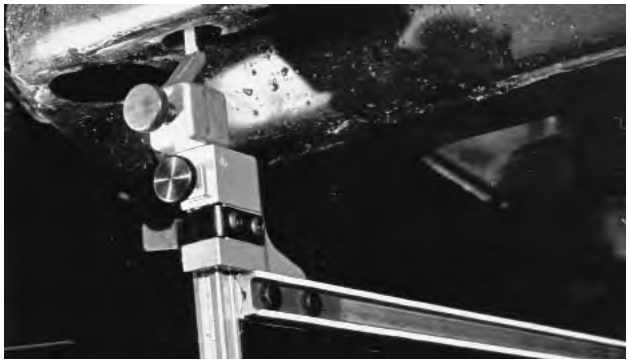


Figure 85 *Notched Attachment used to suspend gauge from reference hole on underside of rail at front of center section.*

Figure 86 *Roll Pin (end of scale) used to mount gauge to lower control arm mounting bolt in front section.*

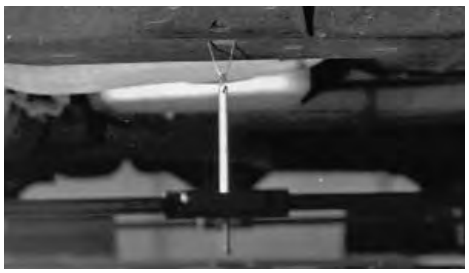


Figure 87 *Crossmembre Pin installed (by means of spring clip) in reference hole in middle of crossmember — shows lateral misalignment of crossmember.*

Figure 88

Fixed Pin Attachment used in conjunction with Offset Attachment to mount gauge to top surface of rail in front section.

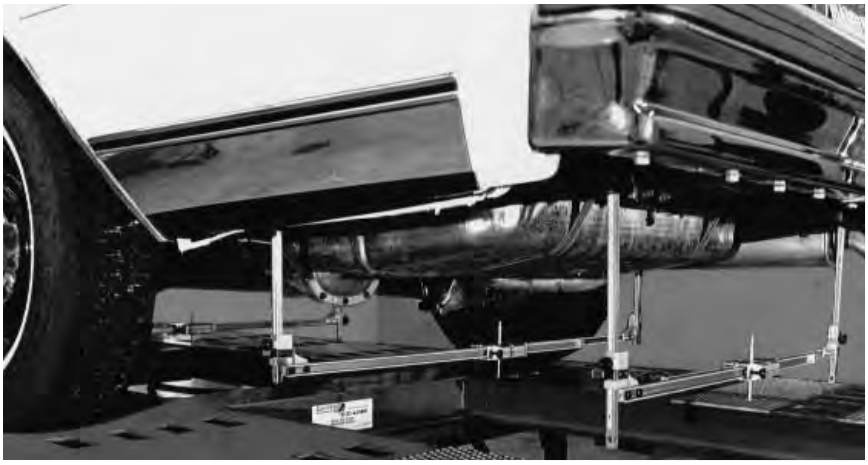


Figure 89 *Gauges installed in rear section of vehicle.*

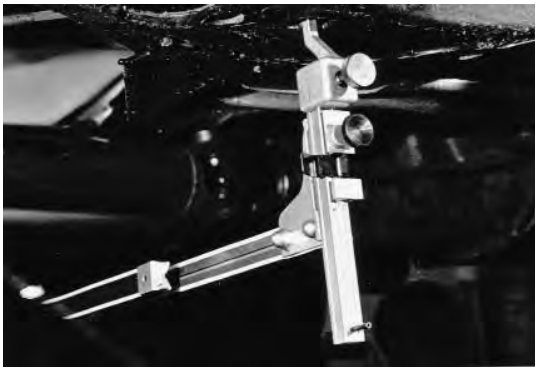


Figure 90 *Notched Attachment used to suspend gauge from reference point (hole) on underside of rail at rear of center section.*

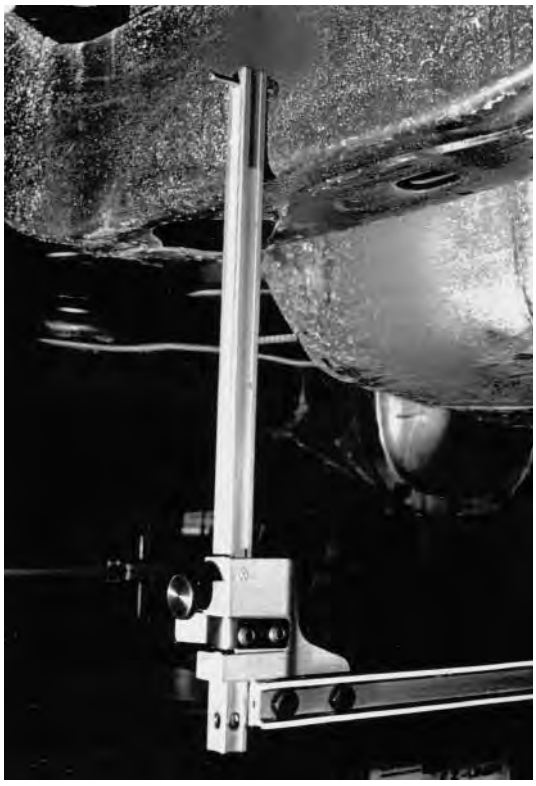


Figure 91

Roll Pin (end of scale) used to suspend gauge from vertical reference point (hole) on rail in rear section of vehicle.

Figure 92

When reference points (holes) are unavailable, gauges can be suspended from other openings on the side or underside of rails. Here, the Roll Pin (end of scale) is used to suspend the gauge from such an opening at rear of vehicle.

Pickup Truck

Figure 93 *Gauges installed on pickup truck.*

The installation of Precision Datum/Centerline Gauges on a pickup truck is similar to installation on unitized body and conventional frame vehicles. A few differences exist, however, regarding methods of attachment.

The photos on this page and the next illustrate some of the ways Precision Datum/Centerline Gauges can be positioned on pickup trucks.

Figure 94 *Roll Pin (end of scale) used to suspend gauge from elongated hole (on side of rail) at front of vehicle.*

Figure 95

Fixed Pin Attachment used to mount gauge to lower control arm mounting bolt in front section. The narrow width of attachment allows mounting the gauge to the bolt shown. If bolt were longer, the Roll Pin (at end of scale) could be used to mount the gauge.

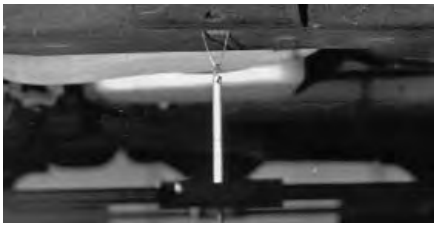


Figure 96

Crossmember Pin is installed (by means of spring clip) in reference hole in middle of crossmember and shows lateral misalignment of crossmember.

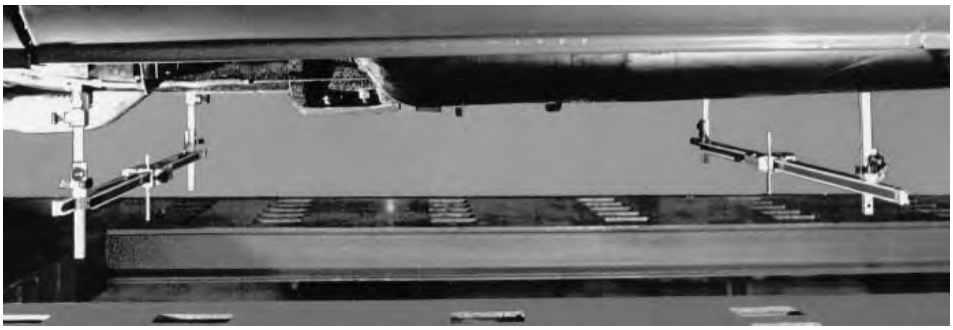


Figure 97 *Base Gauges installed in center section of vehicle. Most pickups have a short center section extending from the cowl to the rear of the cab.*

Figure 98 *Notched Attachment used to mount gauge to inside edge of rail at rear of center section.*

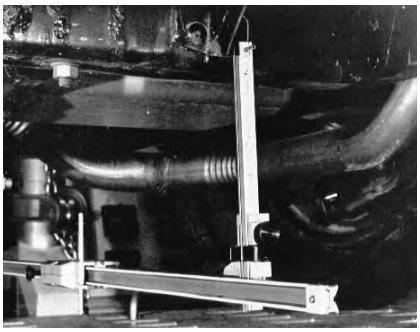


Figure 99 *Roll Pin (end of scale) used to suspend gauge from elongated hole on side of rail at front of center section.*

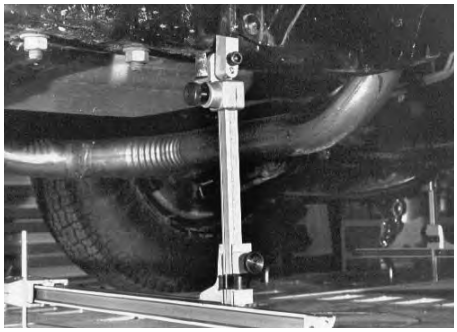
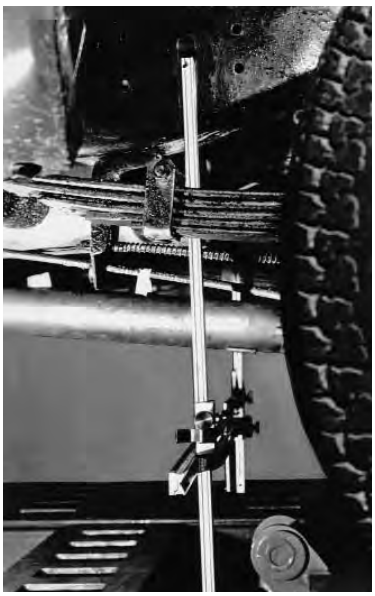


Figure 100 *When reference points (holes) are unavailable, Magnetic Attachments can be used to mount gauge to the underside of structural members. Here, a Magnetic Attachment supports the gauge at front of vehicle's center section.*

Figure 101



Roll Pin (end of scale) used to suspend gauge from vertical reference hole in rail (just ahead of rear wheels).

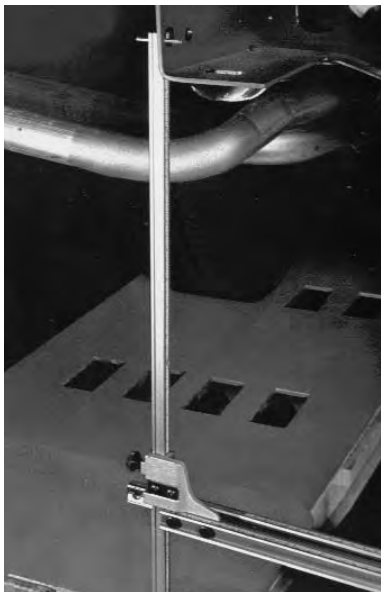


Figure 102 *Roll Pin (end of scale) used to suspend gauge from vertical reference hole at end of rail in rear section of vehicle.*

V. Reading Gauges

Installation is only part of the gauging process. Reading gauges, interpreting what they show and making a repair plan are the next important steps.

For information on reading gauges, Chief recommends that technicians attend a Chief Training Class. For Training Class locations and dates, contact Chief Automotive Technologies, Inc. 1924 E. Fourth Street, Grand Island, NE 68802-1368, 308-384-9747, attention Training Department School Coordinator.

Figure 103

VI. Maintenance Tips

The equipment in the Universal Gauge Measuring System is easy to use, features measuring capabilities and is durable. Like any precision instruments; however, the components of the system should be kept clean and occasionally the calibration should be checked.

Precision Datum/Centerline Gauge

The Precision Datum/Centerline Gauge (see Figure 104 operates by means of two adjustable horizontal bars moving through a center pin housing.

Figure 104

The center pin housing contains spring-loaded bearings that keep the bars level as they move through the housing. The sighting pin of the housing stays in the center of the gauge assembly regardless of the width the bars are extended.

- **Keep Bars Clean**
  In order for the gauge to work properly, the bars must be kept clean. If the gauge runs rough or seems to "jump", the cause may be traced to dirt or chips on the bars or bearings. The bars should be wiped with a cloth dampened with a moderate strength (mineral spirits) cleaning solvent and then wiped dry.

- **Re-centering Capability**
  If a gauge continually fails to stay centered as it is being adjusted outward, check for an accumulation of dirt or a possible defective bearing. If a bearing is defective, replace it. (See Parts Information — Section VII.)

- **Calibration Of Gauge**
  To calibrate the Precision Datum/Centerline Gauge, place a 420mm (16 1/2 inch) scale in each scale housing and check each assembly with a carpenter's framing square. (See Figure 105.) If a scale is not square (perpendicular) with the horizontal bars of the gauge, loosen the attaching bolts of that scale housing and shift it to a position in which the scale is square with the bars and retighten.

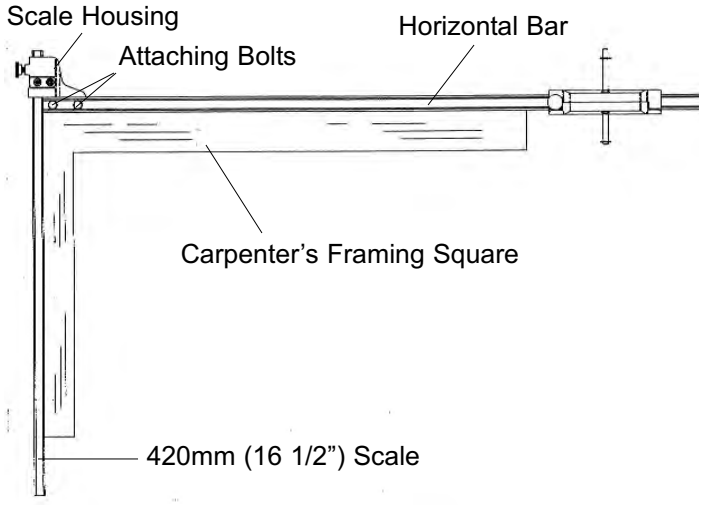


Figure 105

Other Components Of Gauge Measuring System

Like the Precision Datum/Centerline Gauge, it is important to keep all other components of the Gauge Measuring System clean. The scales, hanging attachments and the components of the Upper Body Gauge, Tram Gauge and Crossmember Pin Sets should be wiped with a cloth dampened with a moderate strength (mineral spirits) cleaning solvent and then wiped dry.

After cleaning the items, lightweight oil (not motor oil) should be applied to moving parts such as the plungers on the hanging attachments. (See Figures 106 and 107.)

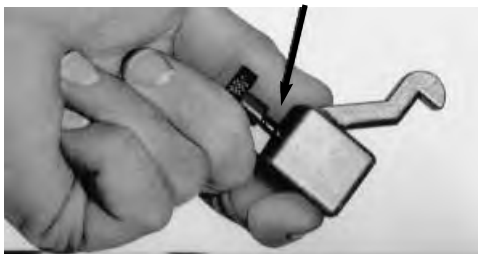


Figure 106

Figure 107

Magnetic Attachment

Magnets on the Magnetic Attachments are strong and will maintain their holding power if proper care is taken.

Each attachment should be positioned on its magnet keeper (base of attachment tray on display board) when not in use. (See Figure 108.) Placement on the tray allows the magnet's strength to stay confined within the magnet for longer life.

IMPORTANT: Never use an arc welder or heat near the magnet as this tends to reduce its holding power.

Figure 108

Strut Tower/Upper Body Gauge (Calibration)

To check the square condition of the Strut Tower/Upper Body Gauge, measure diagonally from scale housing to scale housing. (See Figure 109.) The measurements will be equal if the gauge is square.

If the measurements are not equal, check each scale housing with a carpenter's framing square. (See Figure 110.) If a scale is not square (perpendicular) with the horizontal bar, loosen the attaching bolts of the scale housing and shift the scale and horizontal bar to a position in which they are square (perpendicular) with each other and retighten the attaching bolts.

After checking each scale housing, remeasure diagonally from scale housing to scale housing to verify the gauge is square.

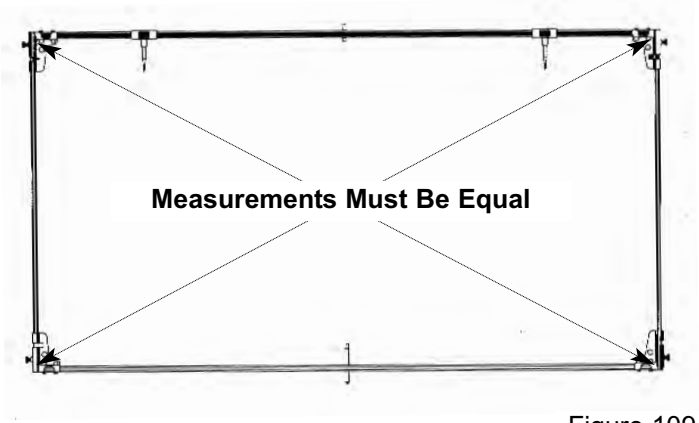


Figure 109

Service Personnel Available

As with all Chief Automotive Technologies, Inc. products, factory trained service personnel are available to maintain your Gauge Measuring System to the highest standards.

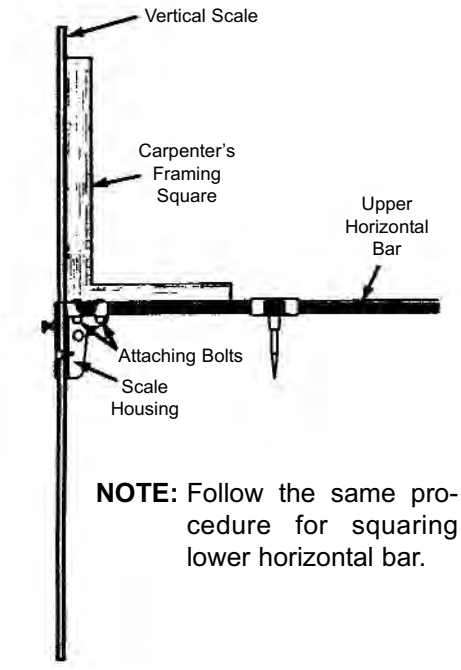


Figure 110

NOTE: Follow the same procedure for squaring lower horizontal bar.

VII. Parts Information

If it becomes necessary to order replacement parts, accessories, or contact a service representative, call the Chief Automotive Technologies, Inc 24-hour toll free telephone number (800-445-9262). If located outside the United States, contact an authorized Chief Automotive Technologies, Inc. representative.

When contacting Chief Automotive Technologies, Inc. by telephone or mail, provide the following information: name of business, business telephone number, and business address. Additional information needed when ordering: description of parts and part numbers.

The parts listed in this parts section represent what Chief Automotive Technologies, Inc. considers to be user installed. Other repairs should be deferred to an authorized Chief representative.

NOTE: Chief reserves the right to alter product specifications and/or package components without notice.

CAUTION: Always use Chief Automotive Technologies, Inc. authorized replacement parts. When replacing any part, make certain the part meets original equipment requirements.

Universal Gauge Measuring System Parts List

Universal Gauge Measuring System (Complete Package) — Part No. 611784
Universal Gauge Measuring System Minus Tram Gauge and 455 mm (18") Tram Pointer — Part No. 611872
Precision Datum/Centerline Gauge Set
UGMS minus Tram Gauge, 455mm (18") Tram Pointer, and Strut Tower/Upper Body Gauge — Part No. 611856

Ref.	Part No.	Description	Quantity
A	611573	815mm (32") Precision Datum/Centerline Gauge	1
B	611581	915mm (36") Precision Datum/Centerline Gauge	2
C	611590	1015mm (40") Precision Datum/Centerline Gauge	2
D	611645	150mm (6") Vertical Scale	4
E	611653	215mm (8 1/2") Vertical Scale	4
F	611661	290mm (11 1/2") Vertical Scale	4
G	611670	355mm ((14") Vertical Scale	2
H	611688	420mm (16 1/2") Vertical Scale	2
I	611696	480mm (19") Vertical Scale	2
J	611709	560mm (22") Vertical Scale	2
K	611741	Adjustable Pin Attachment	4
L	611725	Magnetic Attachment	4
M	611733	Notched Attachment	6
N	611750	Offset Attachment	2
O	611768	Fixed Pin Attachment	2
P	611565	Strut Tower/Upper Body Gauge	1
Q	671074	Tram Gauge	1
R	611792	Crossmember Pin	1
S	629175	Users Manual	1
T	671517	Gauge Display Board	1

NOTE: Universal Gauge Measuring System Components Listed Above (And Their Respective Reference Letters) Appear On The Following Pages.

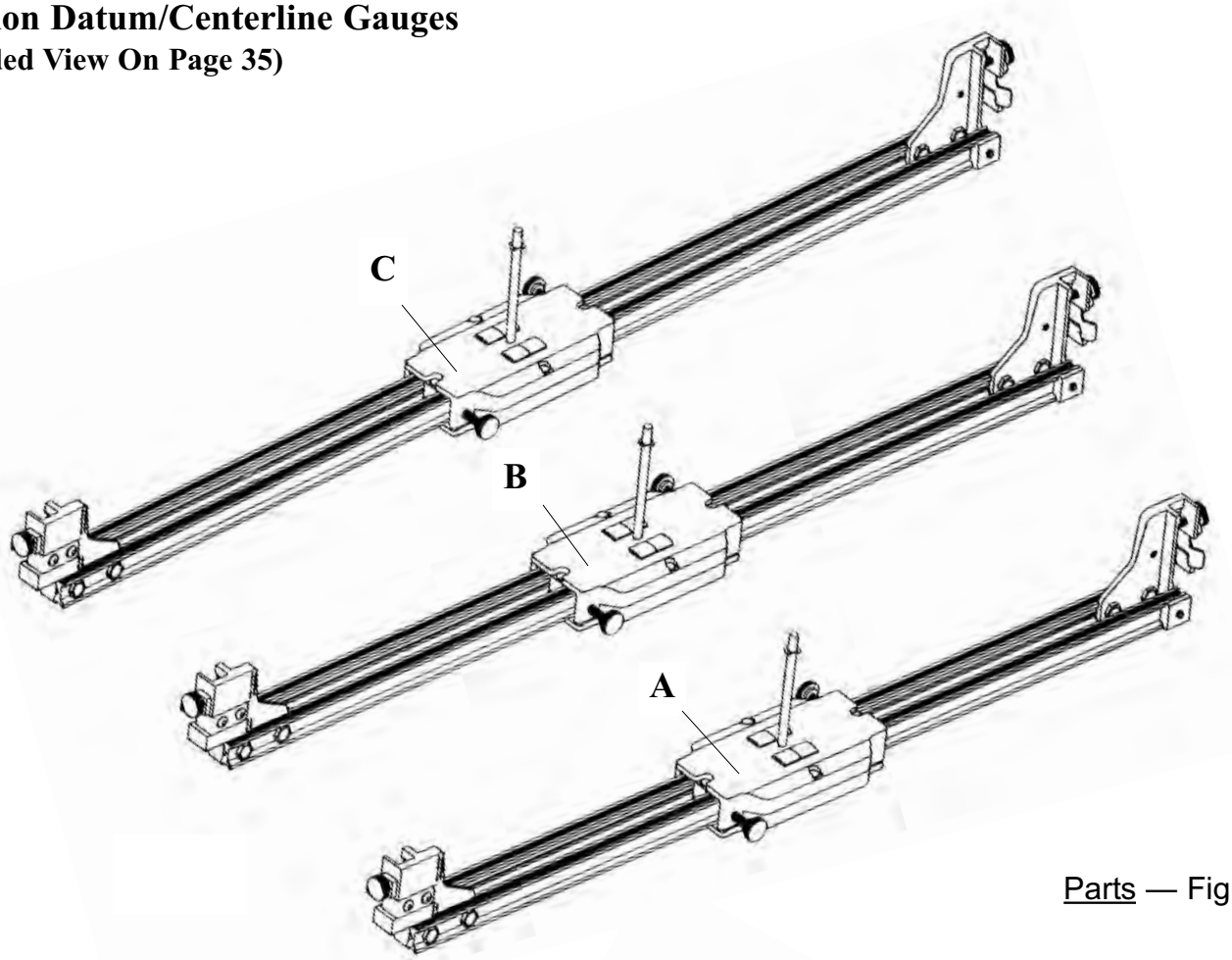
Dimension Manuals (Optional)

IMPORTANT: Domestic and Import Specification Manuals are provided for the three most current years. To obtain earlier Specification Manuals or to receive future publications upon their release, contact Chief's Customer Service Department, 800-445-9262.

Parts — Figure 1

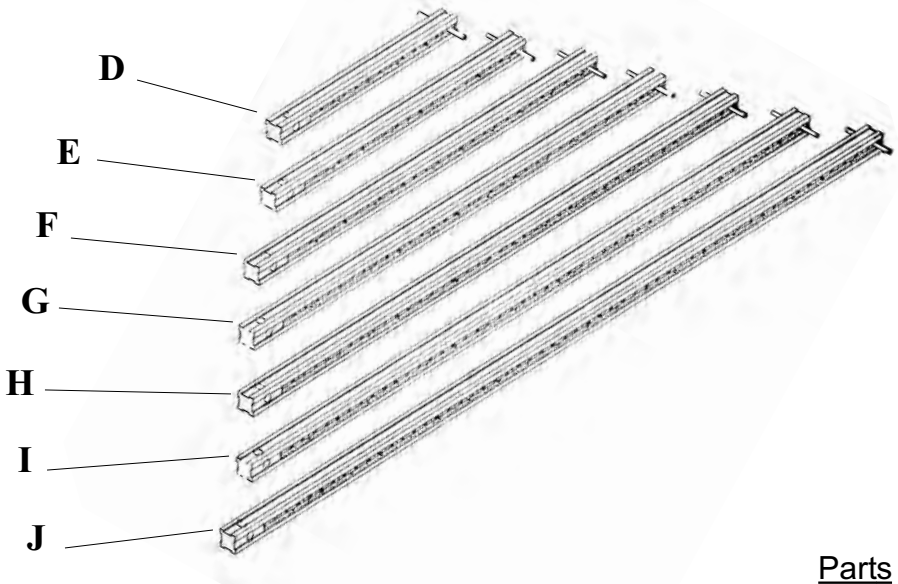
Precision Datum/Centerline Gauges

(Exploded View On Page 35)



Parts — Figure 2

Scales



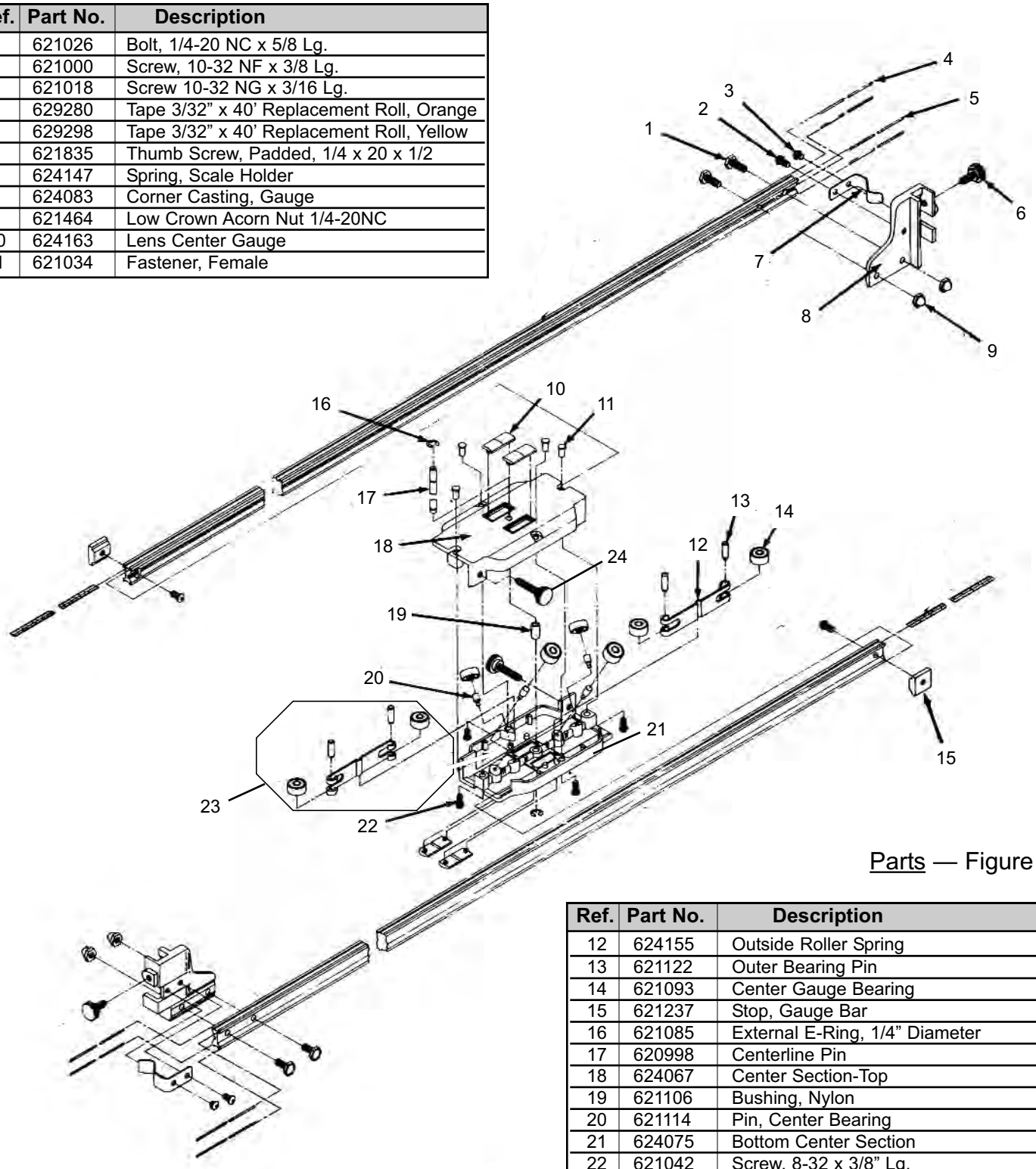
Parts — Figure 3

Exploded View

Precision Datum/Centerline Gauge

(Continued from page 34)

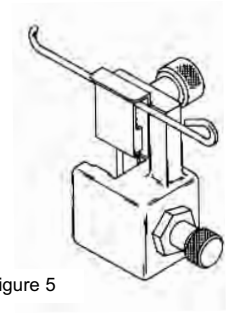
Ref.	Part No.	Description
1	621026	Bolt, 1/4-20 NC x 5/8 Lg.
2	621000	Screw, 10-32 NF x 3/8 Lg.
3	621018	Screw 10-32 NG x 3/16 Lg.
4	629280	Tape 3/32” x 40’ Replacement Roll, Orange
5	629298	Tape 3/32” x 40’ Replacement Roll, Yellow
6	621835	Thumb Screw, Padded, 1/4 x 20 x 1/2
7	624147	Spring, Scale Holder
8	624083	Corner Casting, Gauge
9	621464	Low Crown Acorn Nut 1/4-20NC
10	624163	Lens Center Gauge
11	621034	Fastener, Female



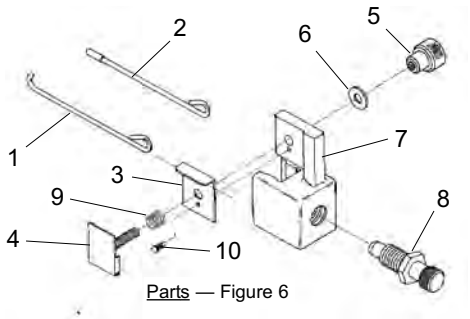
Parts — Figure 4

Ref.	Part No.	Description
12	624155	Outside Roller Spring
13	621122	Outer Bearing Pin
14	621093	Center Gauge Bearing
15	621237	Stop, Gauge Bar
16	621085	External E-Ring, 1/4” Diameter
17	620998	Centerline Pin
18	624067	Center Section-Top
19	621106	Bushing, Nylon
20	621114	Pin, Center Bearing
21	624075	Bottom Center Section
22	621042	Screw, 8-32 x 3/8” Lg.
23	611864	Bearing Assembly
24	635524	Thumb Screw Padded, 1/4”-20 x 5/8”

Adjustable Pin



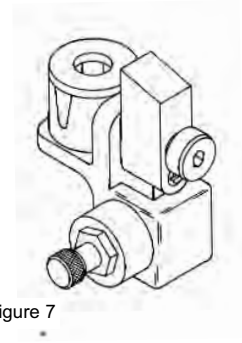
Parts — Figure 5



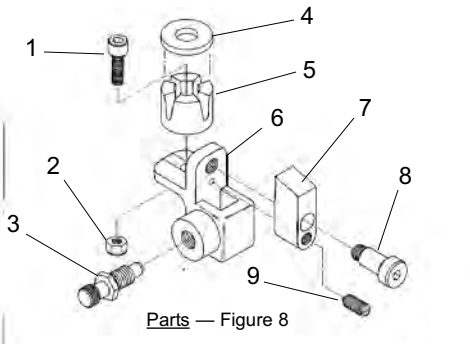
Parts — Figure 6

Ref.	Part No.	Description
1	621587	Pin
2	620103	Adjustable Pin (Bayonet)
3	621536	Pin Holder
4	618783	Front Clip Notched
5	620111	Knob 10-24
6	707401	Washer, Split Sprung
7	621528	Body, Adjustable Pin Attachment
8	611717	Plunger Assembly
9	621958	Spring, Adjustable Pin Attachment
10	632470	Screw, Drive, .073 x .25

Magnetic



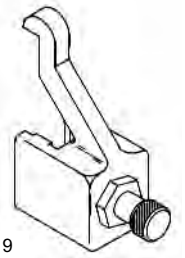
Parts — Figure 7



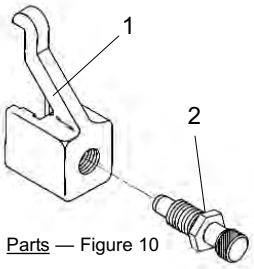
Parts — Figure 8

Ref.	Part No.	Description
1	629060	Bolt, 1/4-20NC x 3/4 Large
2	629044	Nut, Hex Lock 1/4-20NC
3	611717	Plunger Assembly
4	629001	Magnet Keeper
5	629010	Gauge Magnet
6	624227	Magnet Body
7	621245	Riser
8	629036	Shoulder Screw, 3/8" Diameter
9	629028	Plunger, w/Nylon Ball 1/4-20NC

Notched



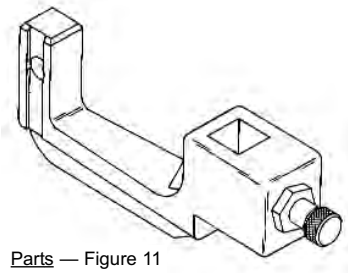
Parts — Figure 9



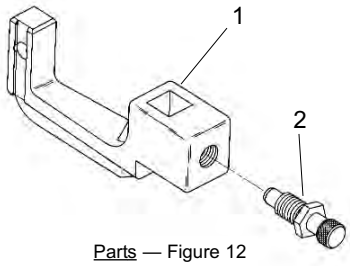
Parts — Figure 10

Ref.	Part No.	Description
1	624198	Body, Notched Attachment
2	611717	Plunger Assembly

Offset



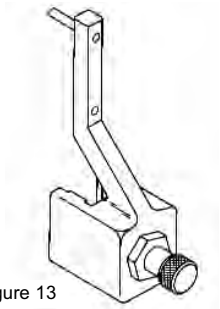
Parts — Figure 11



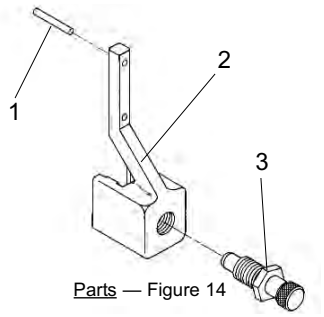
Parts — Figure 12

Ref.	Part No.	Description
1	624219	Body, Offset Attachment
2	611717	Plunger Assembly

Fixed Pin



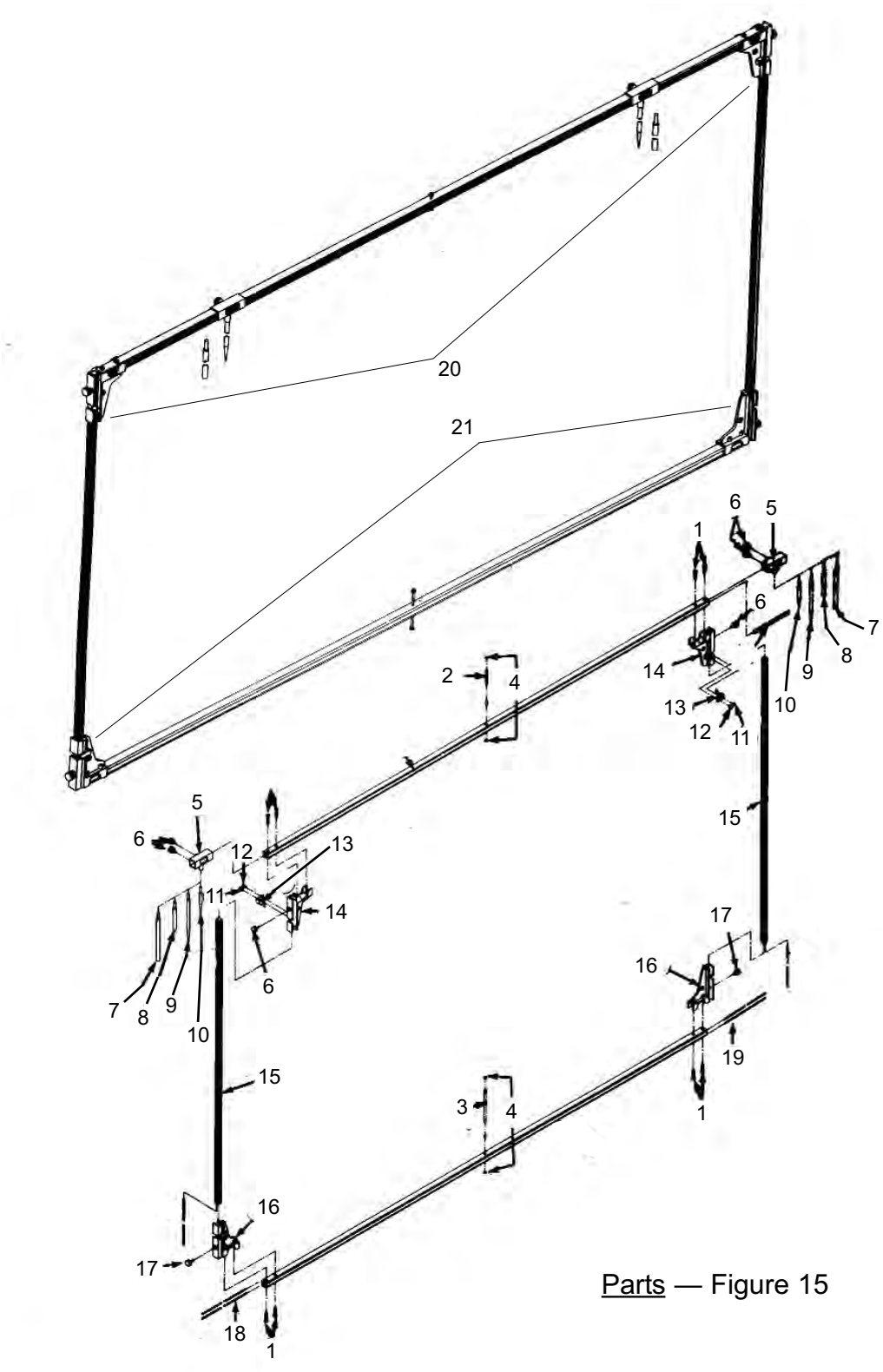
Parts — Figure 13



Parts — Figure 14

Ref.	Part No.	Description
1	629052	Dowel Pin, 3/32" Diameter x 3/4" Large
2	624200	Body, Extended Pin Attachment
3	611717	Plunger Assembly

Strut Tower/Upper Body Gauge

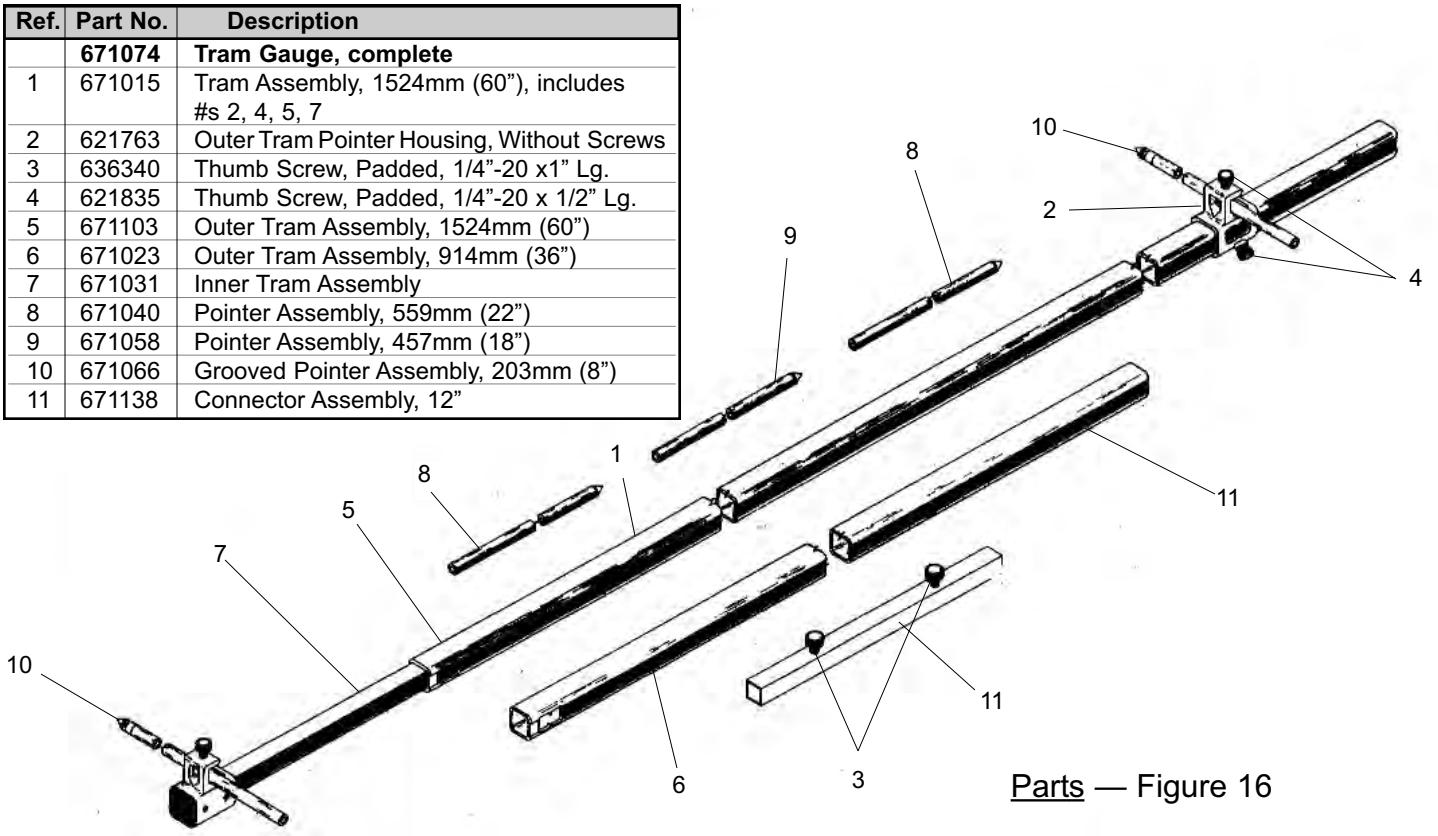


Ref.	Part No.	Description
1	630635	Screw (Hex Hd. Cap) 1/4-20 NC x 1" Large
2	620980	Centerline Pin-Upper
3	620998	Centerline Pin
4	621085	External E-Ring for 1/4" Diameter Shaft
5	624112	Pointer Housing, Without Screws
6	621835	Thumb Screw, Padded, 1/4" x 20 x 1/2"
7	620971	Reverse Cone, 178mm (7")
8	620963	Reverse Cone, 102mm (4")
9	620955	Pointer, 178mm (7")
10	620947	Pointer, 102mm (4")
11	621018	Screw, 10-32 NF x 3/16" Large
12	621000	Screw, 10-32 NF x 3/8" Large
13	624147	Spring, Scale Holder
14	624091	Corner Caster - Upper
15	611530	Vertical Scale Assembly
16	624104	Corner Casting - Lower
17	635591	Thumb Screw, Pointed 1/4" x 20 x 7/8"
18	629298	Tape, 3/32" x 40', Replacement Roll, Yellow
19	629280	Tape, 3/32" x 40', Replacement Roll, Orange
20	611557	Upper Bar Assembly
21	611549	Lower Bar Assembly

Parts — Figure 15

Chief Tram Gauge (Basic Assemblies)

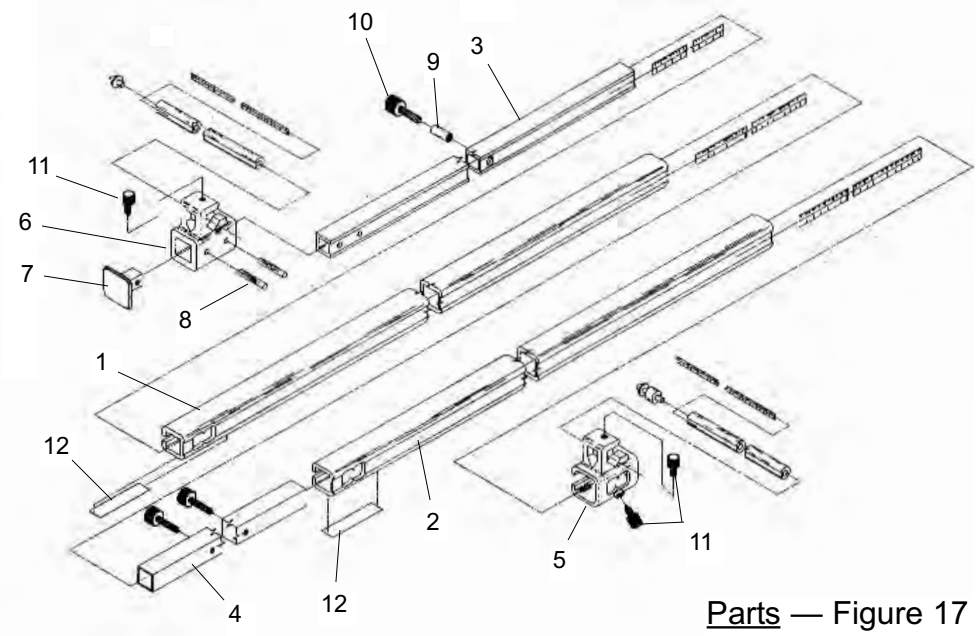
Ref.	Part No.	Description
	671074	**Tram Gauge, complete**
1	671015	Tram Assembly, 1524mm (60”), includes #s 2, 4, 5, 7
2	621763	Outer Tram Pointer Housing, Without Screws
3	636340	Thumb Screw, Padded, 1/4”-20 x1” Lg.
4	621835	Thumb Screw, Padded, 1/4”-20 x 1/2” Lg.
5	671103	Outer Tram Assembly, 1524mm (60”)
6	671023	Outer Tram Assembly, 914mm (36”)
7	671031	Inner Tram Assembly
8	671040	Pointer Assembly, 559mm (22”)
9	671058	Pointer Assembly, 457mm (18”)
10	671066	Grooved Pointer Assembly, 203mm (8”)
11	671138	Connector Assembly, 12”



Parts — Figure 16

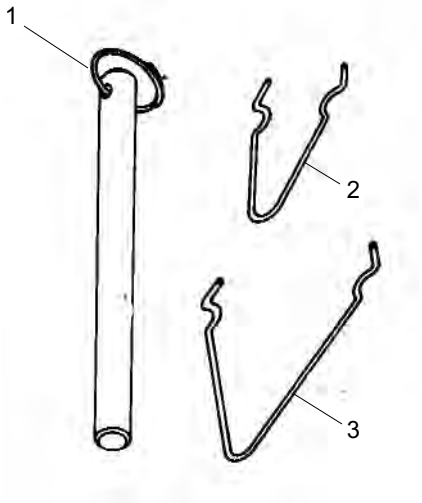
Tram Gauge (Exploded View)

Ref.	Part No.	Description
1	621667	Outer Tram, 60”
2	621675	Outer Tram 36”
3	621683	Inner Tram, 33 1/4”
4	621691	Connector, 12”, without screws
5	621763	Housing, Pointer, Outer Tram, without screws
6	621771	Housing, Pointer, Inner Tram, without screws
7	621780	End Cap, Pointer Housing
8	621800	Dowel Pin, 1/4” x 1 5/16” Lg.
9	621819	Insert, 1/4”-20 x 3/8” Diameter
10	636340	Thumb Screw, Padded, 1/4”-20 x 3/8” Large
11	621835	Thumb Screw, Padded 1/4”-20 x 1/2” Large
12	621878	Decal, 5/8” x 2 1/2”, Clear, Chief Logo
	624788	Box, Assembly
	624796	Users Manual
	671031	Assembly Only



Parts — Figure 17

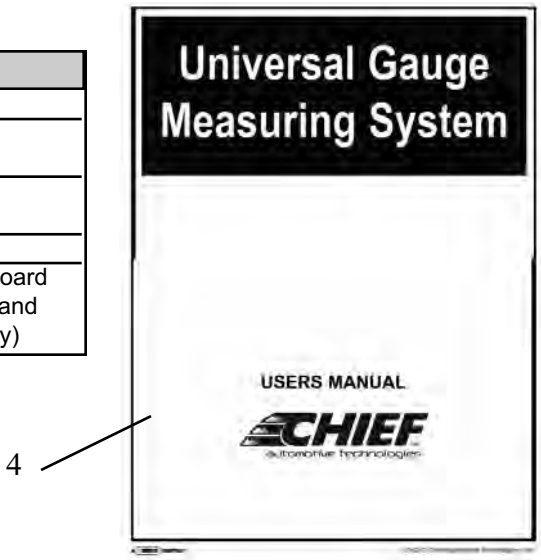
Crossmember Pin



Ref.	Part No.	Description
1	611776	Pin Assembly
2	621560	Crossmember Spring, Small
3	621579	Crossmember Spring, Large
4	629175	Users Manual
5	621659	Gauge Display Board (includes hooks and metal storage tray)

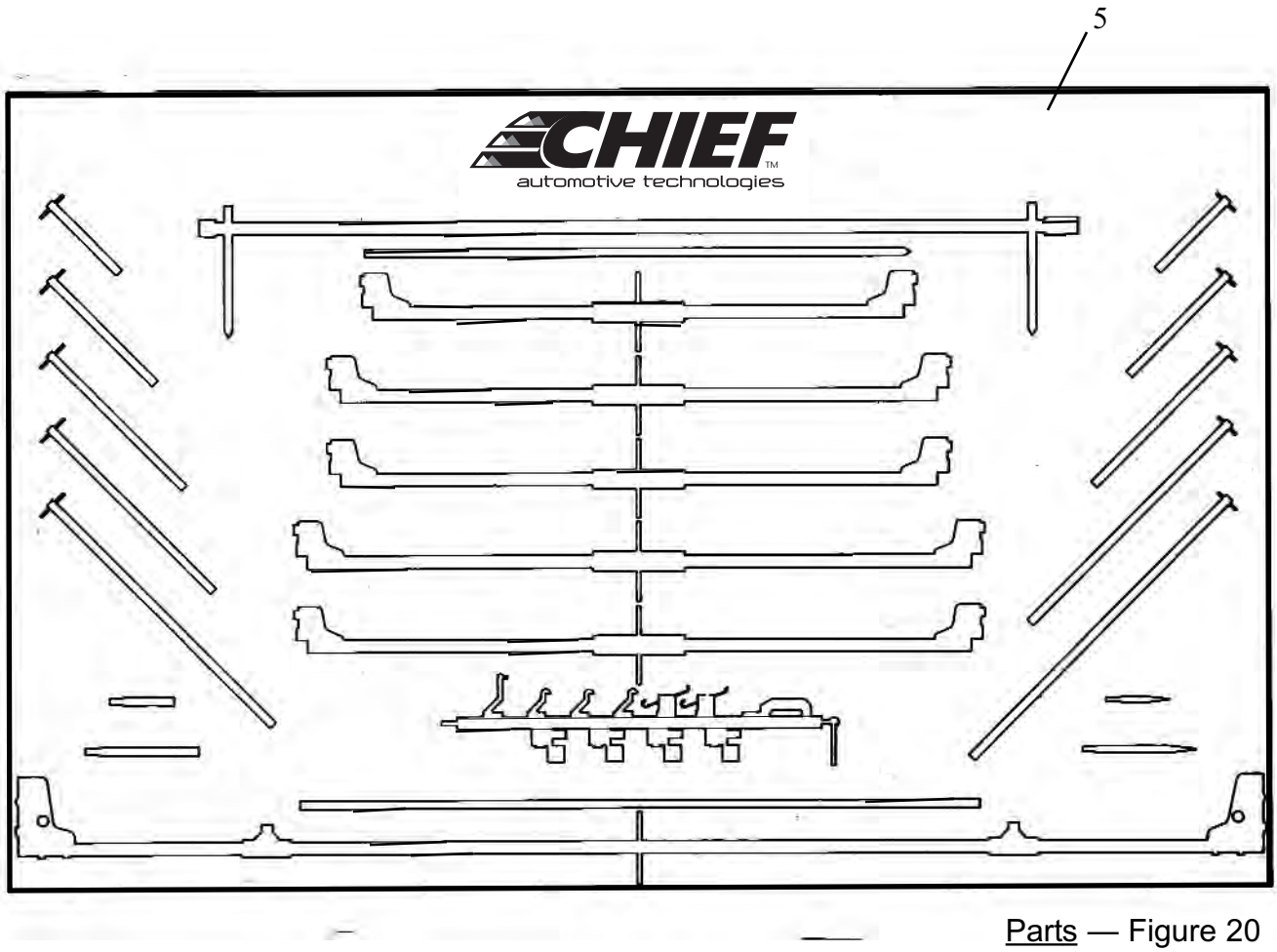
Parts — Figure 18

Users Manual



Parts — Figure 19

Gauge Display Board



Parts — Figure 20

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Chief reserves the right to alter product specifications and/or package components without notice.

Form UGMS (Rev. 2/07)
Part No. 629175