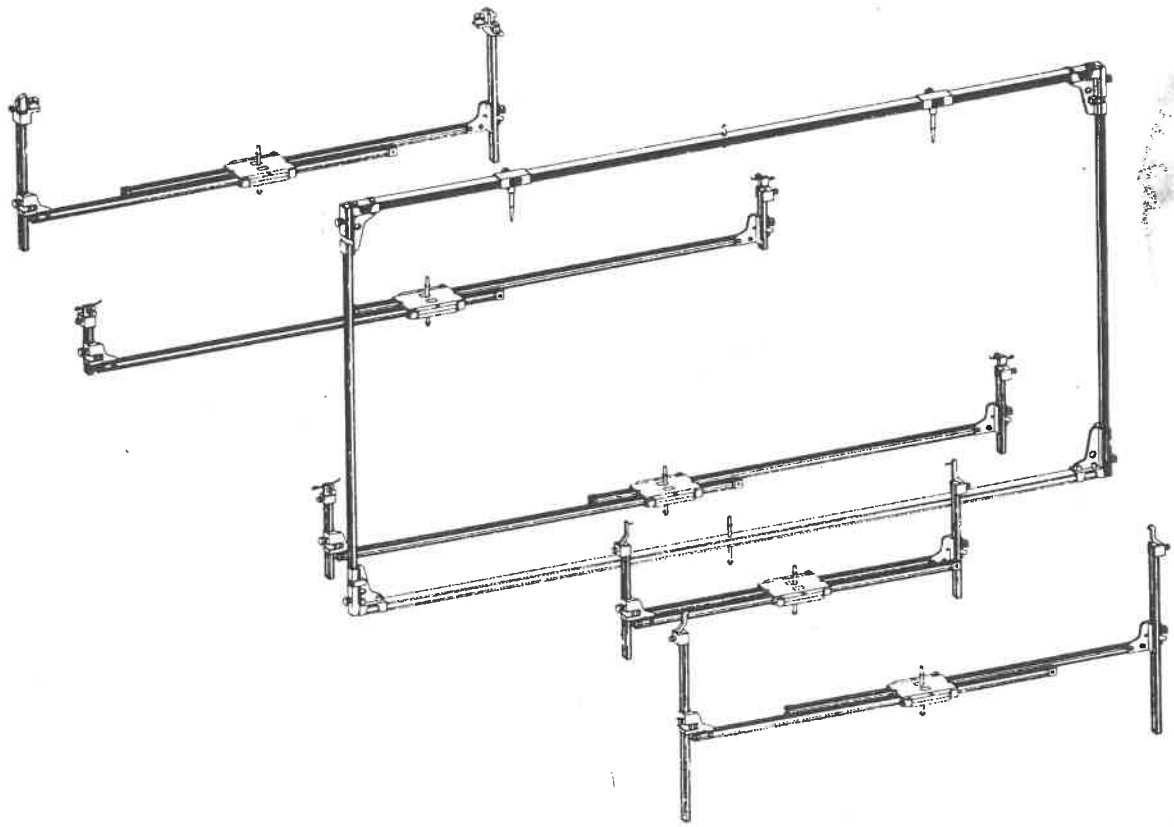


Universal Gauge Measuring System

OWNERS MANUAL



CHIEF AUTOMOTIVE SYSTEMS, INC.

The driving force in collision repair.™

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 I-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 you 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 attend one of Chief's Training Schools. 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 school locations and dates, contact Chief Automotive Systems, Inc., 1924 E. Fourth St., Grand Island, NE 68802, 308-384-9747, Attention Training Department School Coordinator, or your local Chief representative.

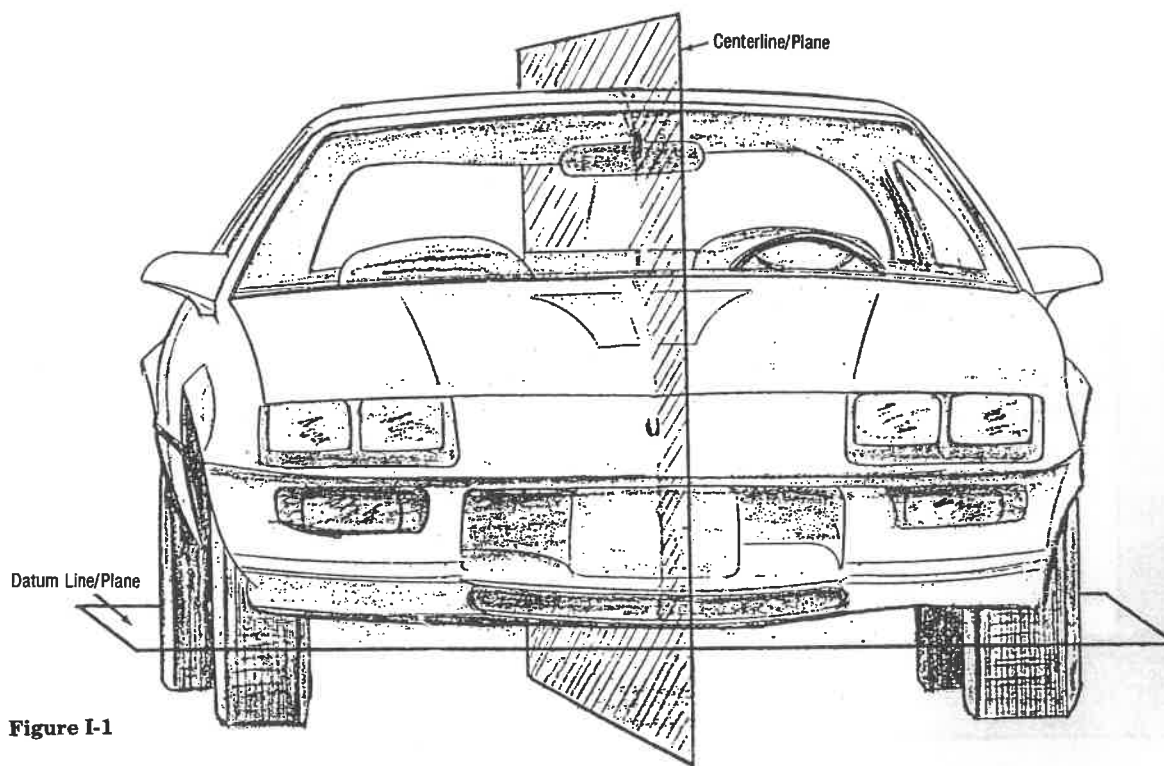


Figure I-1

LIMITED ONE-YEAR WARRANTY & LIABILITY

Chief Automotive Systems, Inc. warrants for one year from date of installation and/or purchase any of its products which do not perform satisfactorily due to defect caused by faulty material or workmanship. Chief's obligation under this warranty is limited to the repair or replacement of products which are defective and which have not been misused, carelessly handled, or defaced by repair or repairs made or attempted by others.

Chief Automotive Systems, Inc. does not assume responsibility for any injury resulting from the operator's misuse of this product or attachments. No other warranty, except as stated here, written or verbal, is authorized by Chief Automotive Systems, Inc.

Returned merchandise requires a "RETURNED GOODS AUTHORIZATION NUMBER" on the package. Authorization numbers can be obtained by calling or writing the Parts Department, Chief Automotive Systems, Inc. No returned merchandise will be accepted without an authorization number. All returned merchandise must be shipped freight prepaid (and may be subject to a 15 percent handling and restocking charge) to:

Chief Automotive Systems, Inc.

Attn: Returned Goods Dept.

1924 E. Fourth St.

P.O. Box 1368

Grand Island, NE 68802-1368

Your Authorized

or Chief Automotive Systems, Inc.

Representative

Disclaimer of Warranty

CHIEF MAKES NO EXPRESS OR IMPLIED WARRANTY WHATSOEVER OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE REGARDING THE EQUIPMENT OR ANY PART OF THE EQUIPMENT.

In regard to its measuring systems, the graphics and specifications provided by Chief Automotive Systems, Inc. have been compiled from authoritative sources. Every effort has been made by Chief Automotive Systems, Inc. to assure accuracy; however, manufacturing changes, errors or omissions might occur. Chief Automotive Systems, Inc. does not assume responsibility nor can it be held responsible for the loss or damage resulting from vehicle manufacturer's changes, errors, or omissions.



CHIEF AUTOMOTIVE SYSTEMS, INC.

The driving force in collision repair."

II. Table of Contents

Section I	Page
Introduction	1
Warranty Information	2
Section II	
Table of Contents	3
Section III	
Components of System	5
-Precision Datum/Centerline Gauges	6
-Scales	7
-Attachments	7
Notched	8
Magnetic	8
Adjustable Pin	9
Fixed Pin	9
Offset Attachment	9
Roll Pin (End of Scale)	10
-Crossmember Pin	10
-Strut Tower/Upper Body Gauge	10
-Tram Gauge	12
-Dimension Manuals	16
Section IV	
Installation	19
Unitized Body Vehicle	20
-Conventional Frame Car	28
-Pickup Truck	30
Section V	
Reading Gauges	33
Section VI	
Maintenance Tips	35
Section VII	
Parts Information	37

III. Universal Gauge Measuring System Components Terminology

The equipment in Chief's Universal Gauge Measuring System (see Figure III-1) 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).

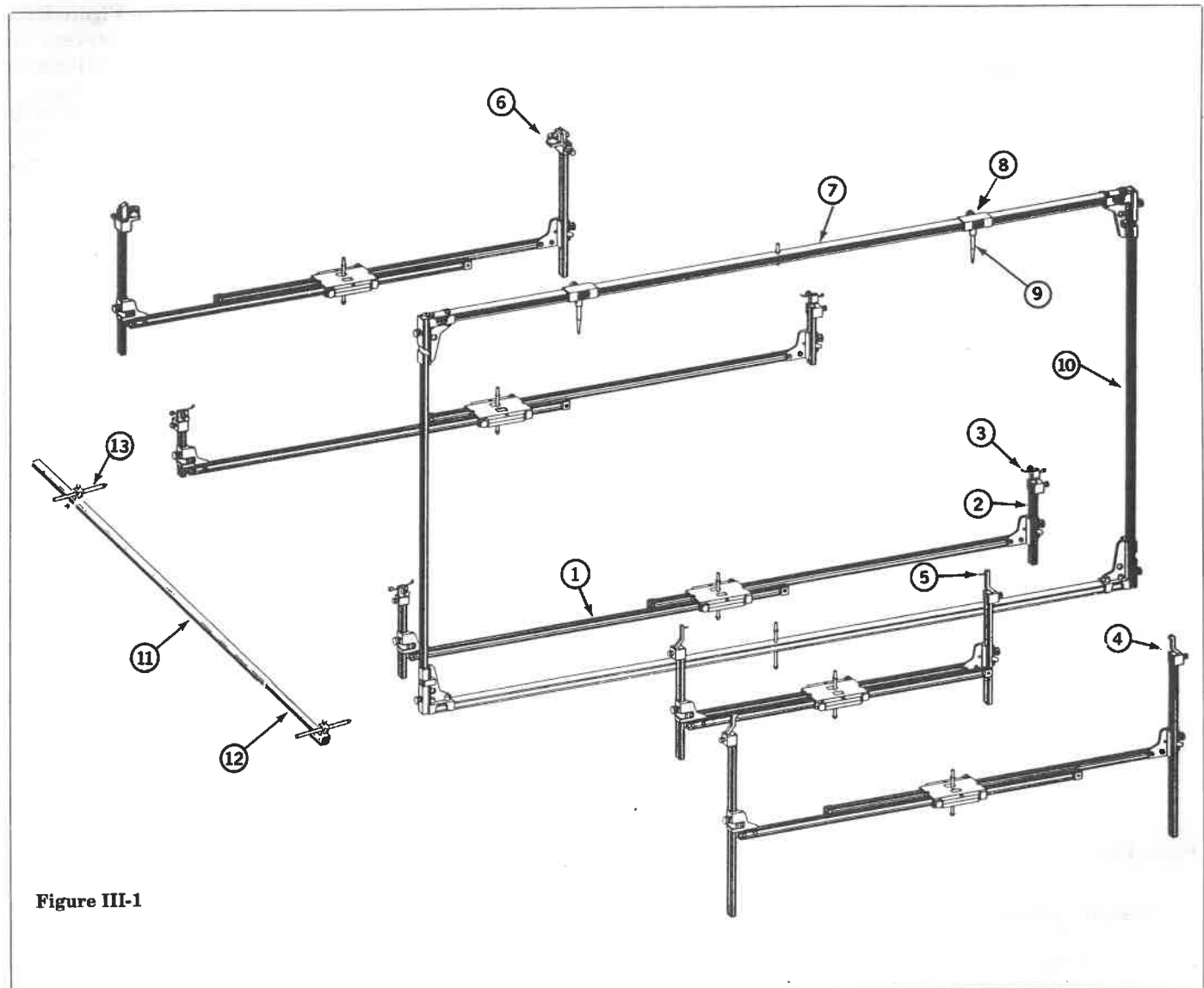


Figure III-1

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 1,015 mm (40 inch), two 915 mm (36 inch), and one 815 mm (32 inch) gauge are provided. (See Figure III-2). These gauges, plus the Strut Tower/Upper Body Gauge (see segment relating to Strut Tower/Upper Body Gauge – pages 10-11), are attached to the vehicle at various points to locate and measure structural misalignment. (See *Section IV-Installation*, for suggested locations.)

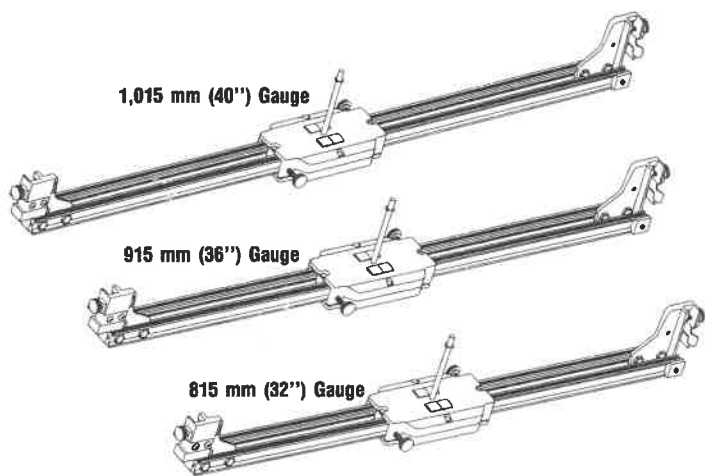


Figure III-2

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 III-3.)

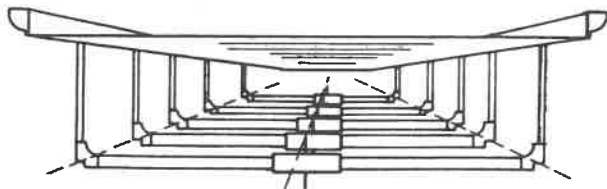


Figure III-3

The scales attach to the scale housings at the ends of the gauge. (See Figure III-4.) 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.

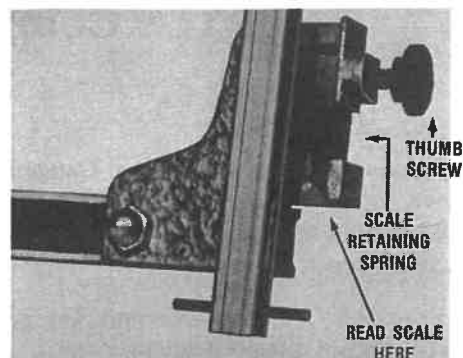


Figure III-4

The center pin housing of each gauge (see Figure III-5) 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 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 III-5) are the distances from the center pin to the inside edges of the scales in the scale housings. (See page 7, Figure III-10.)

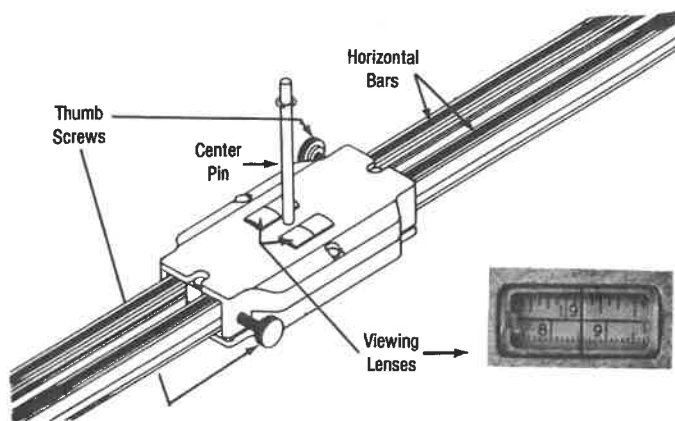


Figure III-5

When a gauge is mounted to nonsymmetrical 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 381 mm (15 inches) from centerline and the other is 483 mm (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 102 mm (4 inch) difference. (See Figure III-6 A and B.) One lens shows a 178 mm (7 inch) reading and the other a 280 mm (11 inch) reading.

Extend the scale housings out and install the gauge.

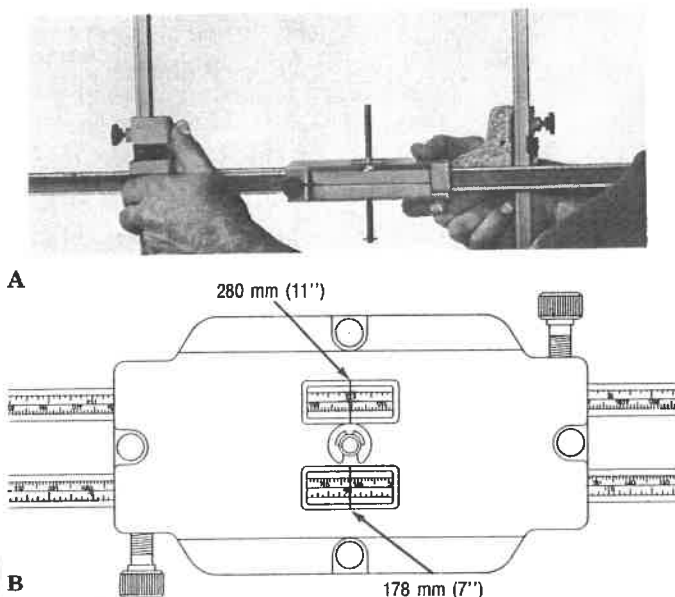


Figure III-6

Scales

Scales ranging in length from 152 to 560 mm (6 to 22 inches) are used to position gauges at a specified datum height below a vehicle. Seven different lengths are provided. The 13 mm (½ 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 III-7.)

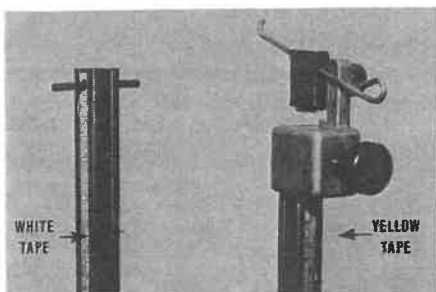


Figure III-7

The yellow tape is used when mounting attachments are used with the scales. Its calibration is based on an 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 calibration on the white tape begins at the bottom edge of the roll pin. (See Figure III-8.)

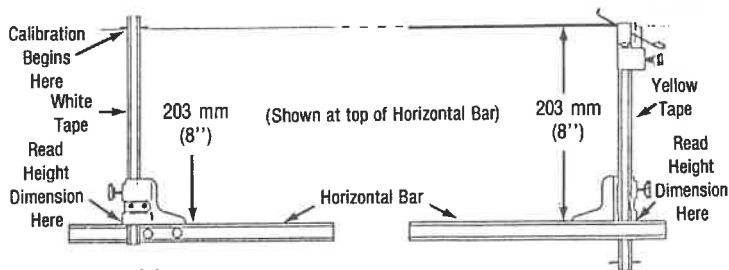


Figure III-8

The tape to be used should face away from the side of the vehicle. Scales, like the one shown in Figure III-9, are provided in the following quantities and lengths: two - 560 mm (22 inch); two - 480 mm (19 inch); two - 420 mm (16½ inch); two - 355 mm (14 inch); four - 290 mm (11½ inch); four - 215 mm (8½ inch); and, four - 152 mm (6 inch).

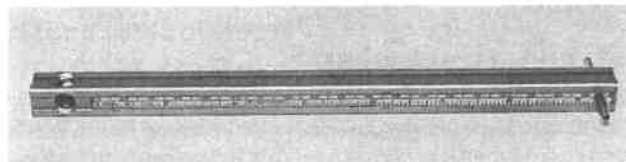


Figure III-9

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 means of 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 III-10.)

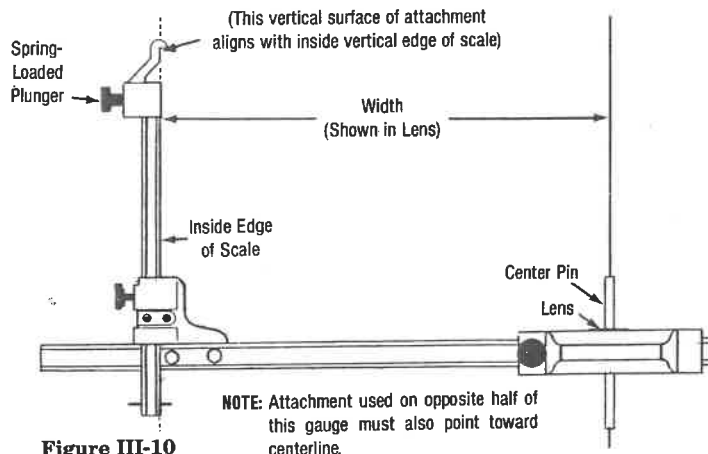


Figure III-10

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

side edge of the scale. (See Figure III-11.) The distance from the center pin to the outside edge of the scale is the measurement shown in the lens plus the 13 mm ($\frac{1}{2}$ inch) width of the scale.

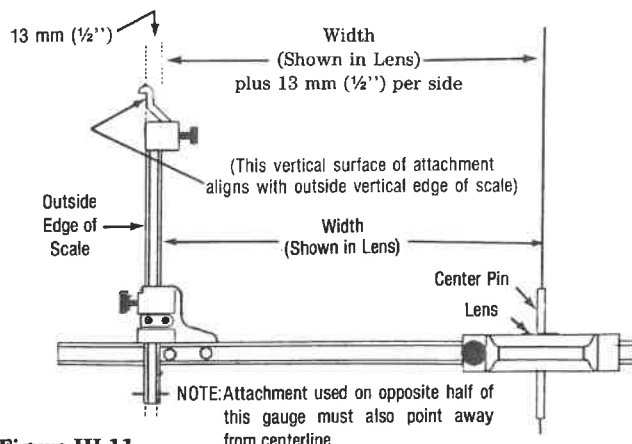


Figure III-11

Notched Attachment

The Notched Attachment (see Figure III-12 A, B, and C) 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 Notched Attachment is 1.5 mm ($\frac{1}{16}$ inch) higher than the scale indicates. It is designed this way to allow for the average thickness of the

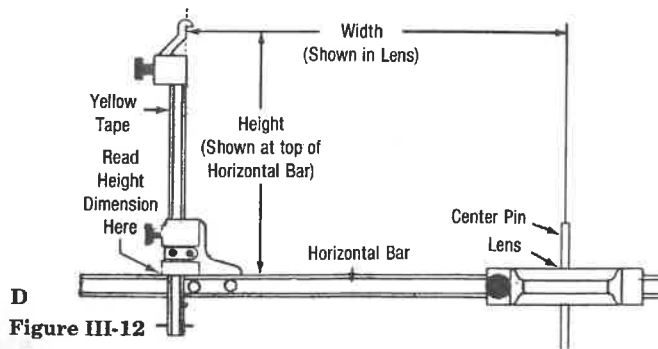
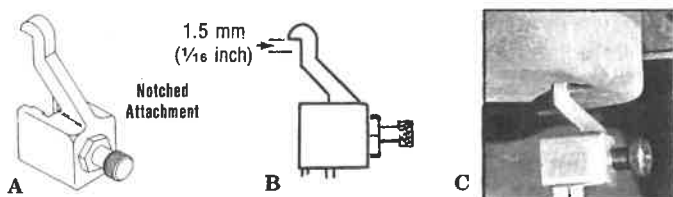


Figure III-12

structural member it mounts to. Most are 1.5 mm ($\frac{1}{16}$ 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 1.5 mm ($\frac{1}{16}$ inch), adjust the height of the gauge by that amount.

Magnetic Attachment

The Magnetic Attachment (see Figure III-13) is used on the bottom of structural members when reference holes or other mounting locations are not available.

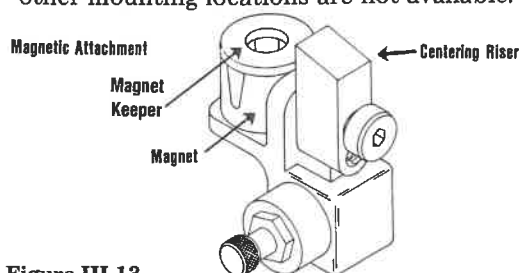


Figure III-13

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 III-14.)

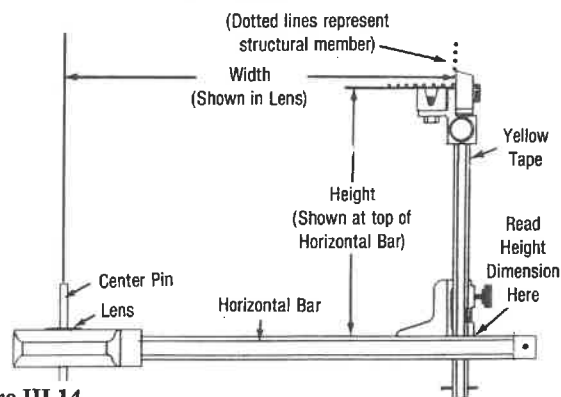


Figure III-14

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 III-15.) In order to secure the attachment to such a surface, its centering riser must be pivoted to a horizontal position.

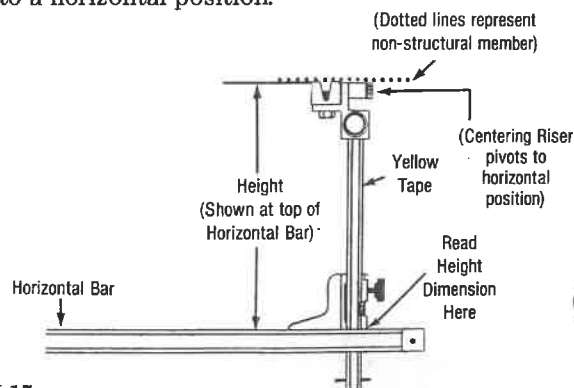


Figure III-15

Adjustable Pin Attachment

The Adjustable Pin Attachment (see Figure III-16) is used primarily to mount gauges to the top outside edge of rocker panels. The pin, which should protrude 6.5 to 9.5 mm ($\frac{1}{4}$ to $\frac{3}{8}$ 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 varies from vehicle to vehicle.

Adjustable Pin Attachment

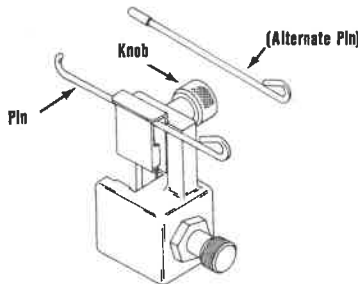


Figure III-16

The scale reading at the horizontal bar of the gauge shows the distance from the top of that bar to the point where the adjustable pin attachment rests on the rocker panel. (See Figure III-17.)

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

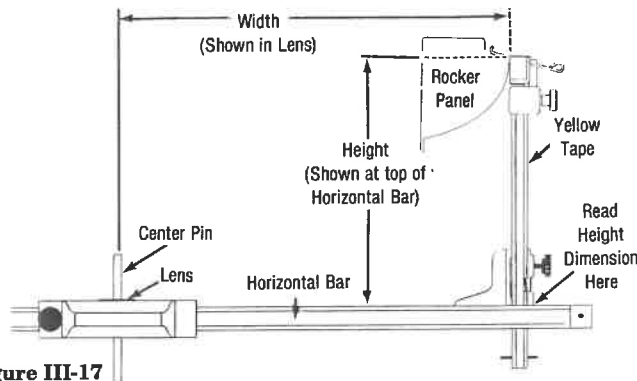


Figure III-17

Fixed Pin Attachment

The Fixed Pin Attachment (see Figure III-18) 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 25 mm (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 25 mm (1 inch) to the scale reading at the top of the horizontal bar. (See Figure III-19.)

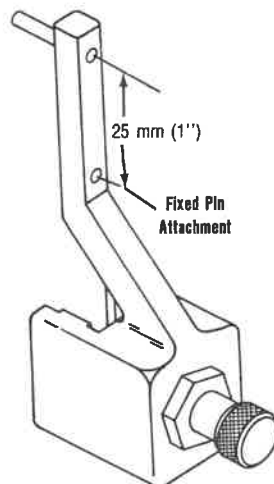


Figure III-18

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

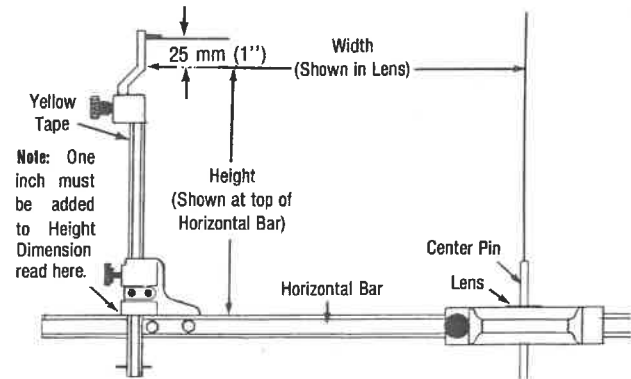


Figure III-19

Offset Attachment

The Offset Attachment (see Figure III-20) extends or shortens the width of a gauge by 76 mm (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.

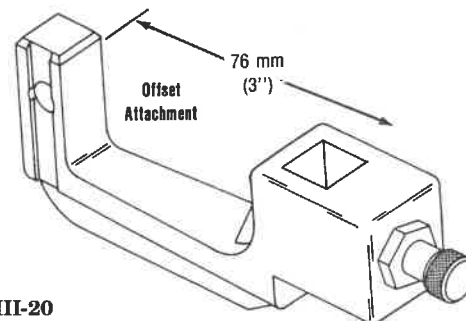
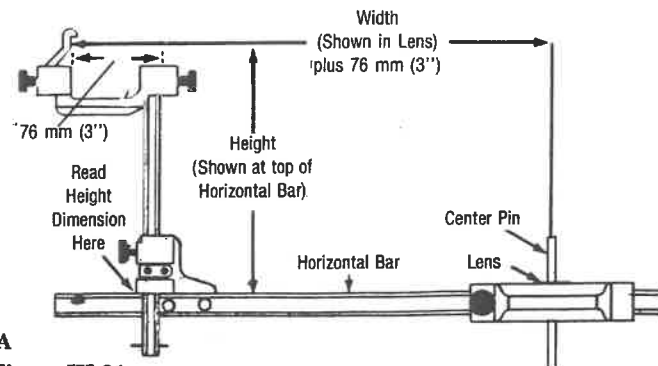
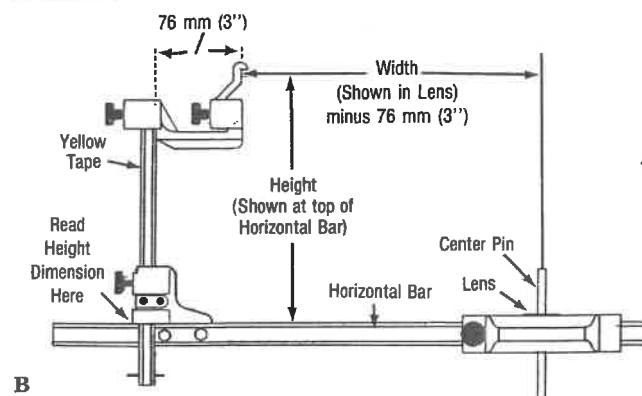


Figure III-20

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 III-21 A and B.)



A
Figure III-21



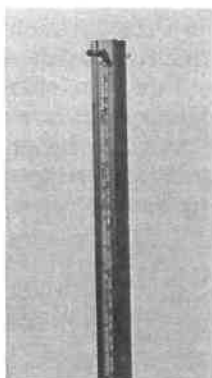
B
Figure III-21

Roll Pin (End of Scale)

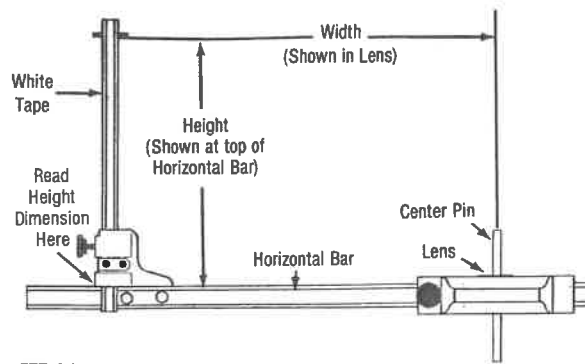
As noted in the description of the scales, one end of each scale features a roll pin. (See Figure III-22 A and B.) This roll pin is used when tight quarters prohibit use of attachments.

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.



A
Figure III-22



B
Figure III-22

Crossmember Pin

The Crossmember Pin (see Figure III-23) 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 - Installation.)

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

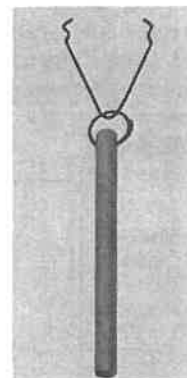


Figure III-23

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 III-24 - page 11.)

Pointers, positioned in adjustable housings on the upper horizontal bar (see Figure III-25 A, B, C and D - page 11) are used to mount the gauge to strut tower/upper body locations. Two types of pointers are provided: 'cone' and 'reverse cone'. The 102 mm (4 inch)

reverse cone is notched to provide additional means of mounting on the vehicle, e.g. ridged surfaces. The pointers are held in the housings by means of the lower thumb screw. (See Figure C.) The housings are secured to the horizontal bar by means of the top thumb screw. (See Figure D.)

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

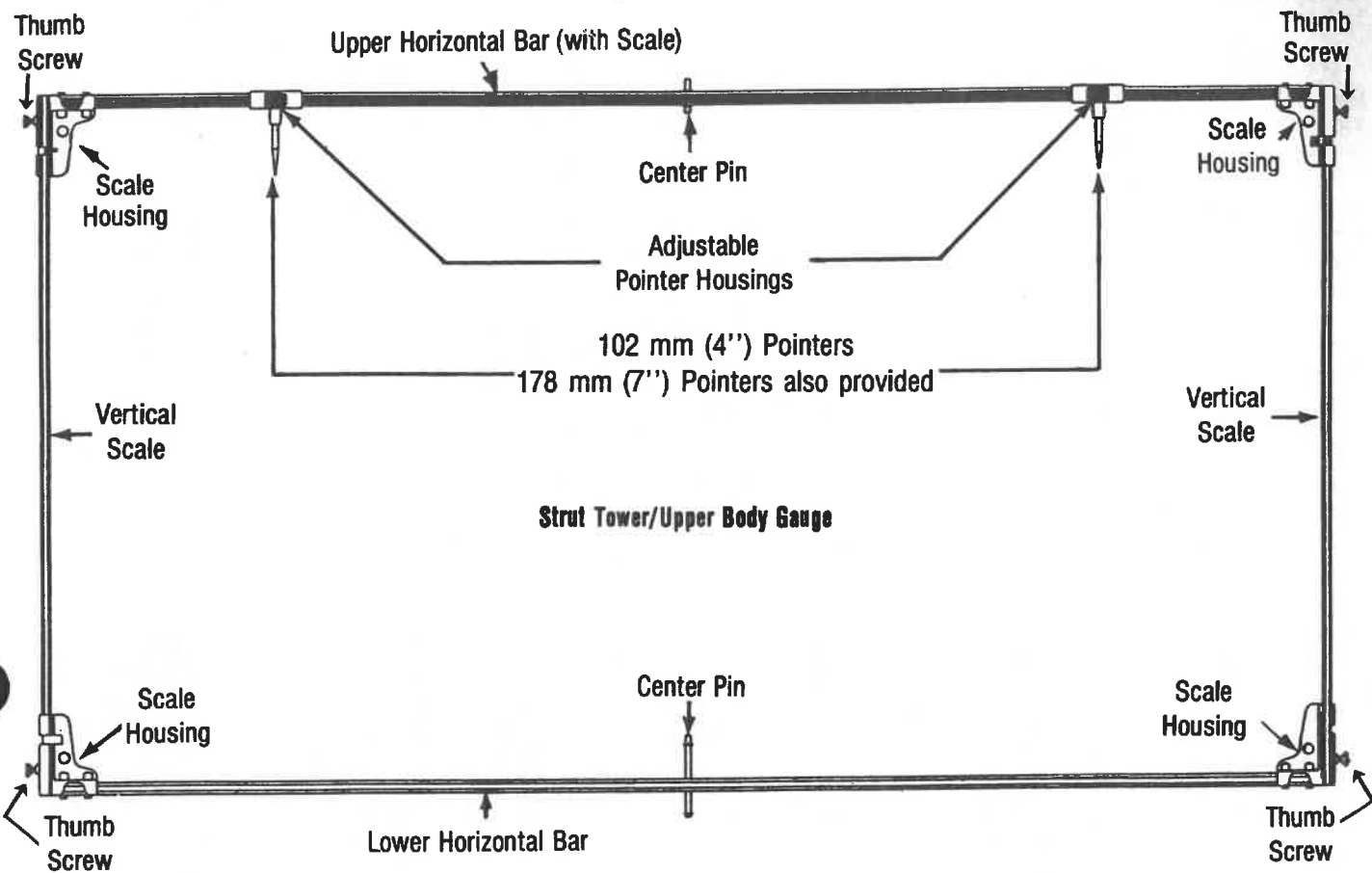


Figure III-24

The vertical scales that link the upper and lower horizontal bars are used to set the lower bar at the datum height of the parts the gauge mounts to. The scales fasten in housings at the ends of the horizontal bars. (See Figure III-26 A and B.) Height adjustments are made at the housings 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.

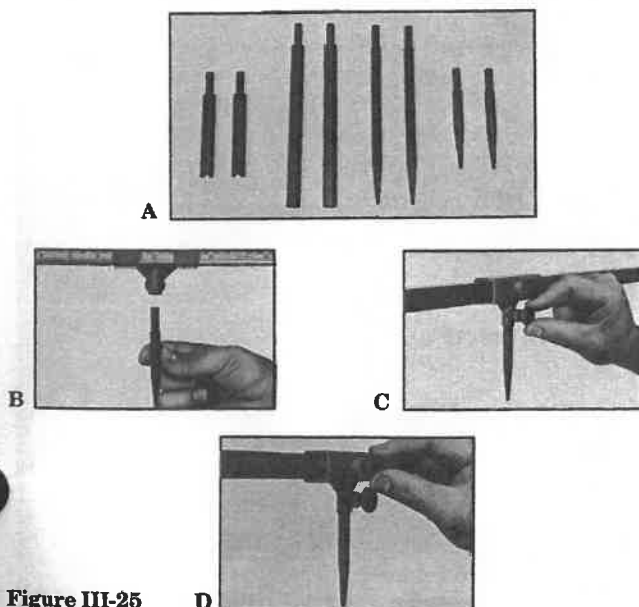


Figure III-25

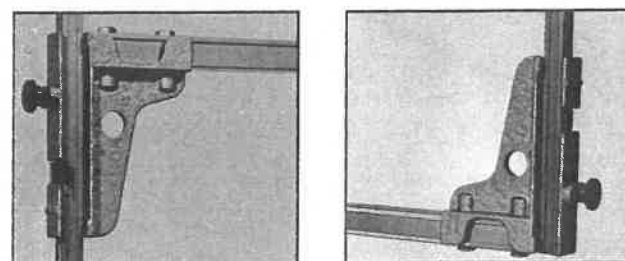


Figure III-26

Tram Gauge

The Chief Tram Gauge (see Figure III-27) 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

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

The 1524 mm (60 inch) tram gauge is pre-assembled. To assemble the 914 mm (36 inch) tram gauge or re-assemble the 1524 mm (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.

2438 mm (96 inch) Tram Gauge

The 2438 mm (96 inch) tram gauge is formed by joining the 1524 mm (60 inch) assembled tram with the 914 mm (36 inch) outer tram. A 305 mm (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 1524 mm (60 inch) tram so the dimension '1524' will appear in the window of the 914 mm (36 inch) outer tram. If reading in inches, slide the connector into the 1524 mm (60 inch) tram so dimension '60' will appear in the window of the 914 mm (36 inch) outer tram.

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

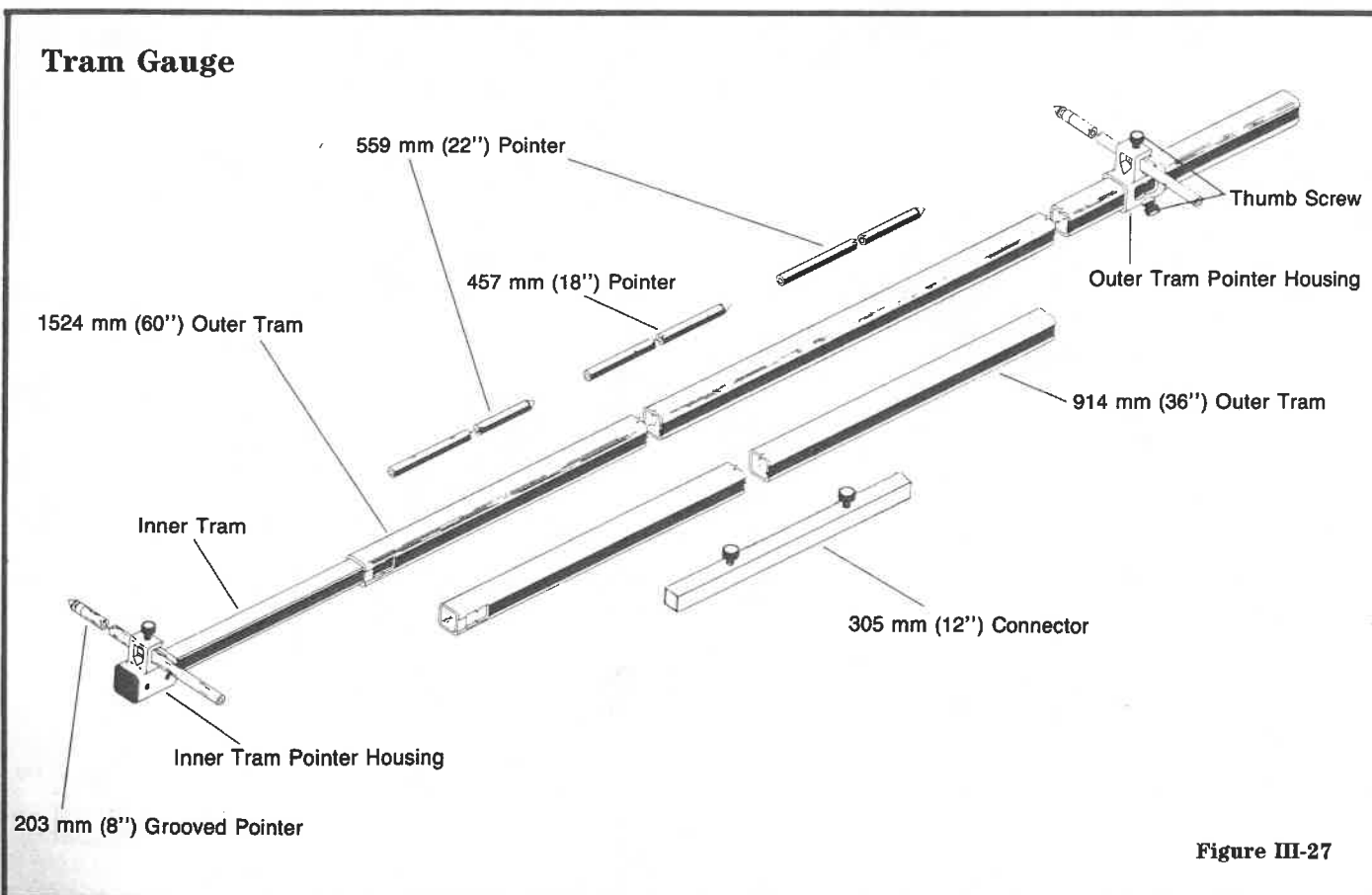


Figure III-27

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 III-28. Set each pointer at 127 mm (5 inches) at the top of its pointer housing. Set the outer tram pointer housing at an even dimension, for example 1400 mm (55½ inches), and the 200 mm (7⅞ inches). The sum of the dimensions shown in the windows of the outer tram and outer tram pointer housing is 1600 mm (63 inches). Measuring the distance between the tips of the two pointers with a tape measure shows the distance is 1600 mm (63 inches).

NOTE: When using the 2438 mm (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 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 III-29. Set one pointer at 300 mm (11⅞ inches) and the other at 100 mm (3⅞ inches). Set the outer tram pointer housing at 1400 mm (55½ inches) and the inner tram at 200 mm (7⅞ inches). A tape measure shows the distance between the tips of the pointers to be 1612 mm (63⅞ inches).

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

203 mm (8 inch) Grooved Pointers

The 203 mm (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 (⅝ inch) longer than the pointer in the inner tram pointer housing. (See inset – Figure III-30.)

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 3 mm (⅛ inch). The subtraction of the 3 mm (⅛ inch) figure represents the radius of the pointer (grooved portion) that is hooked in the reference hole.

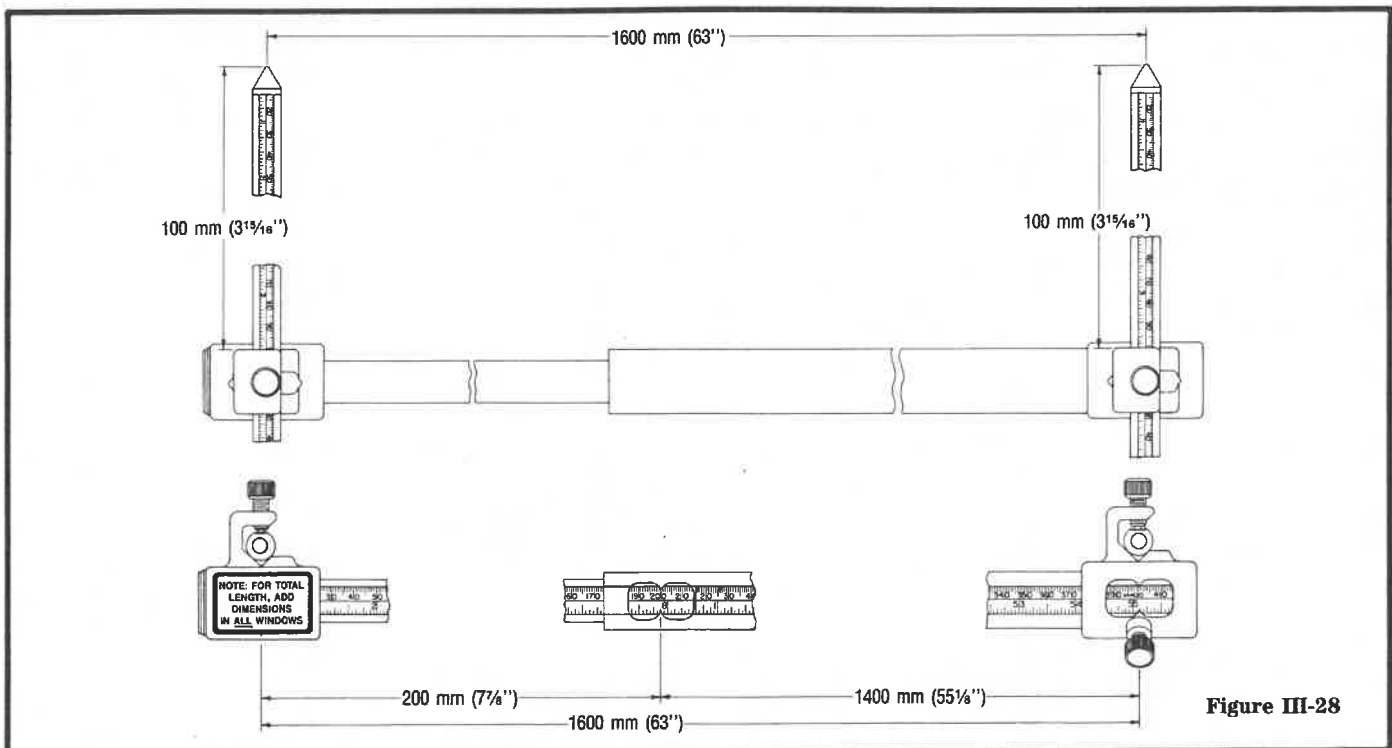


Figure III-28

For example, see Figure III-30. Set the length of the pointer in the outer tram pointer housing at 100 mm ($3\frac{1}{8}$ inches) and the length of the pointer in the inner tram pointer housing at 84 mm ($3\frac{5}{16}$ inches). Set the outer tram pointer housing at 1400 mm ($55\frac{1}{8}$ inches) and the inner tram at 203 mm (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 3 mm ($\frac{1}{8}$ inch). $203 \text{ mm} + 1400 \text{ mm} = 1603 \text{ mm} - 3 \text{ mm} = 1600 \text{ mm}$ ($8'' + 55\frac{1}{8}'' = 63\frac{1}{8}'' - \frac{1}{8}'' = 63''$).

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

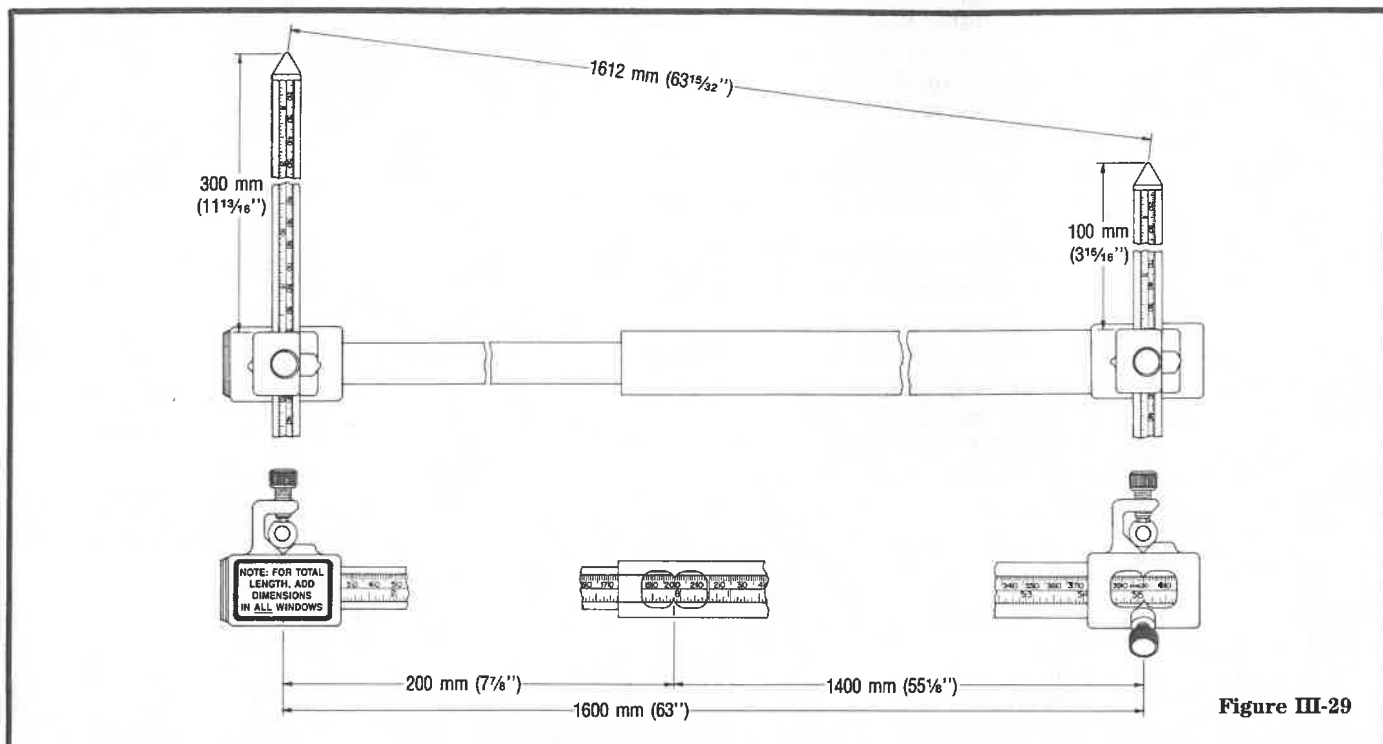


Figure III-29

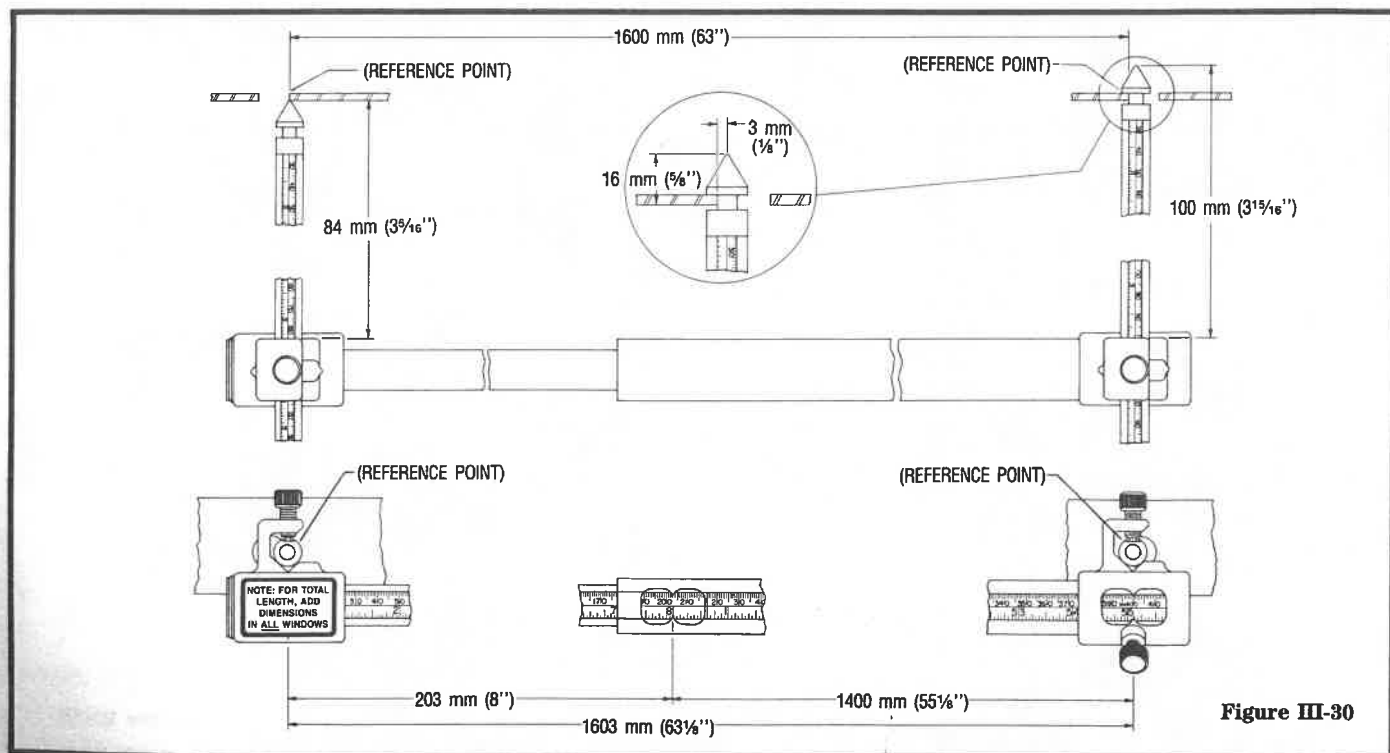


Figure III-30

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 III-31.

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 III-31. Set one pointer at 100 mm ($3\frac{15}{16}$ inches) and the other at 200 mm ($7\frac{7}{8}$ inches). Set the outer tram pointer housing at 1400 mm ($55\frac{1}{8}$ inches) and the inner tram at 200 mm ($7\frac{7}{8}$ 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.

housing. $100 \text{ mm} + 200 \text{ mm} + 1400 \text{ mm} + 200 \text{ mm} = 1900 \text{ mm}$ ($3\frac{15}{16}$ " + $7\frac{7}{8}$ " + $55\frac{1}{8}$ " + $7\frac{7}{8}$ " = $74\frac{13}{16}$ ").

NOTE: When using the 2438 mm (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" in the view entitled "Side View" are applicable "only" for Chief's Dimension III Measuring System.

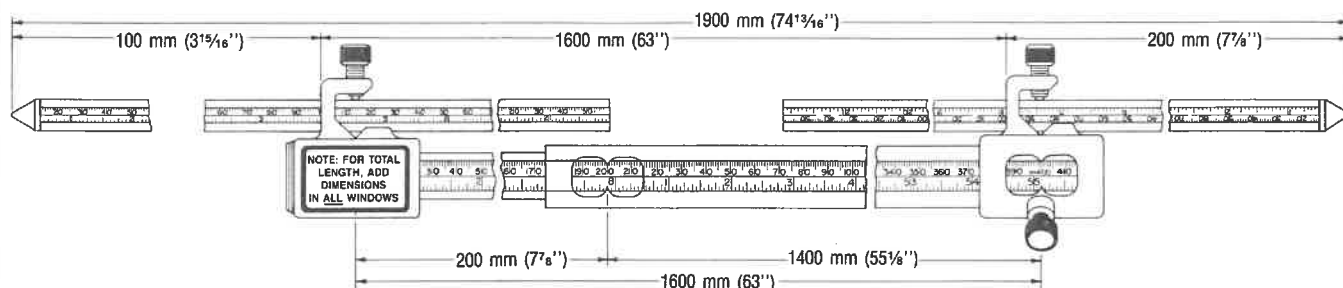


Figure III-31

Dimension Manuals (Optional)

Chief's Dimension Manuals (see Figure III-32) provide technicians with dimensions for structural repair. (They show an underhood view, bottom view and side view of vehicles. (See Figures III-33, 34 and 35.)

The dimension manuals contain numerous point-to-point measurements. Examples are 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.

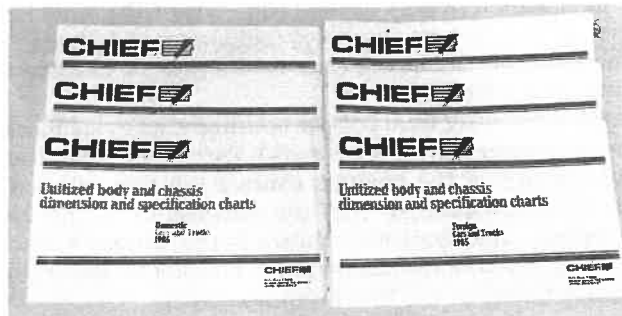


Figure III-32

- 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 Dimension III Universal Measuring System, use the datum length measurements shown in the **Side View** drawings.

Unitized Body Vehicle

EAGLE 1990 TALON AWD

97.2" (2469mm) WHEELBASE

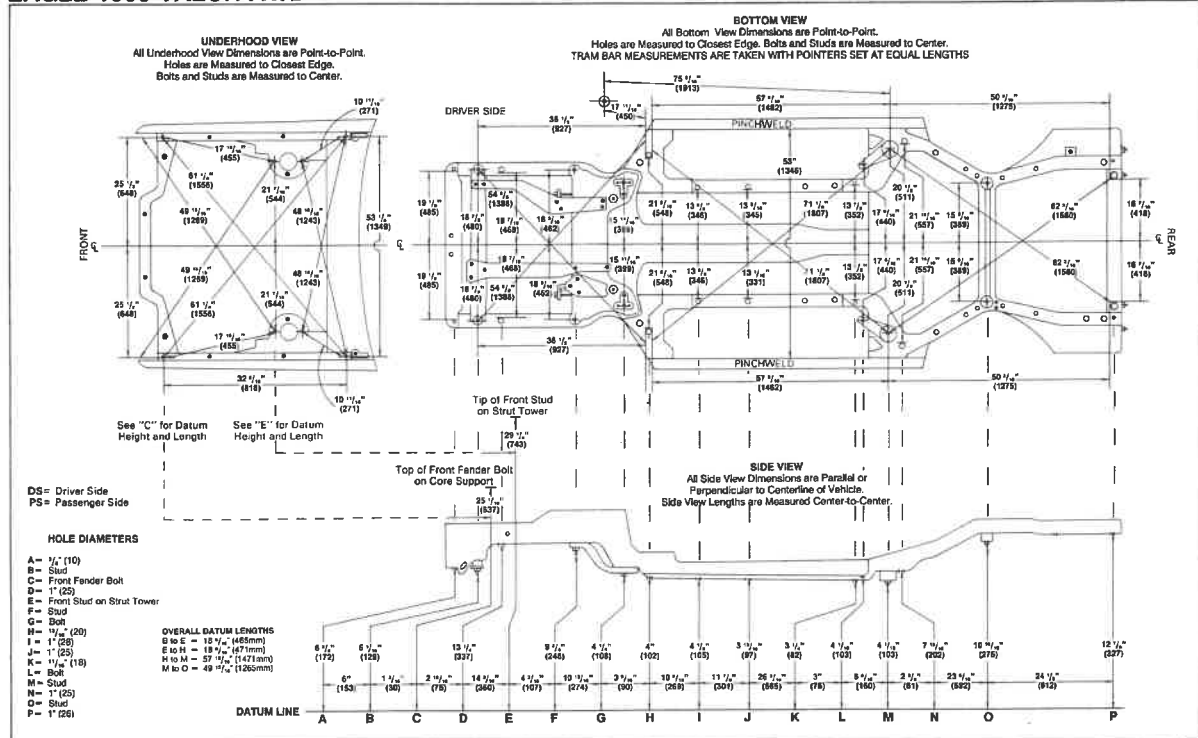


Figure III-33

Conventional Frame Vehicle

MERCURY 1990 GRAND MARQUIS SEDAN

114.3" (2903mm) WHEELBASE

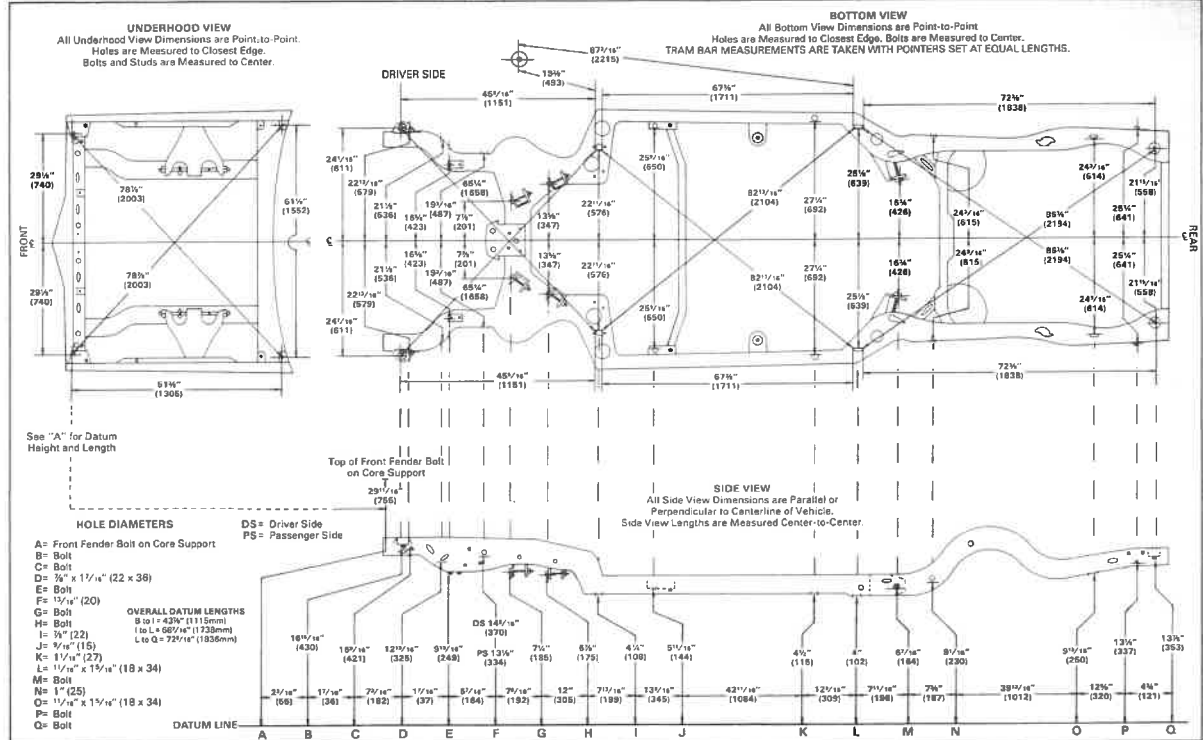


Figure III-34

MR-2

Pickup Truck

CHEVROLET/GMC 1990 C-1500/C-2500 PICKUP LONG BED 2WD

131.5" (3340mm) WHEELBASE

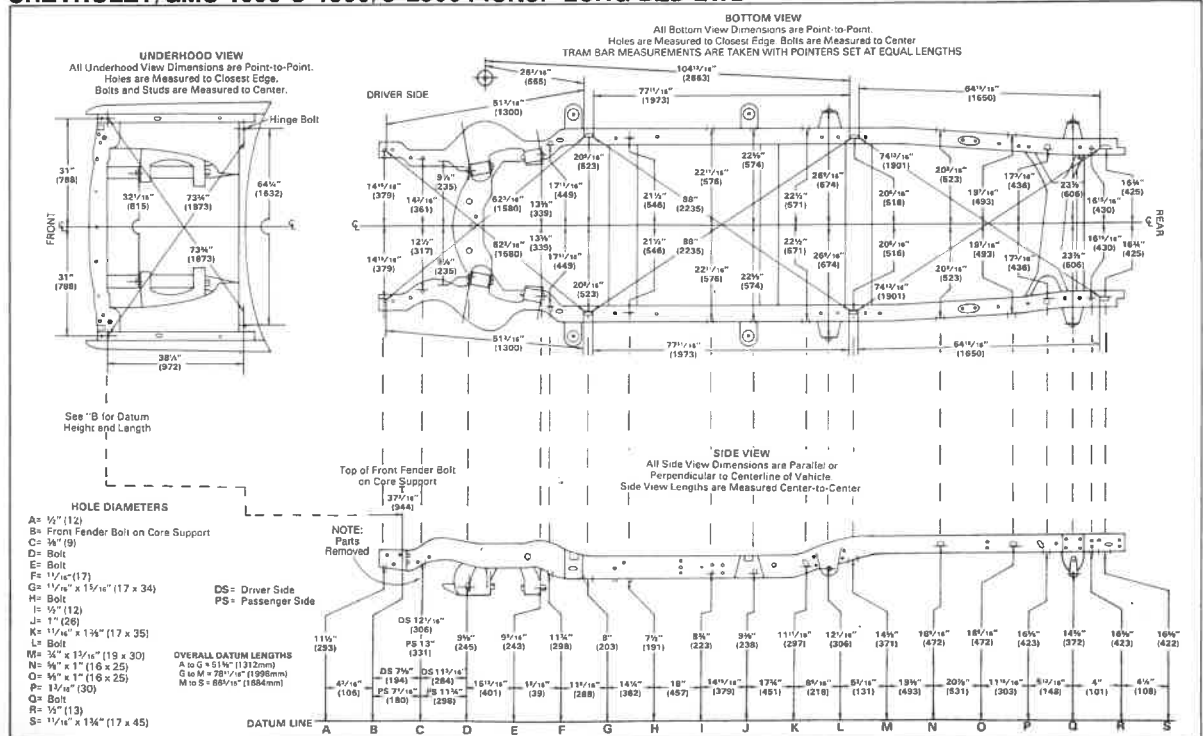


Figure III-35

CHT-4

SEE PROCEDURE EXPLANATION

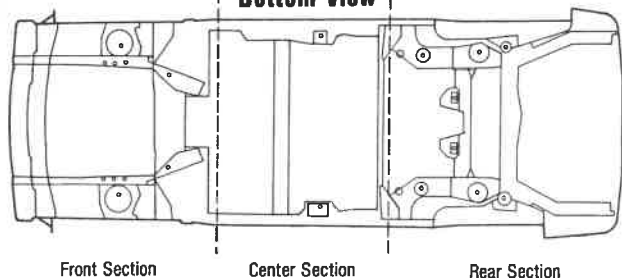
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IV. Installation

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.

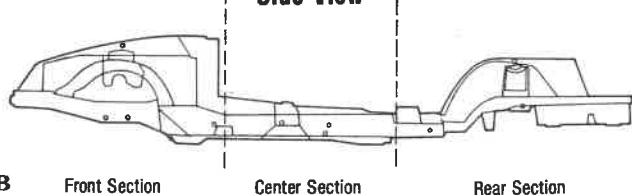
The exact location of gauges on a structure will vary from vehicle to vehicle; however, they will always divide it into three basic sections: front, center and rear. (See Figure IV-1 A and B.)

Three Sections
Bottom View



A

Side View

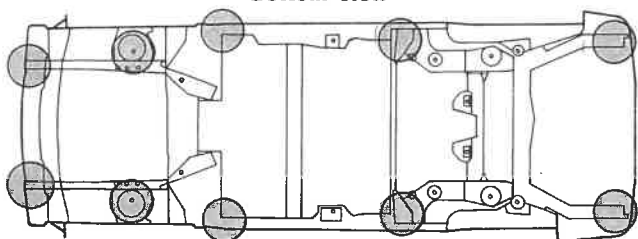


B

Figure IV-1

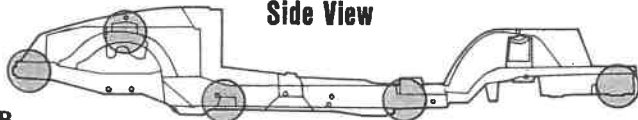
Gauges must be installed at the control points of the vehicle to check the alignment of the structure, suspension and steering. (See Figure IV-2 A and B.) Gauges must also be installed at locations between the control points when there is either obvious or suspected misalignment.

Control Points
Bottom View



A

Side View



B

Figure IV-2

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 IV-3.) Positioning the horizontal bars of each gauge at datum height shows the condition of each section relative to the datum plane.

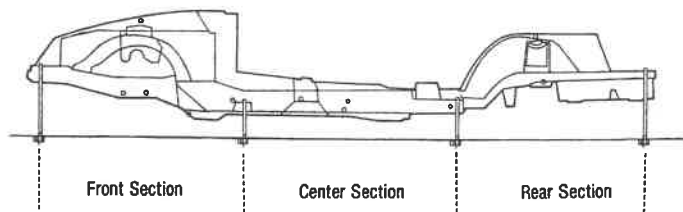


Figure IV-3

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 IV-4.)

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

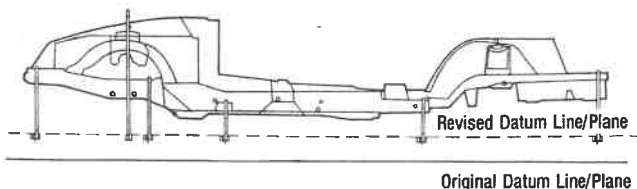


Figure IV-4

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 IV-5.)

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 IV-5

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 IV-6.) 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 IV-6

Installation Procedures

If a diamond condition is suspected, the technician should diagonally measure the vehicle's center section with a Tram Gauge (see Figure IV-7) prior to installing the base gauges. If a diamond condition goes undetected, a false analysis of the damage will be made.

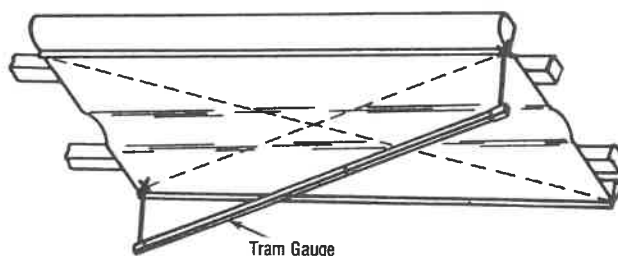


Figure IV-7

It is also best to have the vehicle's weight on its suspension during the gauging process. If the vehicle is supported by the 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 analysis of the damage.

Installing Base Gauges

- 1) Select a 1,015 mm (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) such as the one shown in Figure IV-6.

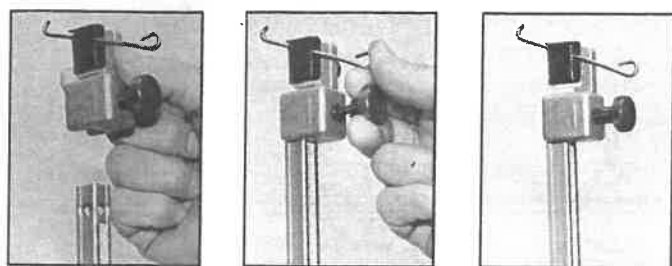
NOTE: See Section III (Pages 8 and 9) – Attachments for additional information.

- 3) Select scales that will position the horizontal bars of the gauge at datum height or at a convenient reading height – approximately 102 mm (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 IV-8 A, B and C.)

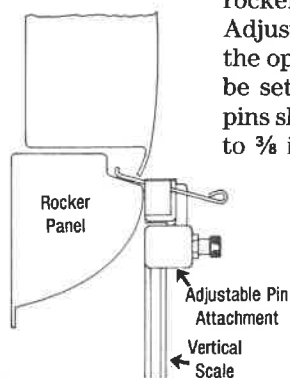


A B C

Figure IV-8

- Remember, attachments should point toward centerline and the yellow tape should face away from the vehicle. (See additional information and illustration – Section III, Pages 7-8.)

IMPORTANT: When using the Adjustable Pin Attachment, adjust the angle of the pin to match the top surface of the rocker panel. (See Figure IV-9.) 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 9.5 mm ($\frac{1}{4}$ to $\frac{3}{8}$ inch) to be effective.

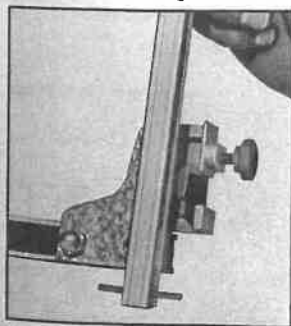


Angle of Pin
must match surface
of Rocker Panel

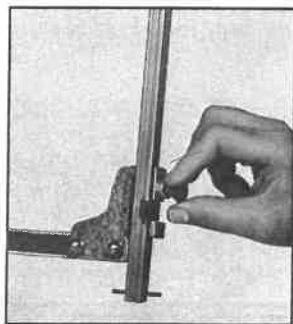
Pin should extend
6.5 to 9.5 mm ($\frac{1}{4}$ " to $\frac{3}{8}$ ")
to be effective

Figure IV-9

- b) Fasten the scale/attachment assemblies in the scale housings of the gauge. (See Figure IV-10 A and B.) 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 102 mm (4 inches), and tighten the scale housing's thumb screw.



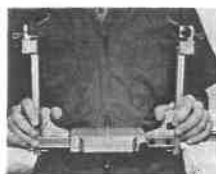
A



B

Figure IV-10

- 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 Figure IV-11 A and B.) When mounting the gauge to rocker panels, position it at the front of the rocker panels. (See Figure IV-12.)



A



B

Figure IV-11

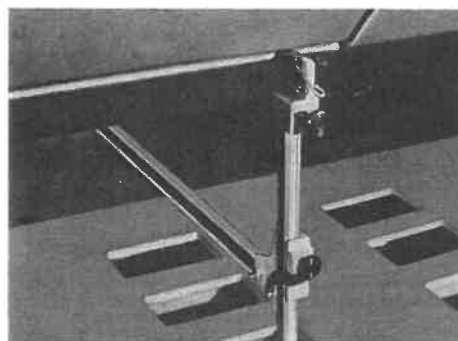
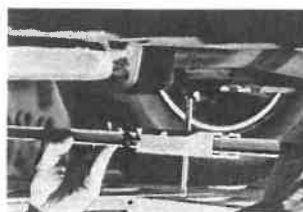


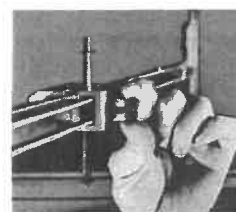
Figure IV-12

- 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 IV-13 A and B.)

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.



A



B

Figure IV-13

- 5) Select another 1,015 mm (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 IV-14) is used in the process.

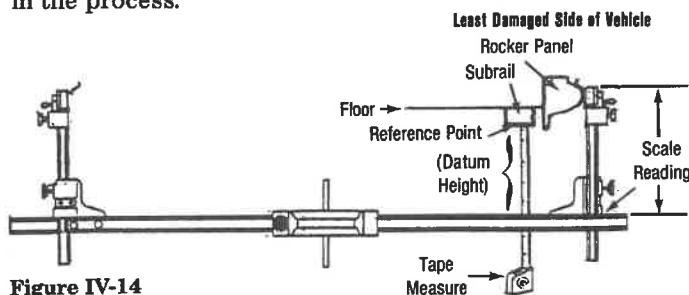


Figure IV-14

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 IV-15.)

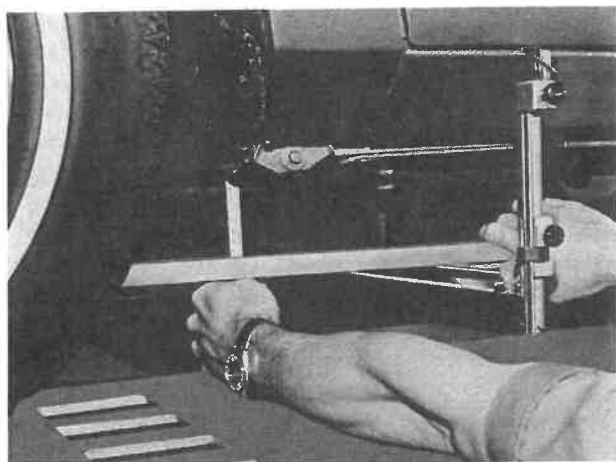


Figure IV-15

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 IV-16.)

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.

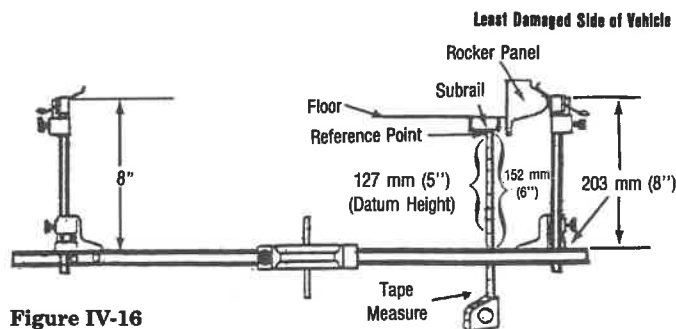


Figure IV-16

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 IV-16, the distance is 152 mm (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 127 mm (5 inches) and the bar must be raised 25 mm (1 inch) to be at datum height.
- 4) Raise the bar on the least damaged side of the vehicle 25 mm (1 inch) and tighten the thumb screw on the scale housing. (See Figure IV-17.)

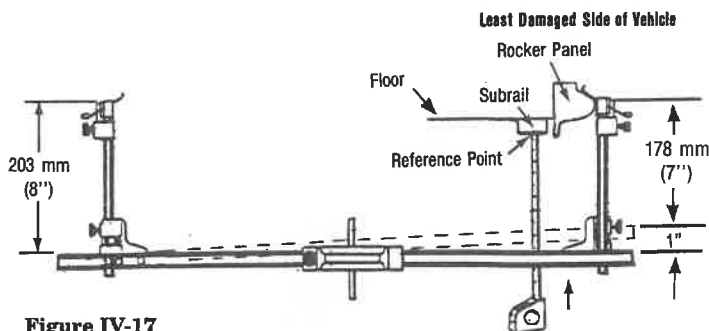


Figure IV-17

- 5) Raise the bar on the most damaged side of the vehicle 25 mm (1 inch) and tighten the thumb screw on the scale housing. (See Figure IV-18.)

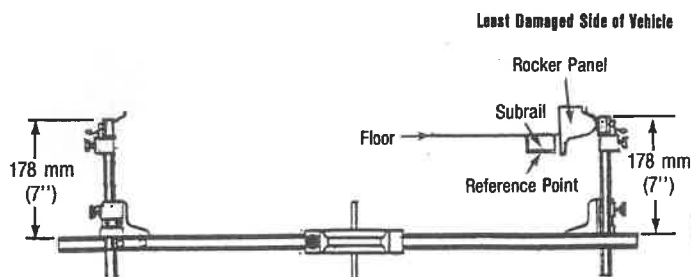


Figure IV-18

- 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 IV-19.) If the top of the bar is not at datum height – in this example 127 mm (5 inches) – repeat the procedure until the desired datum height is achieved and the height of each gauge scale is equal.

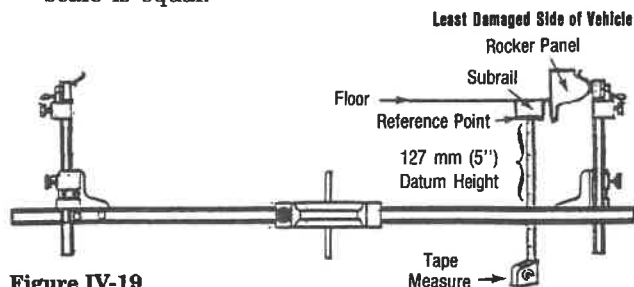


Figure IV-19

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 a tram gauge bar across the two base gauges making certain it passes under a datum reference point on the least damaged side of the vehicle near the horizontal bar.
- 2) Measure from the reference point to the bottom edge of the tram gauge bar. (See Figure IV-20.) The bottom edge of the tram gauge bar corresponds with the top of the horizontal bar of the gauge.

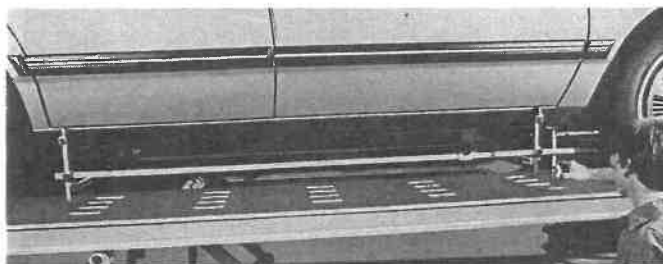


Figure IV-20

- 3) Raise or lower the horizontal bar of the gauge until the bottom of the 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 IV-21.)

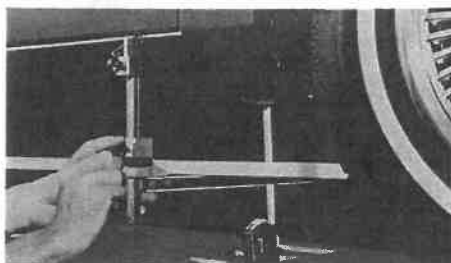


Figure IV-21

- 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 the damaged side of the 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 915 mm (36 inch) gauges for installation at the ends of the vehicle; a 815 mm (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; and, a Strut Tower/Upper Body Gauge for positioning on strut tower or other upper body locations. Refer to the gauges as they are numbered (see Figures IV-22 and 23):

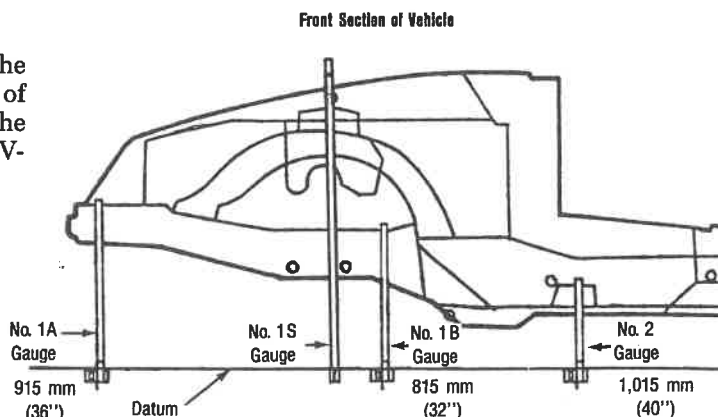


Figure IV-22

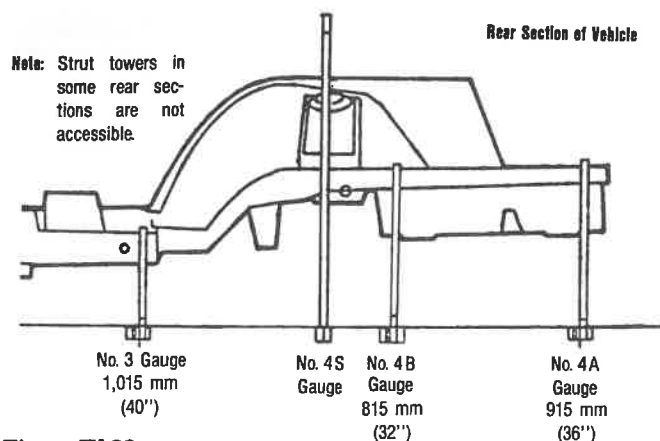


Figure IV-23

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 vehicle's front section and as the No. 4S and 4B Gauges if used in the vehicle's rear section.

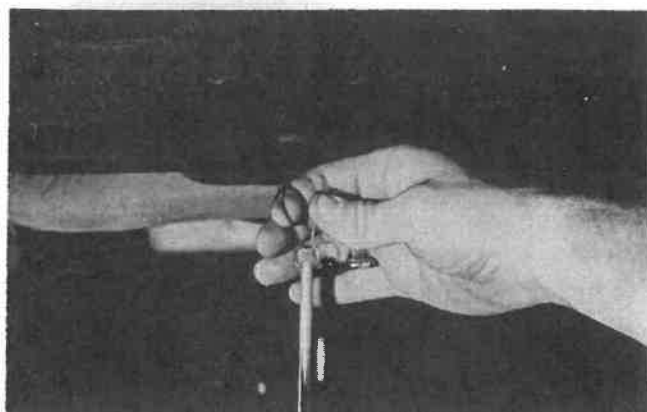
- 2) Select attachments suited for the reference points (holes) each gauge will mount to. Commonly used attachments are the Notched, Magnetic, and Fixed Pin. Also used is the roll pin on the end of each scale. If using this roll pin, turn the scale so the white measuring tape faces away from the side of the vehicle. (See Figure IV-24.) Its calibration begins at the bottom edge of the roll pin. (See additional information - Section III, Page 10.)



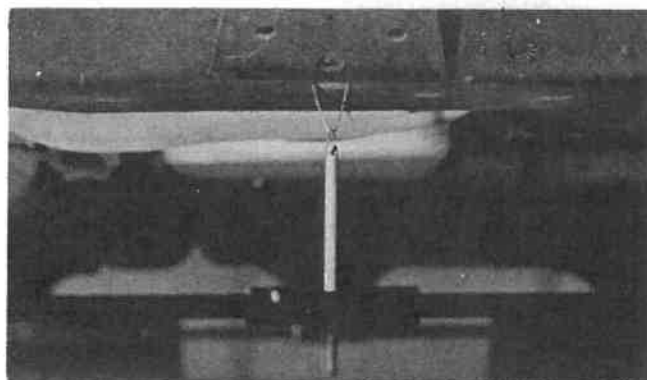
Figure IV-24

- 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 - Section IV, Page 22 - for a similar application)

- 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 Figure IV-25 A and B) 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.



A



B

Figure IV-25

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 IV-26.)

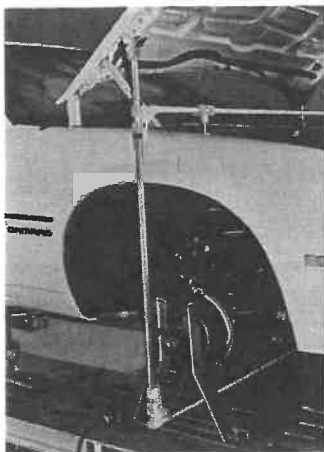
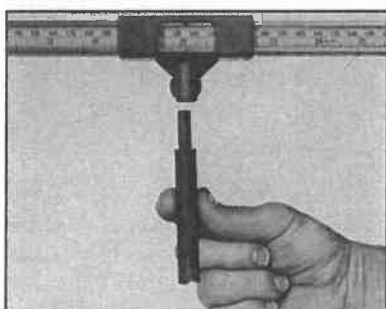


Figure IV-26

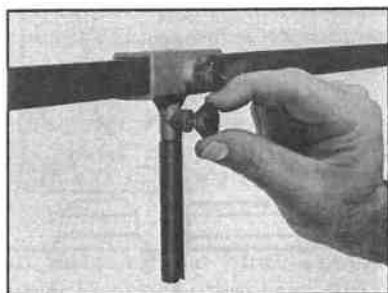
- 2) Select a pair of mounting pointers to match the strut tower reference points. 'Cone' and 'Reverse Cone' are provided in 102 mm (4 inch) and 178 mm (7 inch) lengths.

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 Figure IV-27 A and B.)



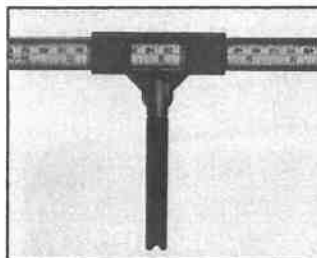
A



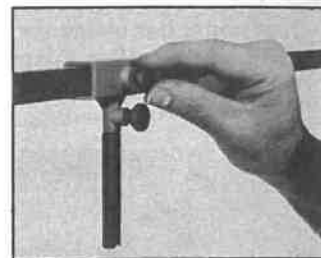
B

Figure IV-27

- 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 Figure IV-28 A and B).



A



B

Figure IV-28

- 5) Place the upper horizontal bar across the strut towers and position the pointers on the strut tower reference points. (See Figure IV-29 A and B.)



A



B

Figure IV-29

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.

The scales are held in the scale housings of the upper horizontal bar by means of a scale retaining spring and thumb screw. (See Figure IV-30.)

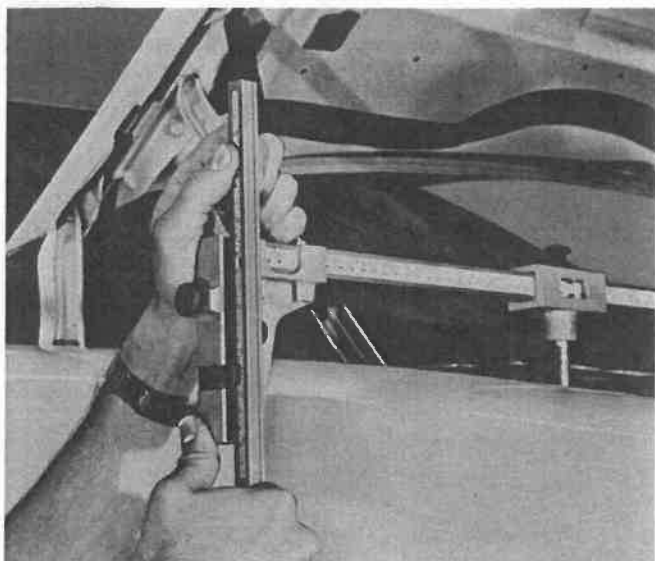


Figure IV-30

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 IV-31.)

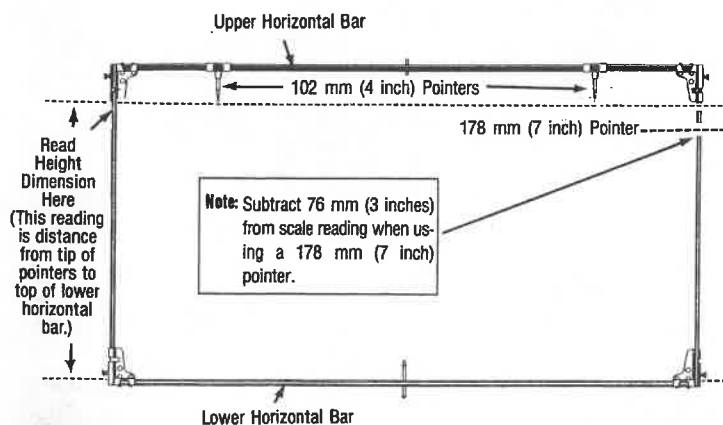


Figure IV-31

- 7) Fasten the lower end of the vertical scales 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 IV-32 – arrow points out hole in scale.)

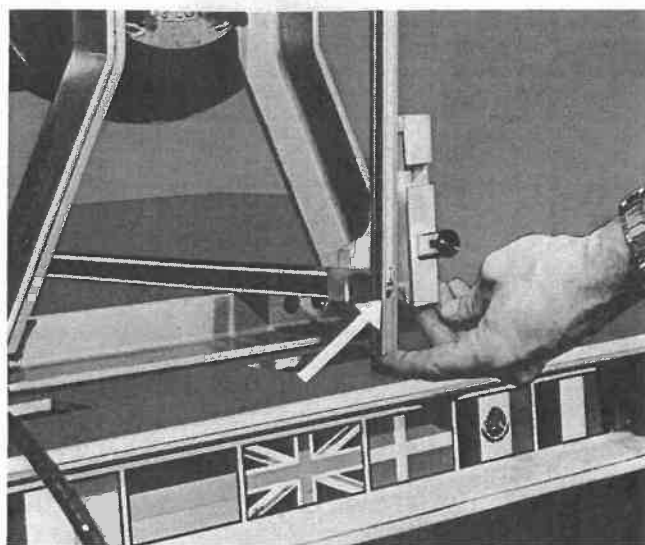


Figure IV-32

IMPORTANT: For correct installation, the thumb screw must align with and fit into the hole on the bottom of the scale. (See Figure IV-33.)

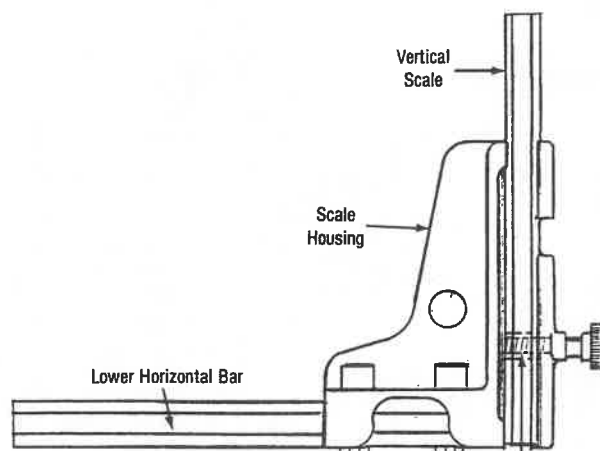


Figure IV-33

Thumb Screw on Scale Housing must align with and fit in hole on the scale.

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 IV-34.) 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 the 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 IV-35.)

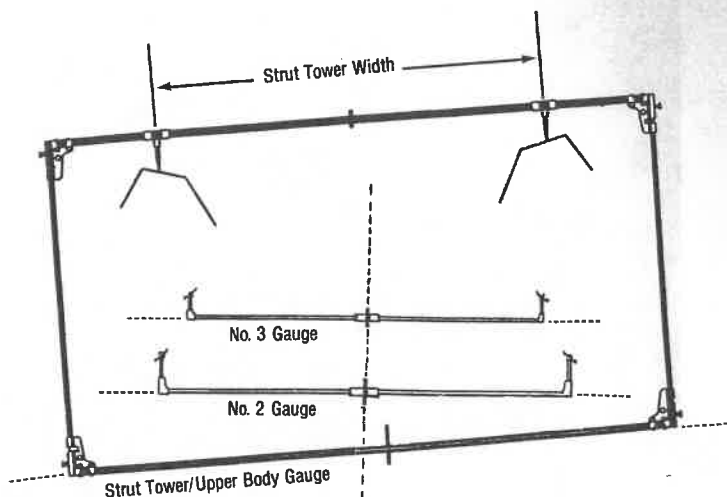


Figure IV-34

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 center 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).

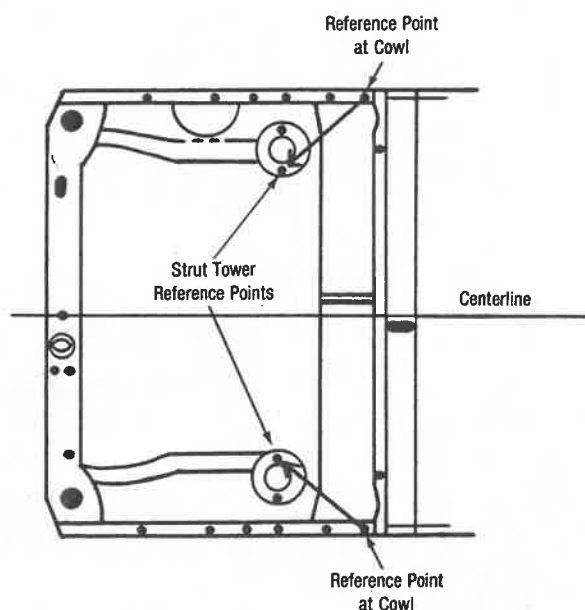


Figure IV-35

Conventional Frame Car

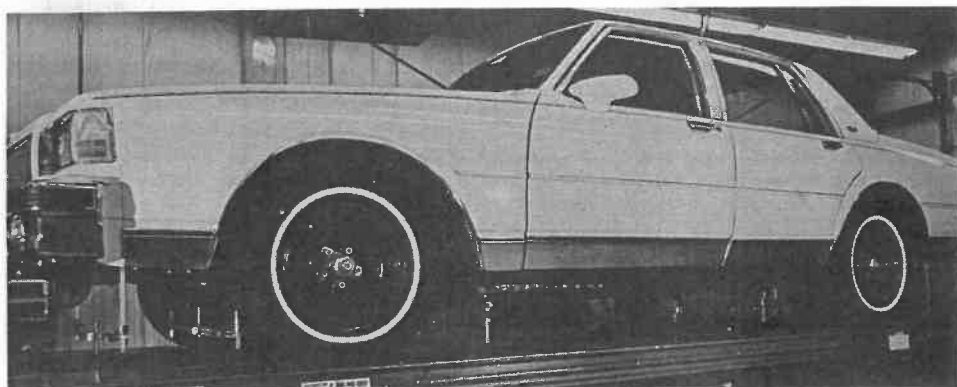


Figure IV-36 Overview of Precision Datum/Centerline Gauges installed on a conventional frame car.

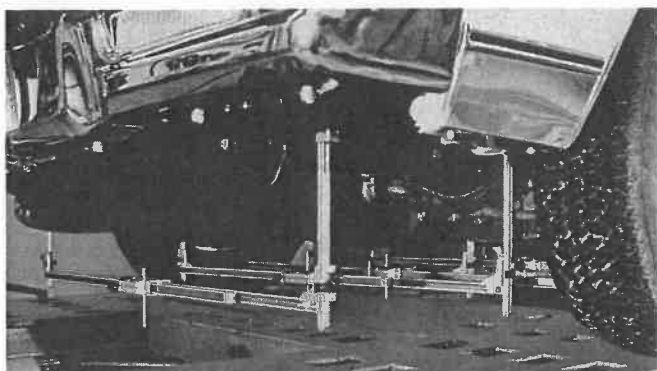


Figure IV-37 Overview of Precision Datum/Centerline Gauges installed in front section of vehicle.

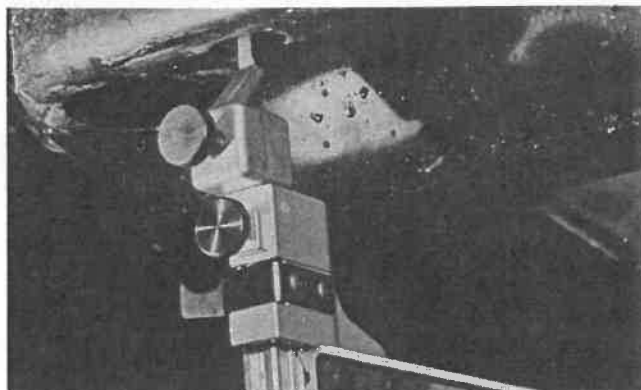


Figure IV-38 Notched Attachment used to suspend gauge from reference hole on underside of rail at front of vehicle's center section.

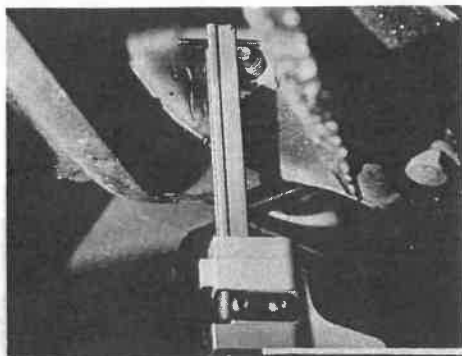


Figure IV-39 Roll Pin (end of scale) used to mount gauge to lower control arm mounting bolt in front section.

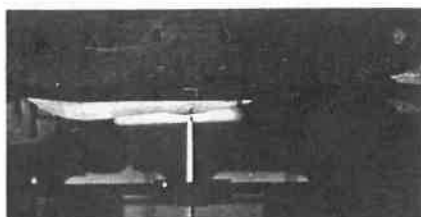


Figure IV-40 Crossmember Pin is installed (by means of spring clip) in reference hole in middle of crossmember and shows lateral misalignment of crossmember.



Figure IV-41

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

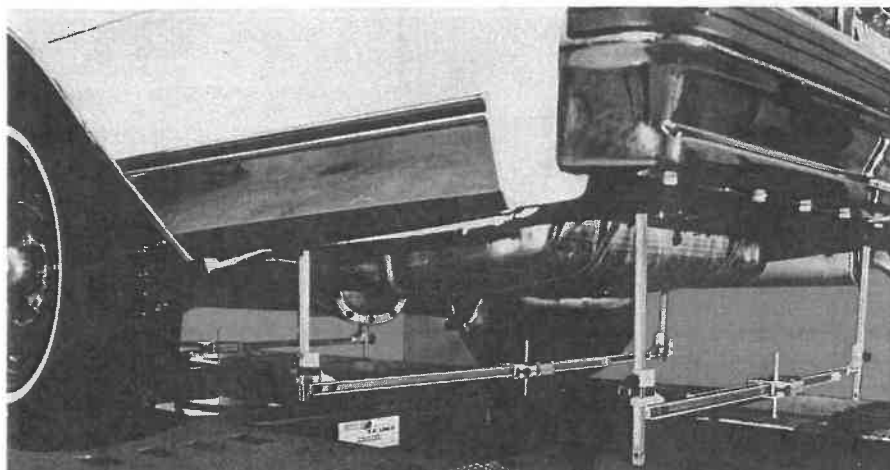


Figure IV-42 Overview of Precision Datum/Centerline Gauges installed in rear section of vehicle.

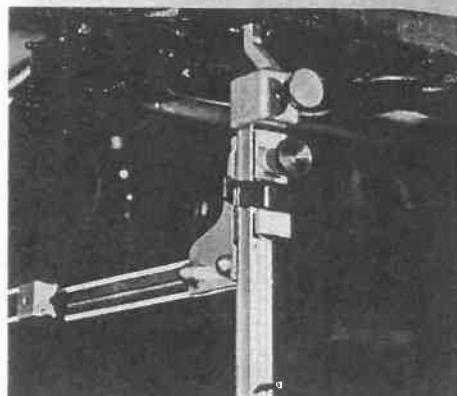


Figure IV-43 Notched Attachment used to suspend gauge from reference point (hole) on underside of rail at rear of center section.

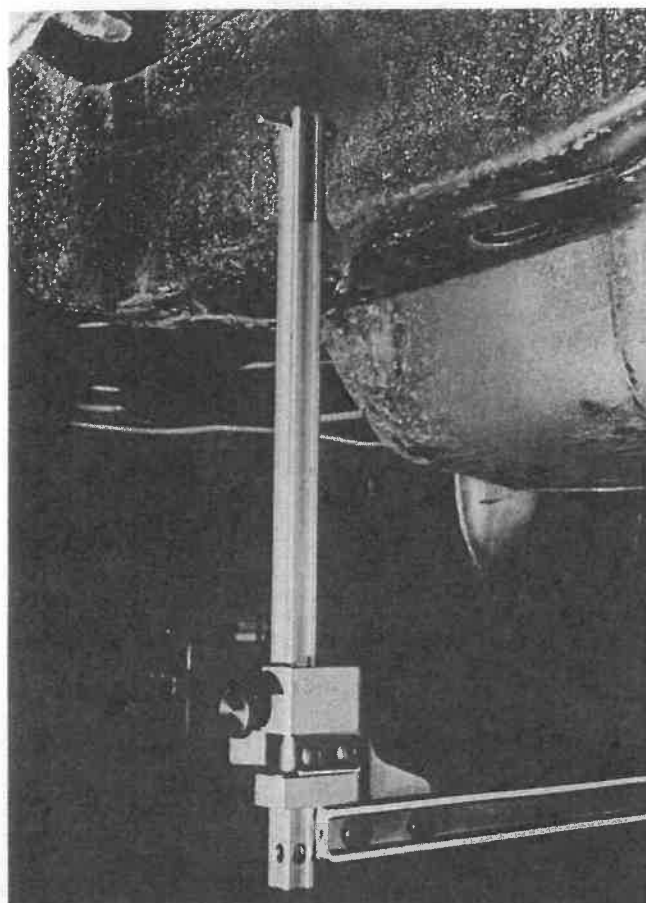


Figure IV-44 Roll Pin (end of scale) used to suspend gauge from vertical reference point (hole) on rail in rear section of vehicle.

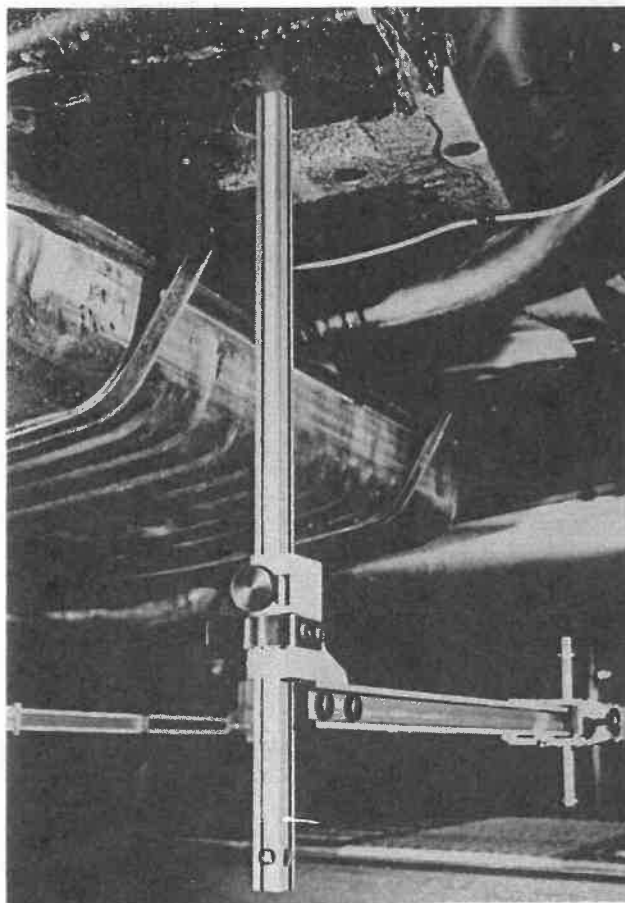


Figure IV-45 When reference points (holes) are unavailable, gauges can be suspended from other openings on the side or underside of rails. In this photo, the Roll Pin (end of scale) is used to suspend the gauge from such an opening at the rear of the vehicle.

Pickup Truck

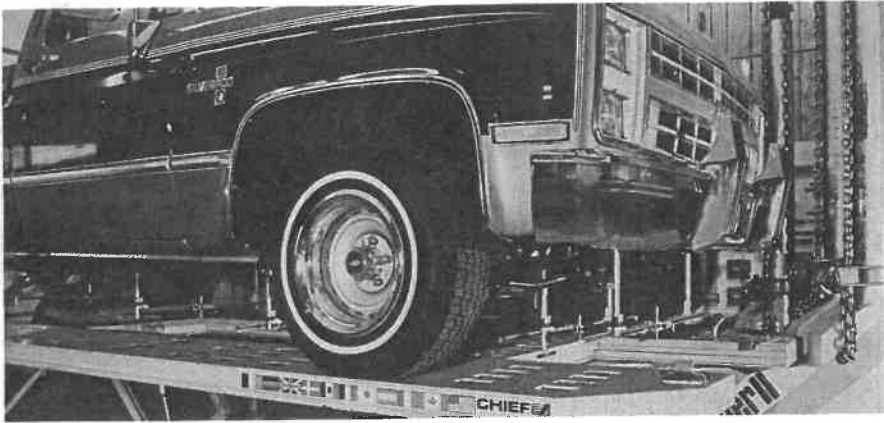


Figure IV-46 Overview of Precision Datum/Centerline Gauges installed on pickup truck.

The installation of Precision Datum/Centerline Gauges on a pickup truck is similar to installation on unitized body vehicles and conventional frame cars. 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 the frame of a pickup truck.

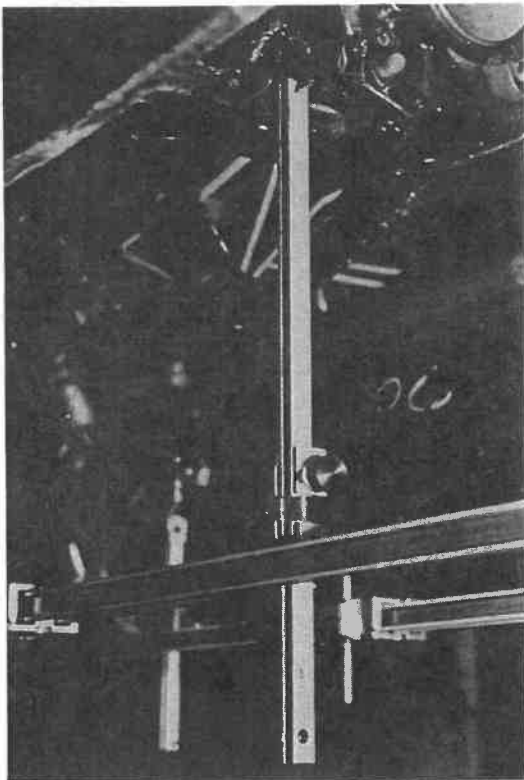


Figure IV-47 Roll Pin (end of scale) used to suspend gauge from elongated hole (on side of rail) at front of vehicle.

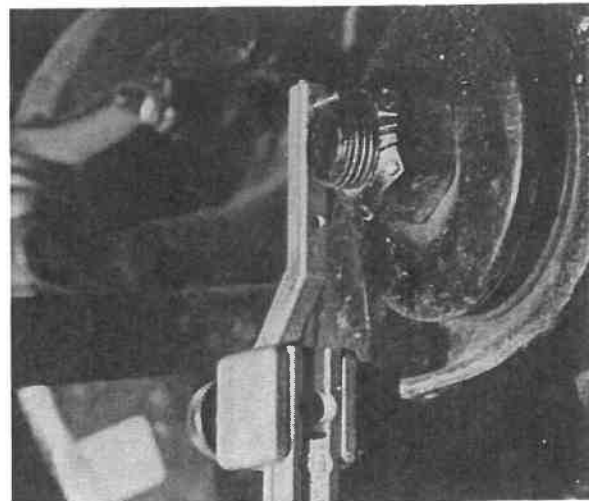


Figure IV-48 Fixed Pin Attachment used to mount gauge to lower control arm mounting bolt in front section. The narrow width of attachment allows mounting the gauge to the bolt shown. If bolt were longer, the Roll Pin on the end of the scale could be used to mount the gauge.



Figure IV-49 Crossmember Pin is installed (by means of spring clip) in reference hole in middle of crossmember and shows lateral misalignment of crossmember.

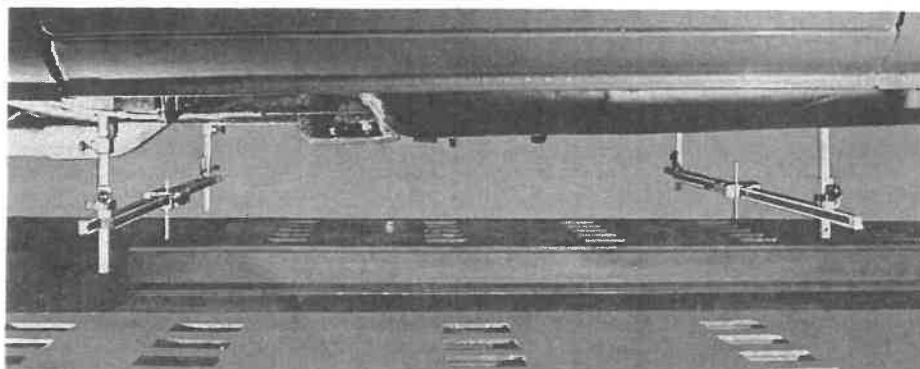


Figure IV-50 Overview of Precision Datum/Centerline Gauges in center section of vehicle. Most pickup trucks have a short center section extending from the cowl to the rear of the cab.

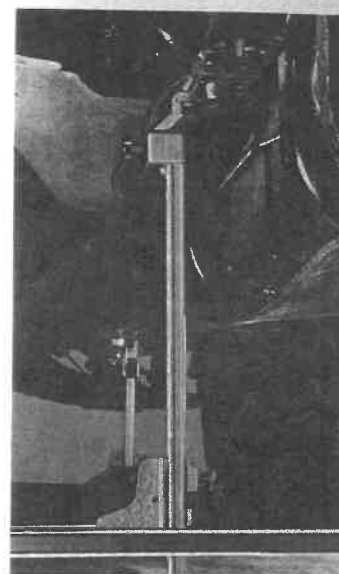


Figure IV-51 Notched Attachment used to mount gauge to inside edge of rail at rear of center section.

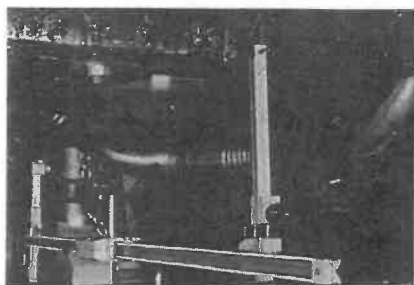


Figure IV-52 Roll Pin (end of scale) used to suspend gauge from elongated hole on side of rail at front of center section,

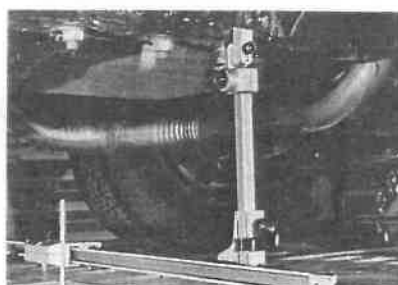


Figure IV-53 When reference points (holes) are unavailable, Magnetic Attachments can be used to mount the gauge to the underside of structural members. In this photo, a Magnetic Attachment supports the gauge at the front of the vehicle's center section.

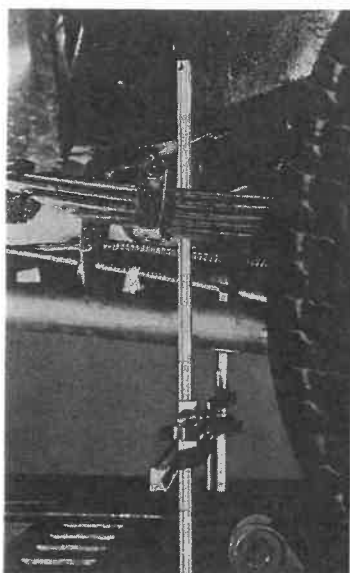


Figure IV-54 Roll Pin (end of scale) used to suspend gauge from vertical reference hole in rail (just ahead of rear wheels).

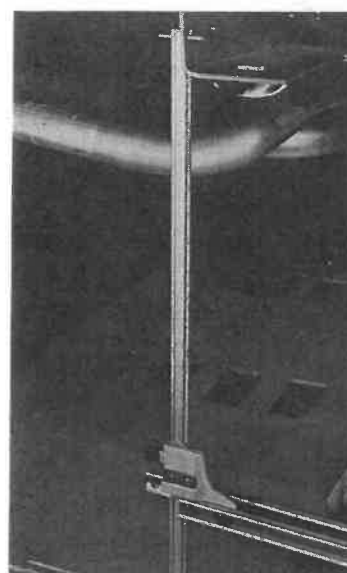


Figure IV-55 Roll Pin (end of scale) used to suspend gauge from vertical reference hole at end of rail in rear section of vehicle.

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 School. In addition, they should refer to Chief's Gauging and Analyzing Collision Damage Booklet for more information. Both

sources provide information on gauge reading, measuring and damage analysis.

For school locations and dates, contact Chief Automotive Systems, Inc., 1924 E. Fourth St., Grand Island, NE 68802-1368, 308-384-9747, Attention Training Department School Coordinator, or your local Chief representative.

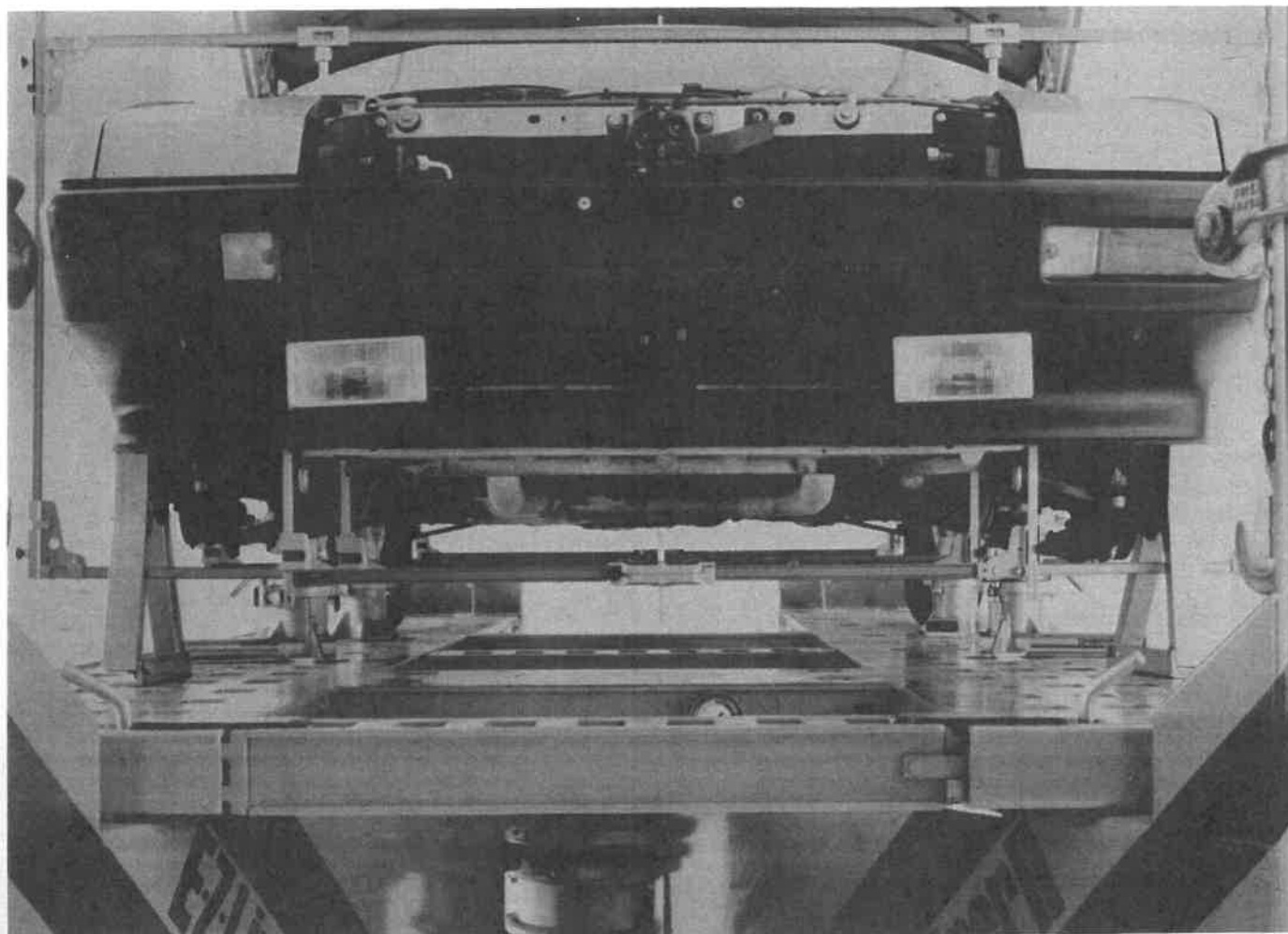


Figure V-1

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 VI-1) operates by means of two adjustable horizontal bars moving through a center pin housing.



Figure VI-1

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.

- **Recentring 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 420 mm (16½ inch) scale in each scale housing and check each assembly with a carpenter's framing square. (See Figure VI-2.) 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.

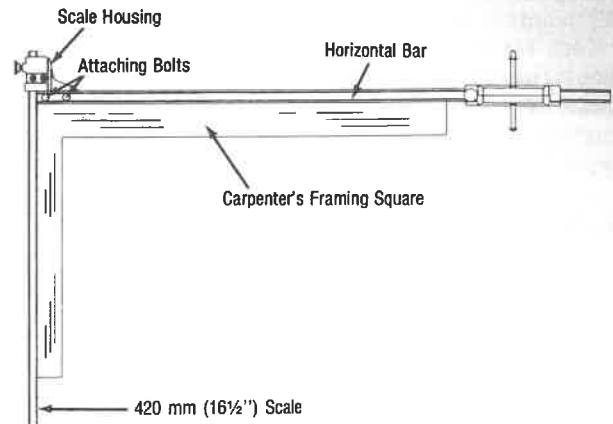
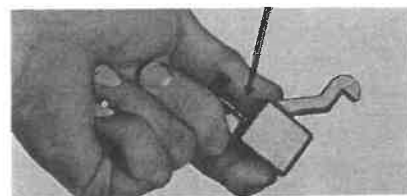


Figure VI-2

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 Figure VI-3 A and B.)



A



B

Figure VI-3

Magnetic Attachment

Magnets on the Magnetic Attachments are strong and will maintain their holding power if properly cared for.

Each attachment should be positioned on its magnet keeper (base of attachment tray on display board) when not in use. (See Figure VI-4.) 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.

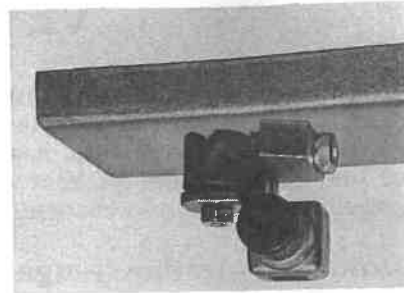


Figure VI-4

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 VI-5.) 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 VI-6.) 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.

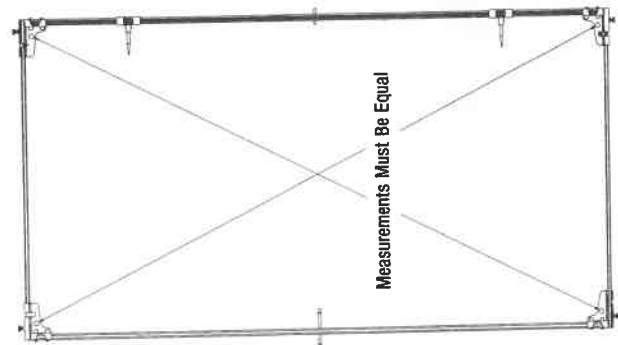
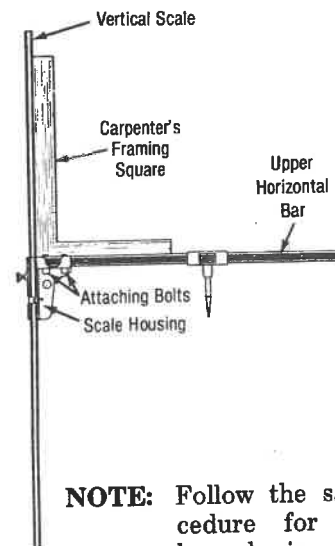


Figure VI-5

Service Personnel Available

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



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

Figure VI-6

VII. PARTS INFORMATION

If it becomes necessary to order replacement parts, accessories, or contact a service representative, contact the 24-hour toll-free hotline answering service in Nebraska and leave a message, **1-800-445-9262**. Your local representative will be notified at the start of the next business day and you will be contacted as soon as possible.

When contacting Chief Automotive Systems, Inc. by telephone or mail, provide the following information: your name, name of your shop, shop telephone number, and shop address.

Additional information needed when ordering parts or

accessories: description of part or accessory, part numbers, and method of payment and shipping charges:

- a) Orders can be billed net 30 days, with approved credit.
- b) "Cash With Order" shipments are shipped freight prepaid by Chief Automotive.

The numbers and drawings on the following pages represent those parts that an owner might install. For part numbers not listed, contact the toll-free number.

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



CHIEF AUTOMOTIVE SYSTEMS, INC.

The driving force in collision repair.™

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Chief Automotive Systems (Canada) Inc.
6580 Davand Drive
Unit #2
Mississauga, Ontario L5T 2M3
905-564-1877
800-268-2345 (Toll Free)

Parts List For:

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

Gauge Measuring System minus Tram Gauge, 455 mm (18") Tram Pointer, and Strut Tower/Upper Body Gauge — Part No. 611856

Ref. No.	Part No.	Description	Quantity
1	611573	815 mm (32") Precision Datum/Centerline Gauge	1
2	611581	915 mm (36") Precision Datum/Centerline Gauge	2
3	611590	1,015 mm (40") Precision Datum/Centerline Gauge	2
4	611645	150 mm (6") Vertical Scale	4
5	611653	215 mm (8½") Vertical Scale	4
6	611661	290 mm (11½") Vertical Scale	4
7	611670	355 mm (14") Vertical Scale	2
8	611688	420 mm (16½") Vertical Scale	2
9	611696	480 mm (19") Vertical Scale	2
10	611709	560 mm (22") Vertical Scale	2
11	611741	Adjustable Pin Attachment	4
12	611725	Magnetic Attachment	4
13	611733	Notched Attachment	6
14	611750	Offset Attachment	2
15	611768	Fixed Pin Attachment	2
16	611565	Strut Tower/Upper Body Gauge	1
17	671074	Tram Gauge	1
18	611792	Crossmember Pin	1
19	629175	Owners Manual	1
20	671517	Gauge Display Board	1

Dimension Manuals (Optional)

Part No.	Year/Type
693206	1990 Domestic Specification Manual
693214	1990 Import Specification Manual
692879	1989 Domestic Specification Manual
692895	1989 Import Specification Manual
692510	1988 Domestic Specification Manual
692529	1988 Import Specification Manual
692203	1987 Domestic Specification Manual
692211	1987 Import Specification Manual
629183	1986 Domestic Specification Manual
629191	1986 Import Specification Manual
620816	1985 Domestic Specification Manual
620824	1985 Import Specification Manual
620630	1984 Domestic Specification Manual
620648	1984 Import Specification Manual
620576	1983 Domestic Specification Manual
620584	1983 Import Specification Manual
620550	1982 Domestic Specification Manual
620568	1982 Import Specification Manual
620533	1981 Domestic Specification Manual
620541	1981 Import Specification Manual

*692908 1980-89 European Specification Manual

*Not Required In North America.



Figure VII-2

NOTE: Dimension Manuals for the three most current years are provided with the purchase or rental of an EZ Liner Repair System.

Precision Datum/Centerline Gauges
(Exploded View on page 40)

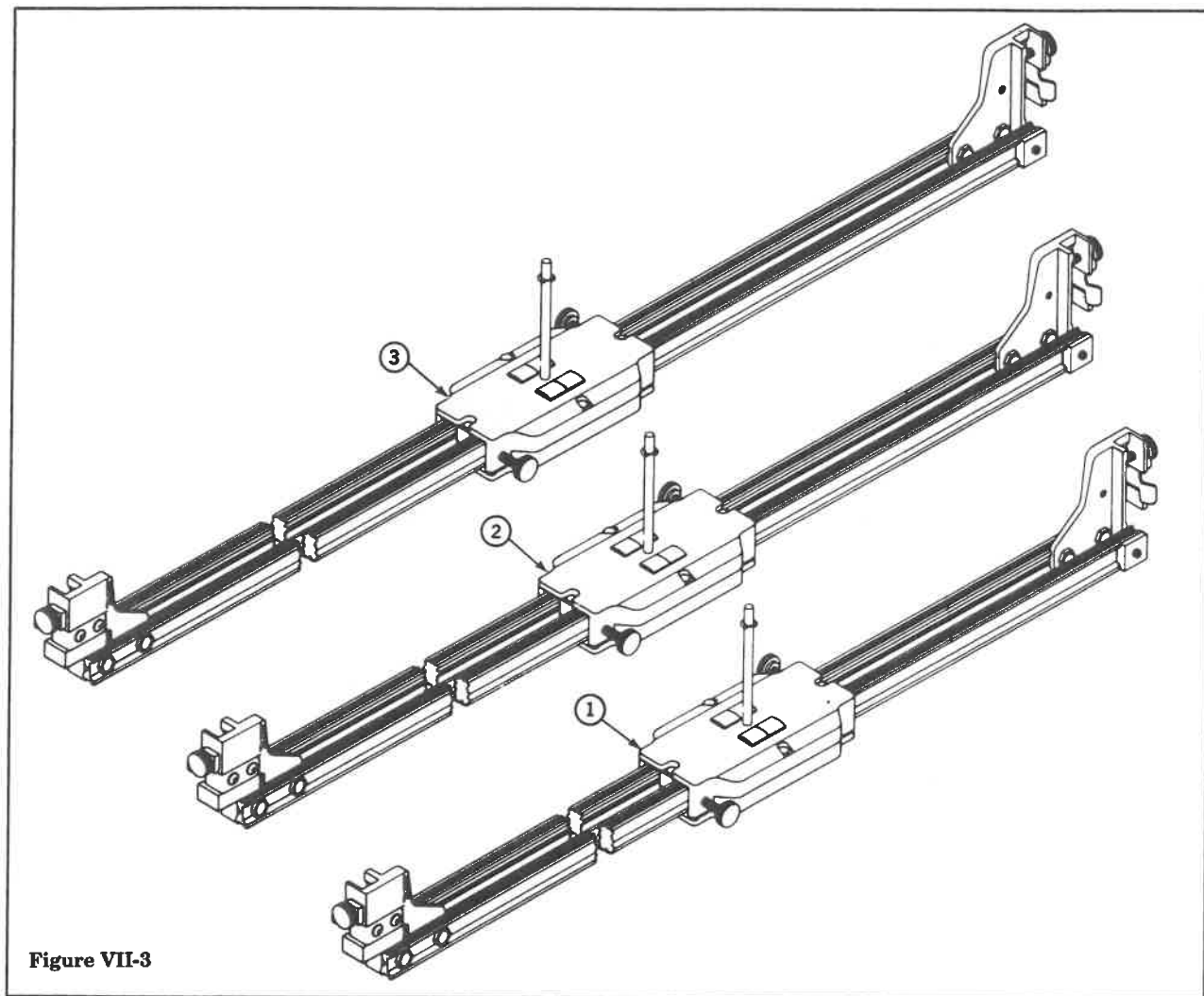


Figure VII-3

Scales

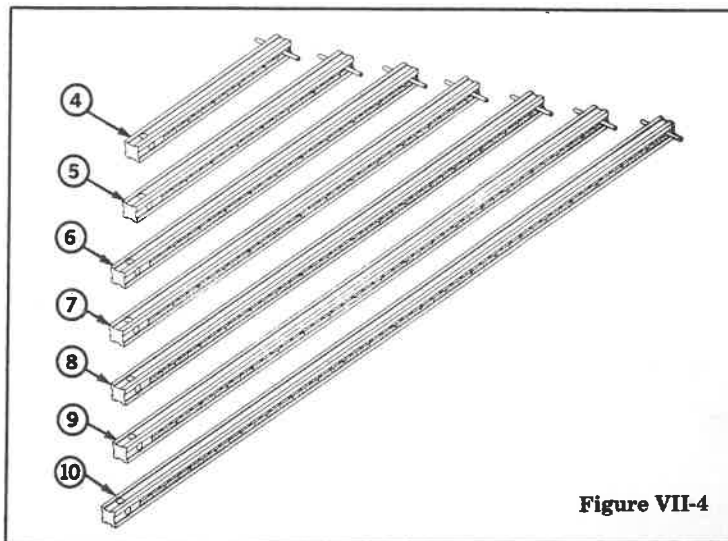


Figure VII-4

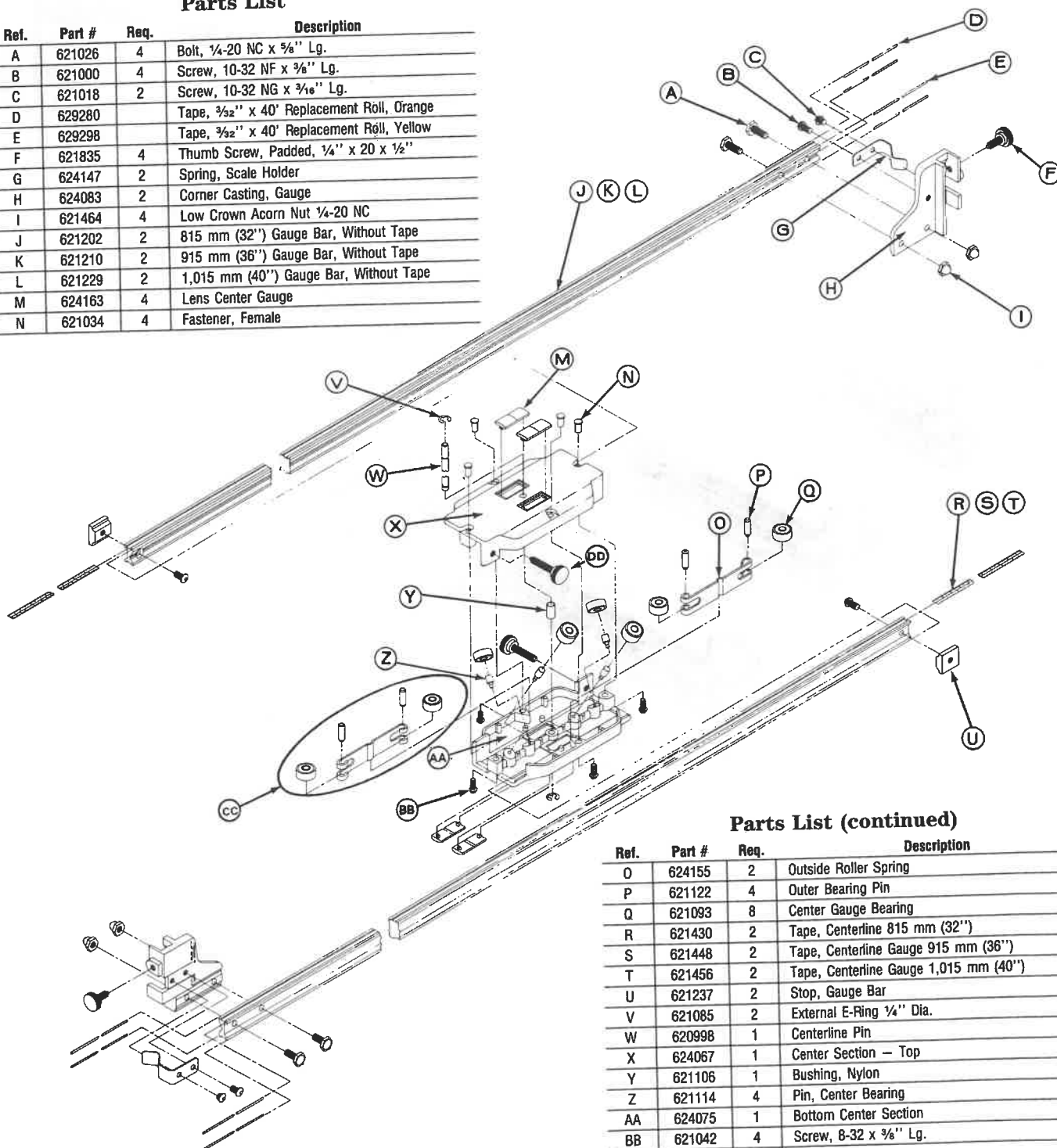
Exploded View

Precision Datum/Centerline Gauge

(Continued from page 39)

Parts List

Ref.	Part #	Req.	Description
A	621026	4	Bolt, 1/4-20 NC x 5/8" Lg.
B	621000	4	Screw, 10-32 NF x 3/8" Lg.
C	621018	2	Screw, 10-32 NG x 3/16" Lg.
D	629280		Tape, 3/32" x 40' Replacement Roll, Orange
E	629298		Tape, 3/32" x 40' Replacement Roll, Yellow
F	621835	4	Thumb Screw, Padded, 1/4" x 20 x 1/2"
G	624147	2	Spring, Scale Holder
H	624083	2	Corner Casting, Gauge
I	621464	4	Low Crown Acorn Nut 1/4-20 NC
J	621202	2	815 mm (32") Gauge Bar, Without Tape
K	621210	2	915 mm (36") Gauge Bar, Without Tape
L	621229	2	1,015 mm (40") Gauge Bar, Without Tape
M	624163	4	Lens Center Gauge
N	621034	4	Fastener, Female



Parts List (continued)

Ref.	Part #	Req.	Description
O	624155	2	Outside Roller Spring
P	621122	4	Outer Bearing Pin
Q	621093	8	Center Gauge Bearing
R	621430	2	Tape, Centerline 815 mm (32")
S	621448	2	Tape, Centerline Gauge 915 mm (36")
T	621456	2	Tape, Centerline Gauge 1,015 mm (40")
U	621237	2	Stop, Gauge Bar
V	621085	2	External E-Ring 1/4" Dia.
W	620998	1	Centerline Pin
X	624067	1	Center Section -- Top
Y	621106	1	Bushing, Nylon
Z	621114	4	Pin, Center Bearing
AA	624075	1	Bottom Center Section
BB	621042	4	Screw, 8-32 x 3/8" Lg.
CC	611864	2	Bearing Ass'y
DD	635524	2	Thumb Screw, Padded, 1/4" - 20 x 5/8"

Attachments

(Exploded Views)

Parts List

**Adjustable
Pin**

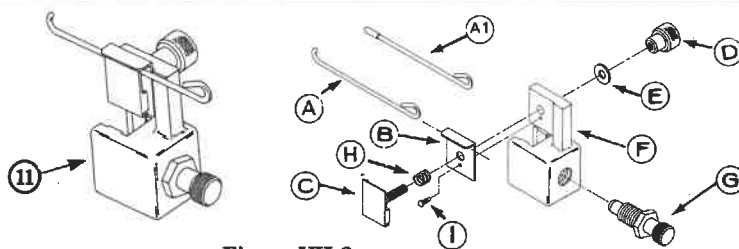


Figure VII-6

Ref.	Part #	Description
A	621587	Pin
A1	620103	Adjustable Pin (Bayonet)
B	621536	Pin Holder
C	618783	Front Clip Notched
D	620111	Knob 10-24
E	707401	Washer, Split Sprung
F	621528	Body, Adjustable Pin Attachment
G	611717	Plunger Assembly
H	621958	Spring, Adjustable Pin Attach.
I	632470	Screw, Drive, .073 x .25

Magnetic

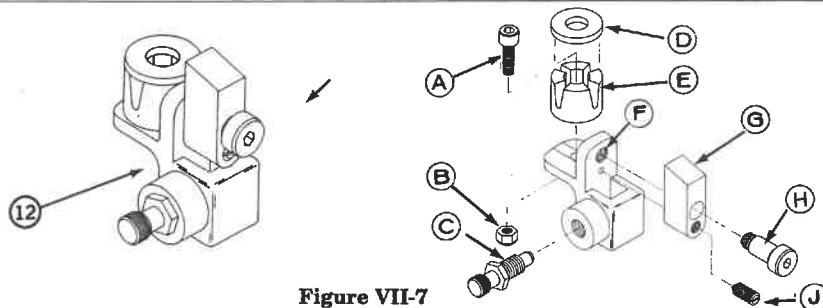


Figure VII-7

Ref.	Part #	Description
A	629060	Bolt, 1/4 - 20NC x 3/4 Lg.
B	629044	Nut, Hex Lock 1/4 - 20 NC
C	611717	Plunger Assembly
D	629001	Magnet Keeper
E	629010	Gauge Magnet
F	624227	Magnet Body
G	621245	Riser
H	629036	Shoulder Screw, 3/8" Dia.
J	629028	Plunger, w/Nylon Ball 1/4 - 20 NC

Notched



Figure VII-8

Ref.	Part #	Description
A	624198	Body, Notched Attachment
B	611717	Plunger Assembly

Offset

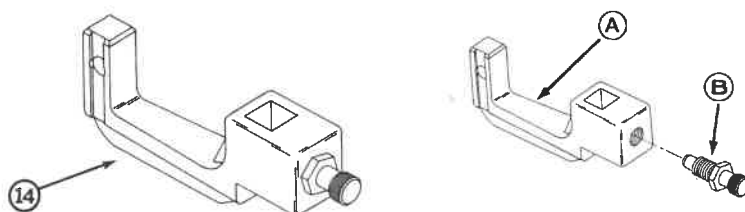


Figure VII-9

Ref.	Part #	Description
A	624219	Body, Offset Attachment
B	611717	Plunger Assembly

**Fixed
Pin**

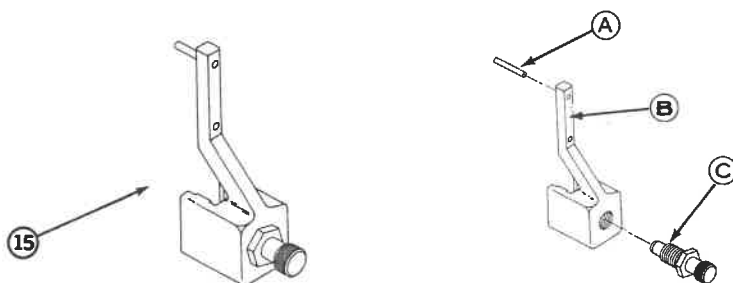
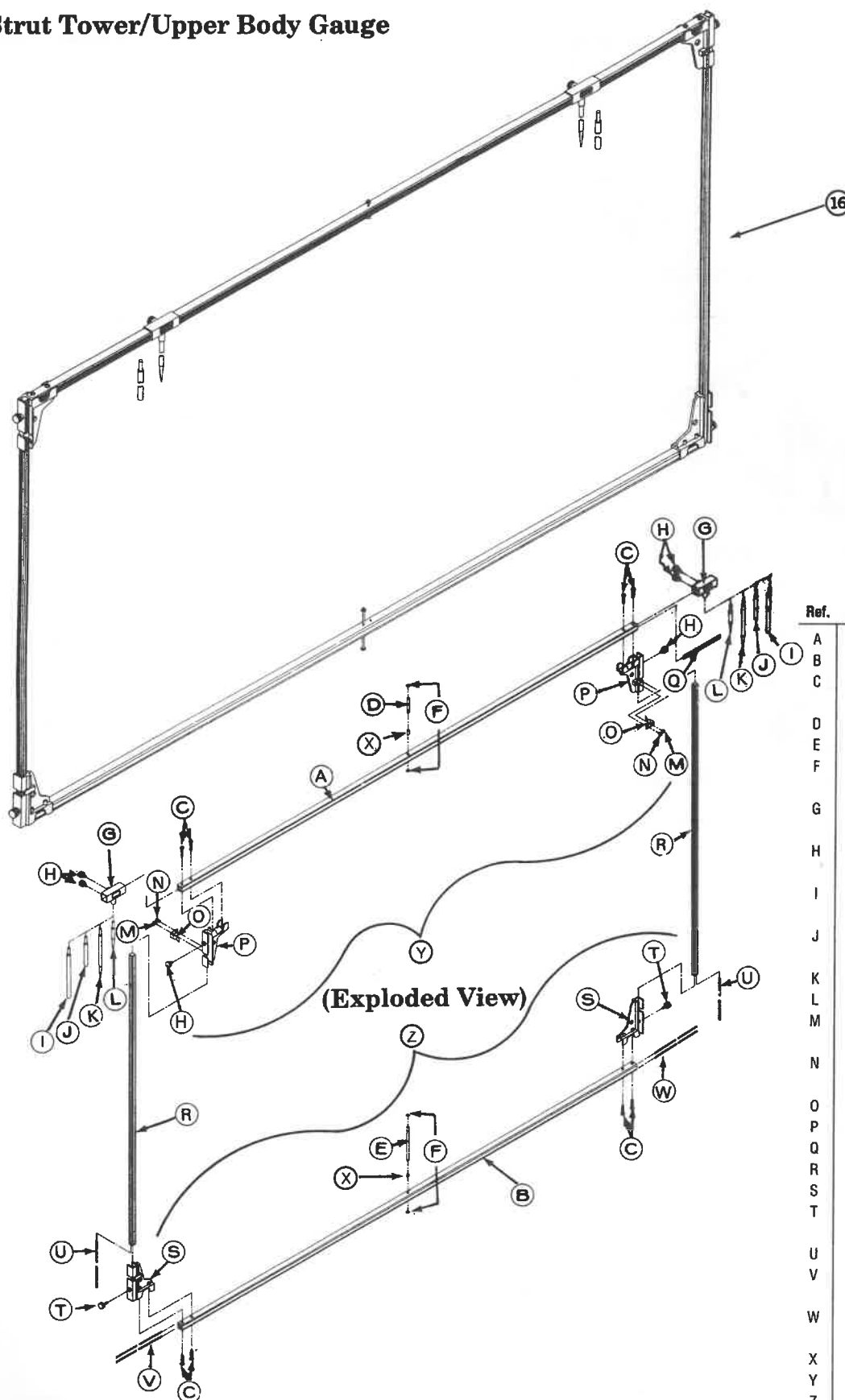


Figure VII-10

Ref.	Part #	Description
A	629052	Dowel Pin, 3/32" Dia. x 3/4" Lg.
B	624200	Body, Extended Pin Attachment
C	611717	Plunger Assembly

Strut Tower/Upper Body Gauge



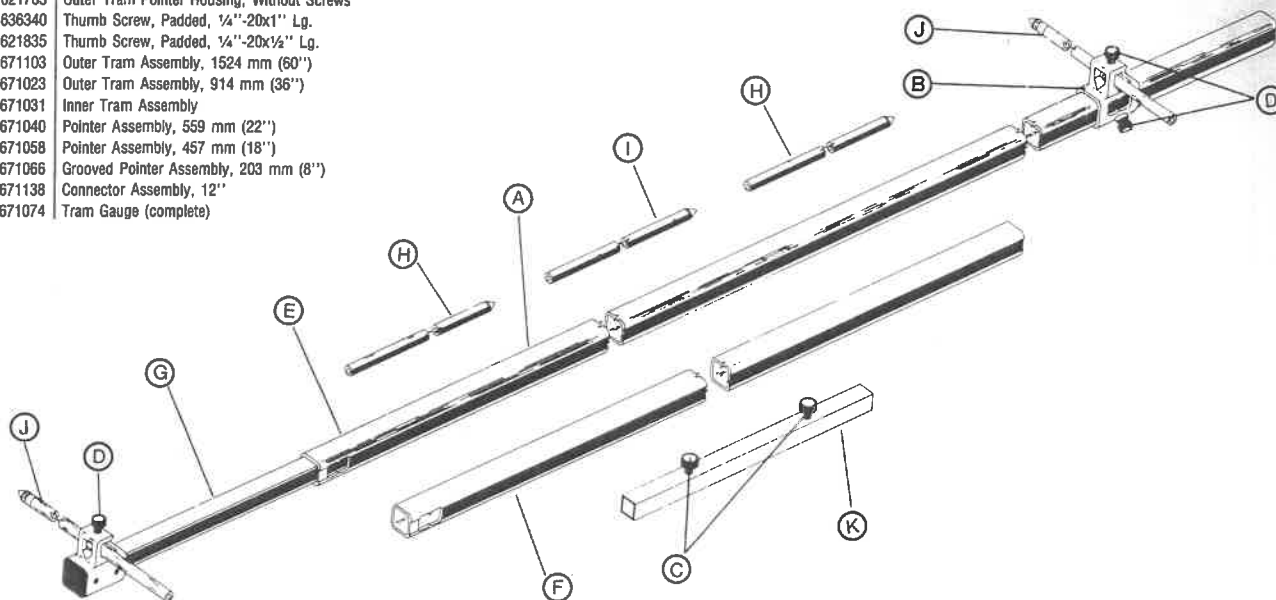
Parts List

Ref.	Part #	Req.	Description
A	620904	1	Upper Bar Only
B	620904	1	Lower Bar Only
C	630635	8	Screw (Hex Hd. Cap) 1/4-20 NC x 1" Lg.
D	620980	1	Centerline Pin - Upper
E	620998	1	Centerline Pin
F	621085	4	External E- Ring for 1/4" Dia. Shaft
G	624112	2	Pointer Housing, Without Screws
H	621835	6	Thumb Screw, Padded, 1/4" x 20 x 1/2"
I	620971	2	Reverse Cone, 178 mm (7")
J	620963	2	Reverse Cone, 102 mm (4")
K	620955	2	Pointer, 178 mm (7")
L	620947	2	Pointer 102 mm (4")
M	621018	2	Screw, 10-32 NF x 3/16" Lg.
N	621000	2	Screw, 10-32 NF x 3/8" Lg.
O	624147	2	Spring, Scale Holder
P	624091	2	Corner Caster - Upper
Q	620920	1	Tape, 1/2" x 36"-0-36"
R	611530	2	Vertical Scale Assembly
S	624104	2	Corner Casting - Lower
T	635591	2	Thumb Screw, Pointed 1/4" - 20 x 7/8"
U	620939	2	Tape, 1/2" x 41"
V	629298	2	Tape, 3/8" x 40', Replacement Roll, Yellow
W	629280	2	Tape, 3/8" x 40', Replacement Roll, Orange
X	621106	2	Bushing, Nylon
Y	611557	1	Upper Bar Assembly
Z	611549	1	Lower Bar Assembly

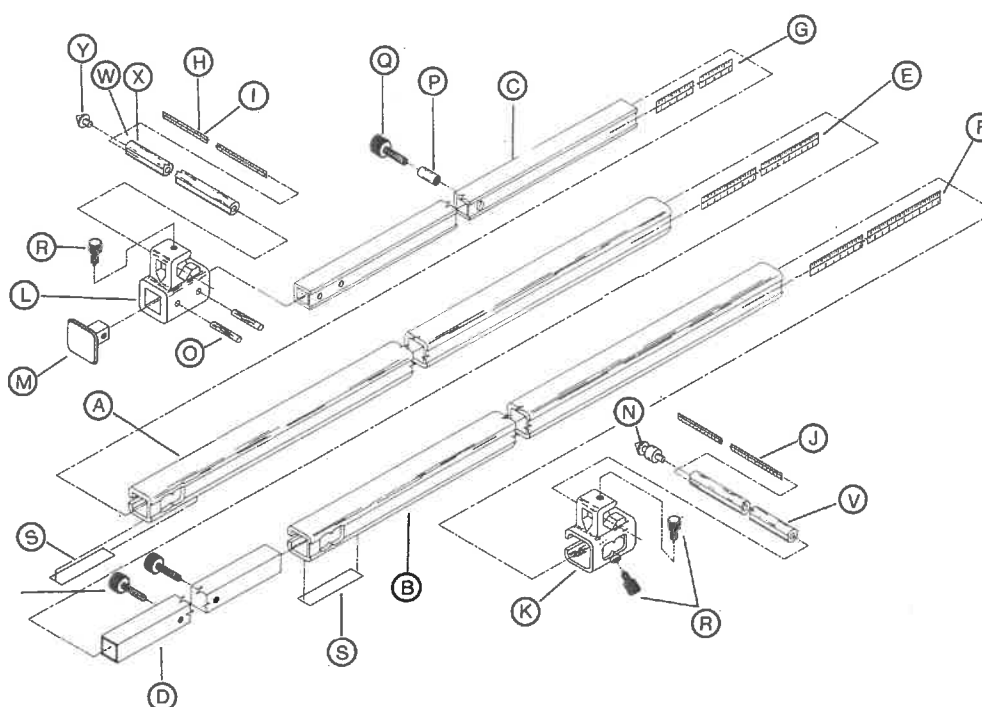
Figure VII-11

Chief Tram Gauge (Basic Assemblies)

Ref.	Part #	Description
A	671015	Tram Assembly, 1524 mm (60") (includes B, D, E and G)
B	621763	Outer Tram Pointer Housing, Without Screws
C	636340	Thumb Screw, Padded, 1/4"-20x1" Lg.
D	621835	Thumb Screw, Padded, 1/4"-20x1/2" Lg.
E	671103	Outer Tram Assembly, 1524 mm (60")
F	671023	Outer Tram Assembly, 914 mm (36")
G	671031	Inner Tram Assembly
H	671040	Pointer Assembly, 559 mm (22")
I	671058	Pointer Assembly, 457 mm (18")
J	671066	Grooved Pointer Assembly, 203 mm (8")
K	671138	Connector Assembly, 12"
	671074	Tram Gauge (complete)



Tram Gauge (Exploded View)



Ref.	Part #	Description
A	621667	Outer Tram, 60"
B	621675	Outer Tram, 36"
C	621683	Inner Tram, 33 1/4"
D	621691	Connector, 12", Without Screws
E	621704	Tape, Outer Tram, 1/2"x15-1498 mm
F	621712	Tape, Outer Tram, 1/2"x25-889 mm
G	621720	Tape, Inner Tram, 1/2"x18-623 mm
H	621739	Tape, Tram Pointer, 1/4"x13-559 mm
I	621747	Tape, Tram Pointer, 1/4"x13-457 mm
J	621755	Tape, Tram Pointer, 1/4"x26-204 mm
K	621763	Housing, Pointer, Outer Tram, Without Screws
L*	621771	Housing, Pointer, Inner Tram, Without Screws
M	621780	End Cap, Pointer Housing
N	621798	Point, Tram Pointer, Grooved
O	621800	Dowel Pin, 1/4"x1 5/8" Lg.
P	621819	Insert, 1/4"-20x3/4" Diameter
Q	636340	Thumb Screw, Padded, 1/4"-20x1" Lg.
R	621835	Thumb Screw, Padded, 1/4"-20x1/2" Lg.
S	621878	Decal, 5/8"x2 1/2", Clear, Chief Logo
T	624788	Box, Assembly
U	624796	Owners Manual
V	635794	Pointer Tube, 7"
W	635866	Pointer Tube, 17 1/2"
X	635892	Pointer Tube, 21 1/2"
Y	635903	Point, Tram Pointer
*	671031	Assembly only

Crossmember Pin

Owners Manual

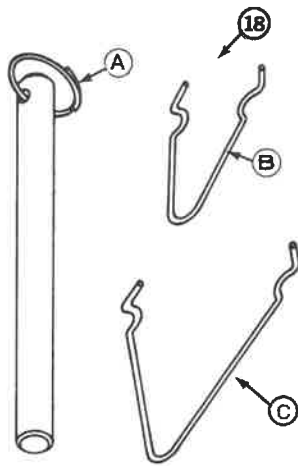


Figure VII-13

Parts List

Ref.	Part #	Required	Description
18A	611776	1	Pin Assembly
18B	621560	2	Crossmember Spring, Small
18C	621579	2	Crossmember Spring, Large



Figure VII-14

Gauge Display Board

(Includes Hooks and Metal Storage Tray – Part No. 621659)

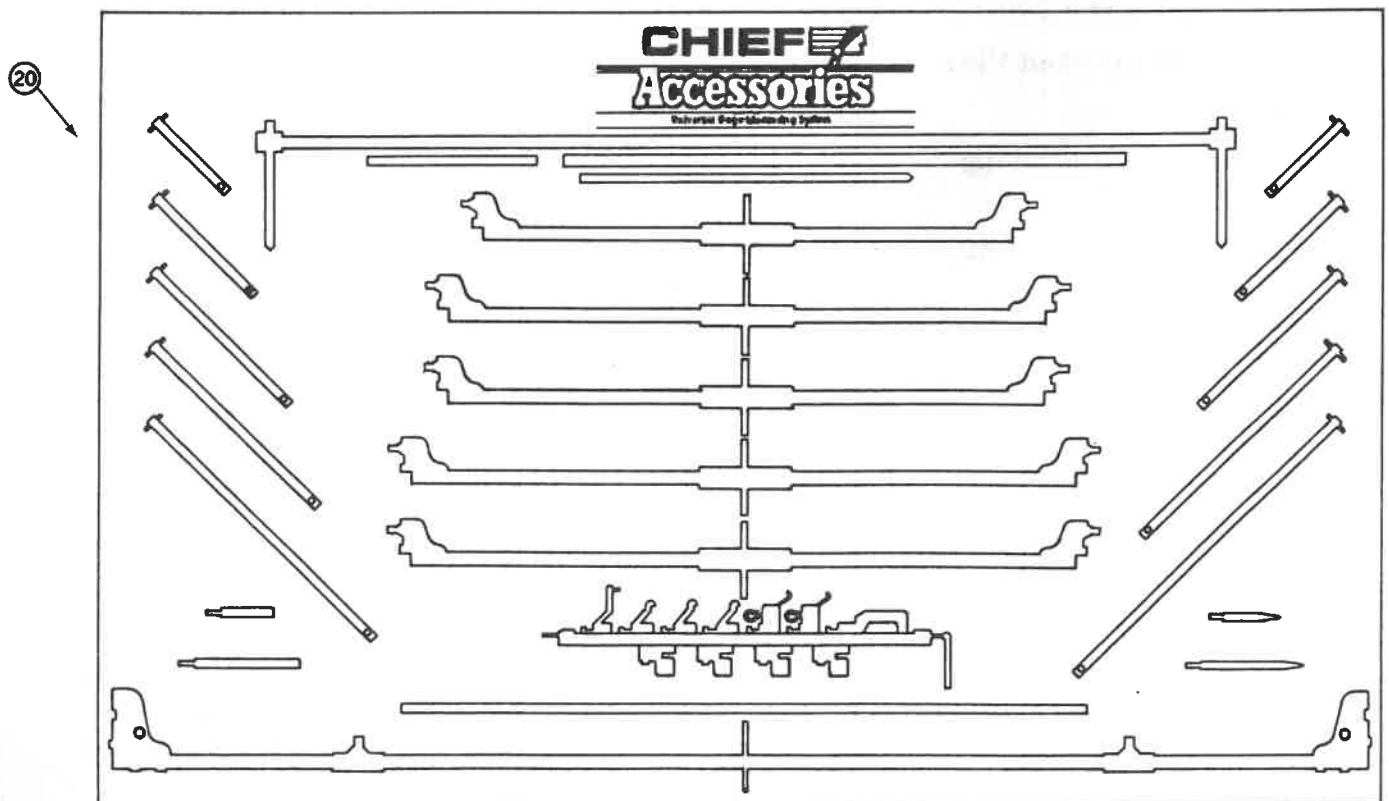


Figure VII-15



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