

# Greenslade & Company Rockwell Hardness Tester, Dial Type



Greenslade & Company, Inc.

Tel: (817) 870-8888 • Fax: (817) 870-9199 • E-Mail: [sales@greensladeandcompany.com](mailto:sales@greensladeandcompany.com)

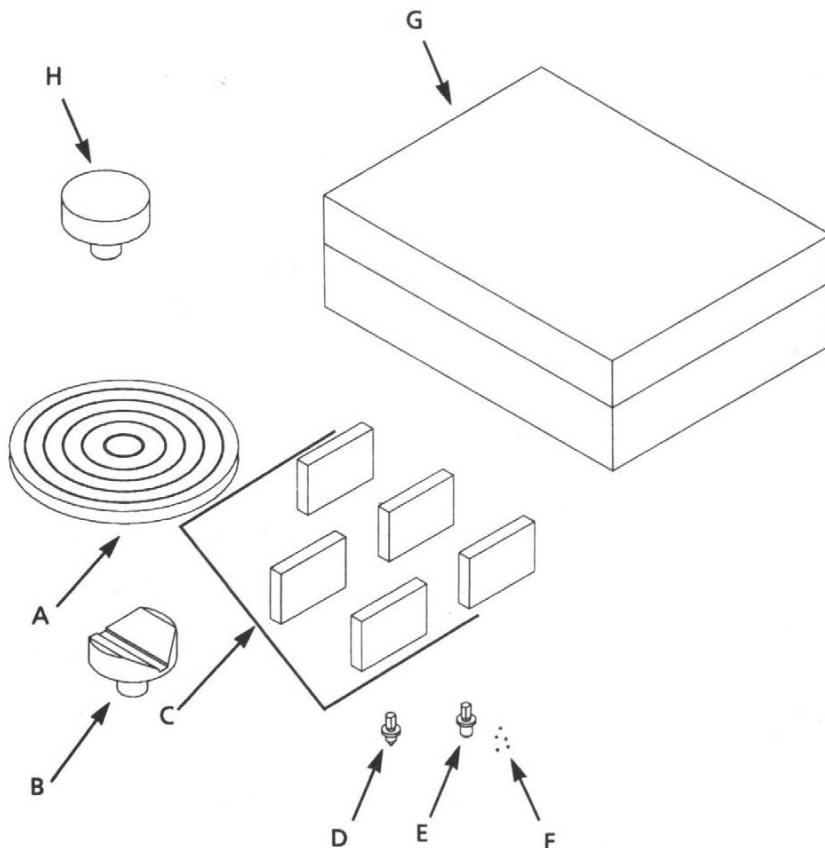
# Greenslade Hardness Tester

## **Operating Instructions & Parts Manual**

*Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the products described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain Instructions for future reference.*

## **Description**

Greenslade Hardness Testers accurately measure hardness of materials in Rockwell hardness A, B, and C scales. Heat-treated steels are tested using a 120° diamond indenter in the C-scale (HRC 20-70). Soft materials are tested using a 1/16" steel ball indenter in the B-scale (HRB 25-100). Very hard materials are tested using a 120° diamond indenter in the A-scale (HRA 20-88). Tester features a weight adjustment handle for quick and easy adjustments between different scales. Release and reset levers are provided for quick and accurate testing. Hardness Tester includes standard, large and V-shaped anvils for holding small, large and round or curved materials. Storage box, 5 test blocks, 120° diamond indenter, steel ball indenter with 5 replacement balls are provided.



**Figure 1 – Loose Parts**

## **Unpacking**

Refer to Figure 1.

## **Loose Parts Storage Box:**

- A. Large Anvil
- B. V-shaped Anvil
- C. Five Test Blocks
  1. One each, HRA 70-85
  2. One each, HRB 75-95
  3. One each, HRC 25-35
  4. One each, HRC 40-50
  5. One each, HRC 55-65
- D. 120° Diamond Indenter
- E. 1/16" Steel Ball indenter
- F. Five each, Replacement 1/16" Steel Balls

- G. Storage Box
- H. Standard Anvil

Remove wood screws from side panels of crate. Remove nuts from end panels.

Carefully lift crate up from base. Leave the tester bolted to crate bottom.

Remove storage box from crate.

**Important:** The tool has been coated with a protective coating. In order to ensure proper fit and operation, the coating must be removed. Remove coating with mild solvents such as mineral spirits and a soft cloth. Nonflammable solvents are recommended. After cleaning, cover all exposed surfaces with a light coating of oil.

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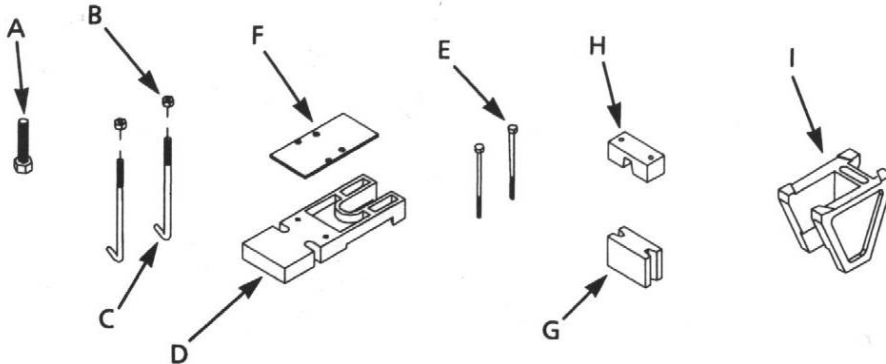
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**Caution: Never use highly volatile solvents. Avoid getting cleaning solution on paint, as it may tend to deteriorate these finishes. Use soap and water on painted components.**

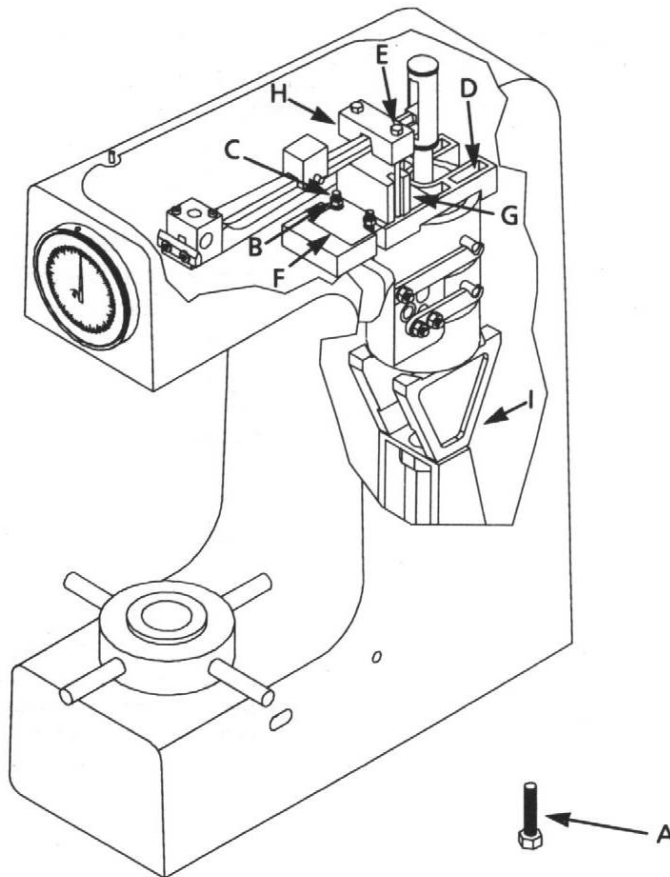
## Unpacking (Continued)

Refer to Figures 2,5,6 and 7

- A. Four each -Hex head bolt, 10-1.5 x 75mm
- B. Two each-Hex nut, 6x 1.0mm
- C. Two each-Lag bolt, 6 x 1.0 x 60mm
- D. Upper weight support bracket
- E. Two each-Hex head bolt 4-0.7 x 90mm
- F. Clamping plate
- G. Lever Clamp
- H. Lever Support
- I. Lower weight support bracket



Note: Parts above shown for visual reference. Parts below shown for location reference. These are for shipping purposes and are not available as replacement parts.



**Figure 2 - Unpacking**

Remove plastic dust cover from tool and store it in a convenient place for reuse. Remove string binding the frame top to the frame (Fig.5, Ref. No.4 and1).

To release wooden block between indenter and elevation screw (Fig.5, Ref. No.14) turn threaded handle (Fig.5, Ref. No 9) clockwise so that threaded collar travels up on the elevation screw. Continue turning the collar handle until the collar is snug against the top compartment of the elevation screw cover (Fig.5, Ref. No. 13) and wooden block is released. Return collar to original position by turning collar handle counter-clockwise. Raise and snap elevation screw cover on to cover top. (Fig 5, Ref. No. 12). Remove frame top and frame rear cover (Fig 5, Ref, Nos. 4 & 2). Remove 4 each hex head bolts (Fig 2, Ref. A) securing tester to crate bottom, keep the hex head bolts for use when mounting the tester. Remove hex head bolts to remove lever clamp and lever support (Fig. 2, Ref. E, G and H). Remove lag bolts and hex nuts (Fig.2, Ref. C and B). Remove clamping plate and upper weight support bracket (Fig. 2, Ref. F and D).

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Scale	Indentor	Total force (Kg-F)	Hardness Range
A	120 Diamond	60	HRA 20-88
B	1/16" Ball	100	HRB 25-100
C	120 Diamond	150	HRC 20-70

**Figure 3**

## Unpacking (Continued)

Slowly raise weight assembly by lifting weight support rod (Fig. 7, Ref. No. 45), remove the lower weight support bracket, (Fig.2, Ref.1).

Slowly lower weight assembly so that the pins on the sides of the weight are properly seated in the hooked ends of the upper and lower weight arms (Fig.7, Ref. Nos. 61 and 62). Remove the string at the front of the lever arm (Fig. 6, Ref. No. 15).

Be sure lever arm counter weight (Fig. 6, Ref. No, 13) is positioned between the red marks on the lever arm. Replace frame top and secure frame rear cover to frame using the knob (Fig. 5, Ref. No. 3).

## General Safety Instructions

1. Never use clamps, straps, any other tooling or equipment to mount specimen to the tester anvil.
2. Always use the proper anvil supplied.
3. Be sure to use proper indentor and weight for material and hardness to be tested. (See Figure 3).

## Hardness Tester Should Be Maintained

1. Consult operation instructions for specific maintaining and adjusting procedures.
2. Keep the tool clean for best results.
3. Remove adjusting tools and wrenches. Form habit of checking that adjusting tools are removed before using machine.
4. Keep all parts in working order. Check to determine that the parts will operate properly and perform their intended function.
5. Check for damaged parts. Check for alignment, binding, breakage, mounting and any other condition that may affect tool's operation.
6. Part that is damaged should be properly repaired or replaced. Do not perform makeshift repairs. (Use the parts list provided to order replacement parts.)

## Installation

Refer to Figure 2 and 7

Hardness Tester must be installed in a dust and vibration free environment. Mount tester to a support bench or table for a load of at least 500 lbs.

1. Position tester on support surface as desired, mark location of the 4 mounting holes in the corners of the frame base and for the elevation screw on the support surface.
2. Drill 10mm (7/16") diameter holes at the 4 mounting hole locations. Drill a 2" diameter hole for the elevation screw.

**Caution: The hardness tester will not operate properly unless the elevation screw is allowed to pass through a hole on the support surface.**

3. Bolt tester to support surface securely using the 4 each hex head bolts (Fig.2, Ref. A), use longer 10-1.5mm bolts if required.
4. Be sure tester is level both front/back and left/right to 0.002 in/in.

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## Operating Instructions & Parts Manual

5. Read Operation Instructions and perform a hardness test using one of the test blocks. Record the time taken for the large needle to stop after releasing the weights, time should be 4 to 8 seconds. Adjust time as necessary by turning dash pot adjustment needle and needle collar (Fig. 7, Ref. Nos. 35 Nos. 36).

### Operation:

Refer to Figures 1,3,4,5,6,and 7

1. Determine the proper indenter, scale and weight for the material hardness to be tested (see Figure 3). Mount the required indenter in the indenter holder using the set screw (Fig. 6, Ref. Nos. 27 and 28) on the side of the holder.

**Caution: To ensure accuracy, mount the indenter by sliding it in the holder as far as possible and then securing the indenter by tightening the set screw finger-tight only.**

Rotate the weight adjustment handle (Fig. 7, Ref. No.53) until the required weight scale is aligned with the red alignment mark on the frame.

2. Prepare the test specimen properly. Be sure that the top and bottom surfaces of the specimen are clean and free of any grease, oil dirt, etc and free of any burrs or debris.
3. For small specimens (under 3" maximum length or diameter) use the standard anvil, (Fig. 1,Ref. H). Use the large anvil, (Fig 1 Ref. A), for larger specimens. Use the V-shaped anvil, (Fig.1, Ref B), for round or curved specimens.

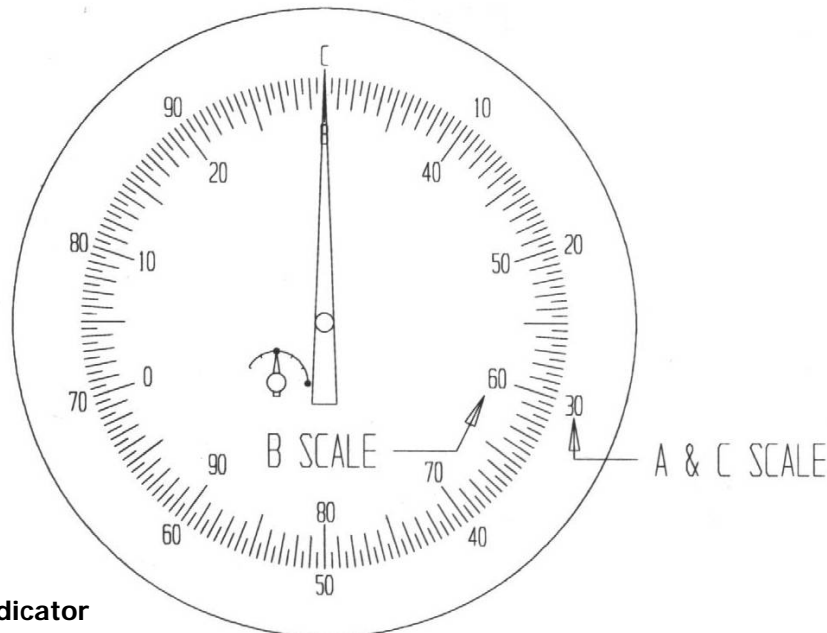


Figure 4 - Dial Indicator

**Warning: Do not test any specimen that cannot be safely and properly positioned on and supported by the tester anvil.**

### Test Procedure

Test procedure consists of a preload of the specimen using the force of the leadscrew and a test load using the weights and lever arm assembly. Be sure that the weight reset handle (Fig. 7, Ref. No 23) is in rest position.

1. Mount specimen on required anvil. Rotate the elevation screw threaded collar (Fig 5, Ref No. 10) clockwise slowly until the specimen contacts the indenter. Be sure to position specimen so the indenter contacts clean, untested material.

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# Operating Instructions & Parts Manual

2. Preload the specimen by rotating the threaded collar slowly until the large needle on the dial indicator assembly (Fig.5, Ref.No.6) rotates three (3) revolutions. Stop rotation of threaded collar when the large needle is within 5 hash marks of vertical as shown in Figure 4.

**Caution: As the large needle is properly rotated 3 revolutions, the small needle rotates counterclockwise 90° to vertical at the red dot. If the large needle overshoots vertical by more than 5 hash marks, the test is invalid and must be repeated from step 1.**

## Test Procedure (Continued)

Figure 4 shows the proper preload position of the large and small needle on the dial indicator.

3. Rotate the bezel so that the hash mark at the B-C mark at the top of the dial is aligned with the large needle.
4. Pull the weight release handle (Fig. 7, Ref. No. 3) to lower the weights and indenter. Wait until the large needle stops rotating, at least 10 seconds.
5. Slowly push the weight reset handle (Fig.7, Ref. No. 23) back until it resets and locks in the reset position.
6. Read the material hardness from the required scale (see Figure 3) on the dial.
7. Rotate the elevation screw threaded collar counterclockwise to lower and release the specimen.

## Maintenance

1. If large needle on the dial indicator rotates suddenly at first and then slows during a test, then the dash pot (Fig. 7, Ref .No 33) may be low on oil. To fill the dash pot, remove the felt cover and pour hydraulic oil into the dash pot. Bleed the air from the dash pot by manually raising and lowering the dash pot piston until all air bubbles have been released from under the piston.
2. Be sure elevation screw and threaded collar (Fig.5, Ref. Nos. 14 and 10) are clean and lubricated. Lubricate with general purpose wheel bearing grease.
3. Keep top of leadscrew, collar and anvils clean and free of grease, oil, dirt, burrs, etc.
4. Use the test blocks periodically to check tester accuracy. Use an oil sharpening stone to remove the burrs from the test blocks.

## Troubleshooting Chart

Symptom	Possible cause(s)	Corrective Action
Incorrect hardness measurement	<ol style="list-style-type: none"> <li>1. Contaminants effecting measurement</li> <li>2. Elevation screw cover &amp; top, (Fig. 5, Ref. Nos. 12 and 13) are interfering with specimen, anvil or elevation screw.</li> <li>3. Indenter is damaged.</li> <li>4. Dash pot is low on oil.</li> </ol>	<ol style="list-style-type: none"> <li>1. Be sure the anvil, top of elevation screw, threaded collar, indenter and specimen are all clean and free of oil, grease, dirt, shavings, debris, etc.</li> <li>2. Be sure elevation screw cover and top is clean and free of any dirt, oil, grease, etc. Position cover properly on the elevation screw.</li> <li>3. Inspect indenter for damage, replace diamond indenter if chipped or broken, replace 1/16" steel ball if deformed or damaged.</li> <li>4. Refill dash pot, see Maintenance, above.</li> </ol>
When using the test block, a different hardness is measured at	<ol style="list-style-type: none"> <li>1. Burrs on bottom of test block.</li> <li>2. Air trapped under test block.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use oil sharpening stone to remove burrs.</li> </ol>

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different locations on the block.

2. When testing different locations on a test block, slide test block on anvil, maintaining contact between anvil and block.

Dial indicator needle rotates too fast at start of test

1. Dash pot is low on oil.

1. Refill dash pot  
See Maintenance, above.

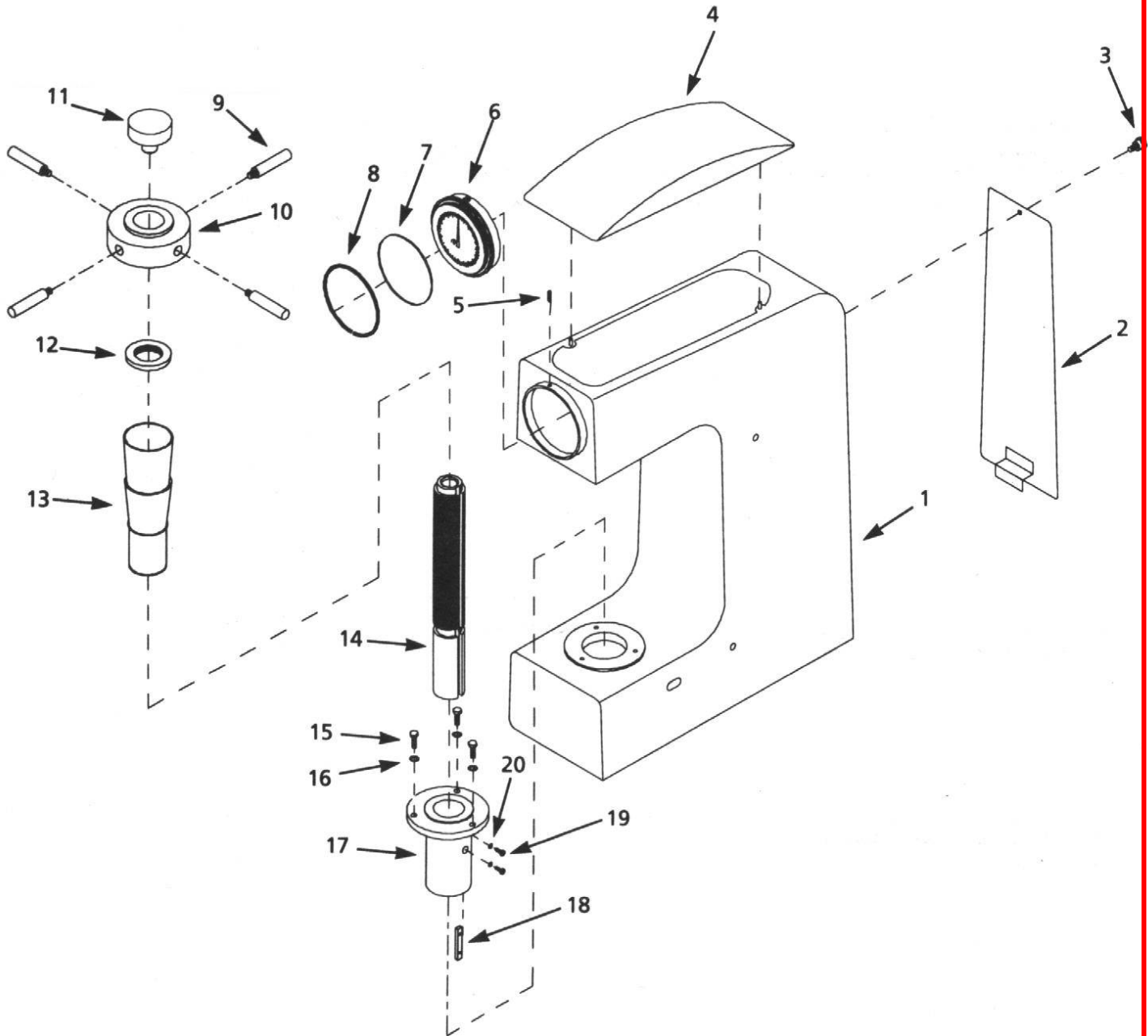


Figure 5 – Replacement Parts Illustration

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## Replacement Parts List (Figure 5)

Reference Number	Description	Part Number	Quantity
1	Frame	9395	1
2	Frame rear cover	9396	1
3	Knob	9397	1
4	Frame top	9398	1
5	4-0.7 x 12mm Cone point set screw	9399	1
6	Dial indicator assembly	9400	1
7	Indicator crystal	9401	1
8	Indicator bezel spring clamp	9402	1
9	Threaded collar handle	9403	4
10	Threaded collar	9404	1
11	Standard Anvil	9405	1
12	Elevation Screw cover top	9406	1
13	Elevation Screw cover	9407	1
14	Elevation screw	9408	1
15	6-1.0 x 22mm Hex head bolt	*	3
16	6mm Flat washer	*	3
17	Elevation screw sleeve	9409	1
18	Elevation screw key	9410	1
19	4-0.7 x 10mm Fillister head screw	9307	2
20	4mm lock washer	*	2
∇	Large anvil	9411	1
∇	V-shaped anvil	9412	1
∇	Test Block HRA 70-85	9413	1
∇	Test Block HRB 75-95	9414	1
∇	Test Block HRC 25-35	9415	1
∇	Test Block HRC 40-50	9416	1
∇	Test Block HRC 55-65	9417	1
∇	Storage Box	9418	1
∇	Dust Cover	9419	1

∇ Not shown

\*Standard Hardware Item, Can Be Purchased Locally

When ordering parts, specify:

-Model Number

-Serial Number

-Part descriptions and number as shown in parts list

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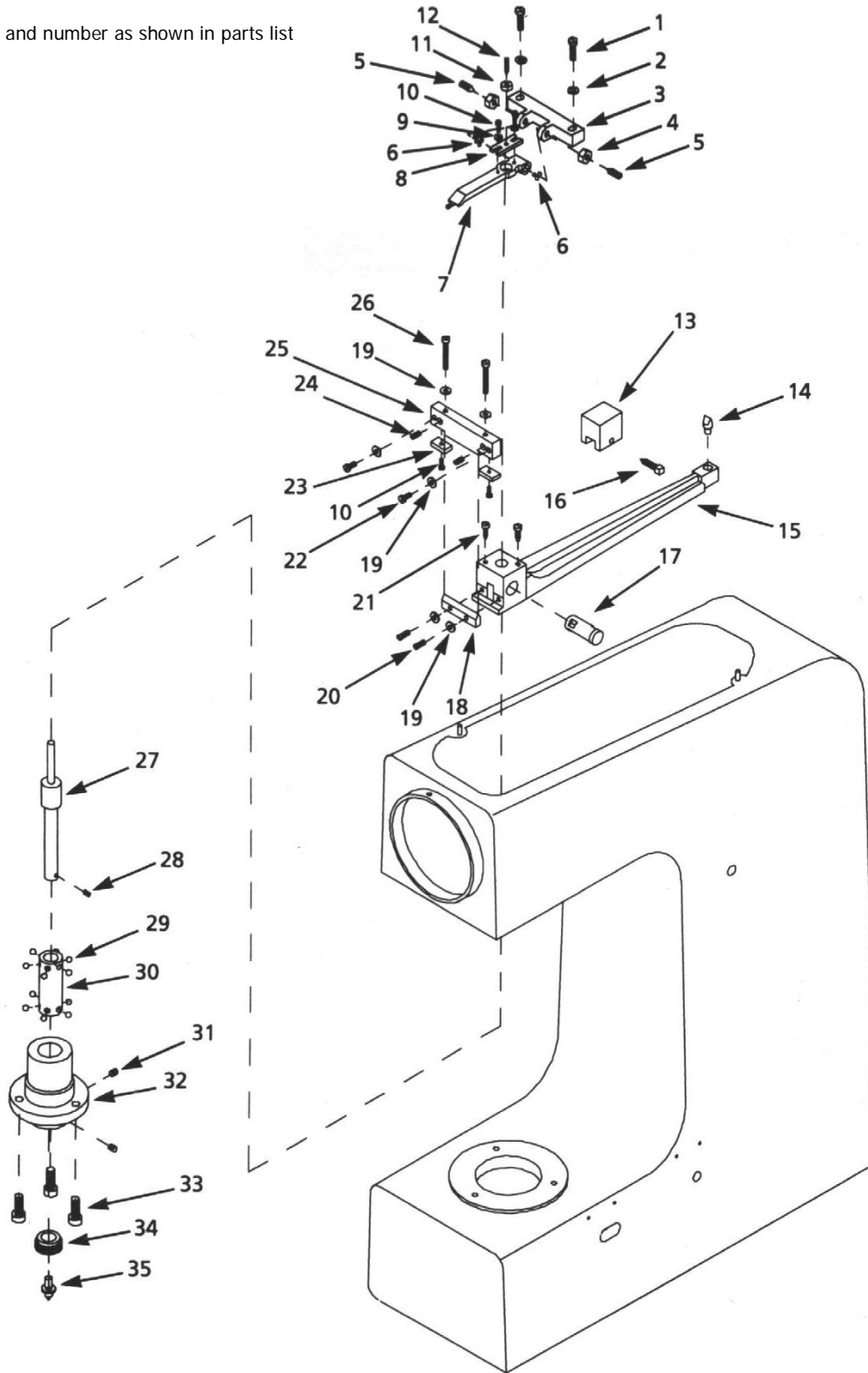


Figure 6- Replacement Parts Illustration

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## Replacement Parts List (Figure 6)

Reference Number	Description	Part Number	Quantity
1	5-0.8 x 20mm Round Head screw	*	2
2	5mm Flat washer	*	2
3	Dial lever bracket	9420	1
4	5mm-0.8 Hex nut	*	2
5	5-0.8 x 13mm Cone point set screw	9421	2
6	1/8 Ball bearing	9422	6
7	Dial lever	9423	1
8	Adjustment plate	9424	1
9	3mm Flat washer	*	2
10	3-0.5 x 8mm Round head screw	*	4
11	4mm-0.7 Hex nut	*	1
12	4-0.7 x 16mm Cone point set screw	9425	1
13	Lever arm counter weight	9426	1
14	Pivot Pin	9427	1
15	Lever arm	9428	1
16	5-0.8 x 20mm Dog point bolt	9429	1
17	Pivot shaft	9430	1
18	Pivot Bar	9431	1
19	4mm Flat washer	*	6
20	4-0.7 x 12mm Hex head bolt	*	2
21	4-0.7 x 12mm Dog point round head screw	9432	2
22	4-0.7 x 18mm Round head screw	*	2
23	Pivot support spacer	9433	2
24	4-0.7 x 10mm Set screw	*	2
25	Pivot support	9434	1
26	4-0.7 x 25mm Round head screw	*	2
27	Indentor holder	9435	1
28	4-0.7 x 6mm set screw	*	1
29	3/16" Ball bearing	8163	12
30	Sleeve	9436	1
31	5-0.8 x 6mm Cone point set screw	9437	2
32	Indentor housing	9438	1
33	6-1.0 x 15mm Socket head bolt	*	3
34	Bushing	9439	1
35	120° Diamond indentor	9440	1
∇	1/16" Steel Ball indentor	9441	1

∇ Not shown

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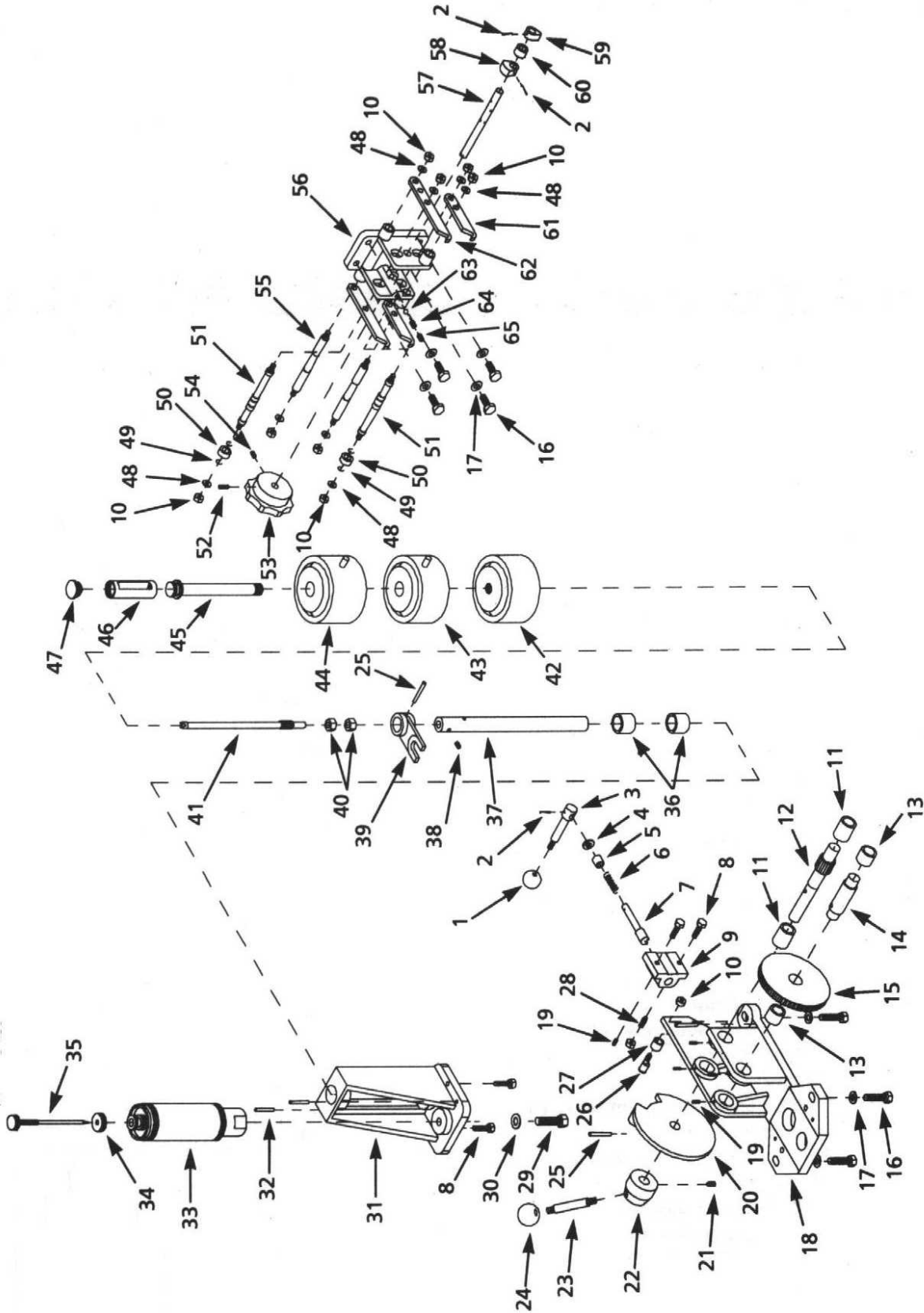


Figure 7- Replacement Parts Illustration

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## Replacement Parts List (Figure 7)

Reference Number	Description	Part Number	Qty	Reference Number	Description	Part Number	Qty
1	Weight Release knob	9442	1	36	Needle collar	9471	2
2	2 x 16mm Dowel pin	9443	3	37	Fork rod	9472	1
3	Weight release handle	9444	1	38	5-0.8 x 8mm set screw	*	1
4	Rubber washer	9445	1	39	Dash pot fork	9473	1
5	Sleeve	9446	1	40	10-1.0mm Hex nut	9474	2
6	Spring	9447	1	41	Weight support rod	9475	1
7	Weight release pin	9448	1	42	Lower weight	9476	1
8	6-1.0 x 25mm Hex head bolt	*	4	43	Center Weight	9477	1
9	Weight release housing	9449	1	44	Upper weight	9478	1
10	6mm-1.0 Hex nut	*	10	45	Weight support rod	9479	1
11	Bushing	9450	2	46	Pivot cap cylinder	9480	1
12	Weight reset gear shaft	9451	1	47	Pivot cap	9481	1
13	Bushing	9452	2	48	6mm Flat washer	*	8
14	Gear shaft	9453	1	49	Retaining ring	9482	4
15	Gear	9454	1	50	Roller	9483	3
16	8-1.25 x 25mm Hex head bolt	*	7	51	Roller shaft	9484	2
17	8mm Flat washer	*	7	52	5-0.8 x 12mm cone point set screw	9485	1
18	Dash pot assembly bracket	9455	1	53	Weight adjustment handle	9486	1
19	4-0.7 x 8mm cone point set screw	9456	5	54	5-0.8x 8mm set screw	*	1
20	Weight release disc	9457	1	55	Idler shaft	9487	1
21	6-1.0 x 12 dog point set screw	9458	1	56	Lever frame	9488	1
22	Weight reset hub	9459	1	57	Cam shaft	9489	1
23	Weight reset handle	9460	1	58	Large cam	9490	1
24	Weight reset knob	9461	1	59	Small cam	9491	1
25	4-5 x 35mm Taper pin	9462	3	60	Spacer	9492	1
26	Disc stop	9463	1	61	Lower weight arm	9493	2
27	Bushing	9464	1	62	Upper weight arm	9494	2
28	6-1.0 x 16mm dog point set screw	9465	1	63	3/16" Ball bearing	9495	1
29	10-1.5 x 35mm Hex head bolt	*	1	64	Spring	9496	1
30	10mm Flat washer	*	1	65	6-1.0x 7mm set screw	*	1
31	Dash pot bracket	9466	1				
32	4-4.5 x 30mm Taper pin	9467	2				
33	Dash pot	9468	1				
34	Collar	9469	1				
35	Dash pot adjustment needle	9470	1				

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## ROCKWELL HARDNESS SCALES

Scale	Indentor	Load/ KG	Dial	Application	Brinell L Value	Working Range
A	Diamond	60	Black	Carbides, Thin Steel, Shallow case-hardened steel Case carburized surfaces	Over HB 400	40-91 for hardness greater than C 65
B	1/16" Ball	100	Red	Aluminum alloys, copper alloy, unhardened steel, in rolled, drawn, extruded or cast metal	HB 100-240	30-100 for hardness lower than C 20
C	Diamond	150	Black	Hard cast irons, pearlitic malleable iron, steel deep case hardened steel, titanium	Over HB 230	20-70 for material harder than HRB 100
D	Diamond	100	Black	Pearlitic malleable iron, Thin steel, Medium case Hardened Steel	Over HB 400	40-77 for intermediate load between A & C Scale
E	1/8" Ball	100	Red	Cast Iron, Aluminum and Magnesium alloys, Bearing Metals	Below HB 125	50-100 for hardness lower than HRB 0
F	1/16" Ball	60	Red	Thin soft sheet metals Annealed copper alloys	HB 50-120	30-100 for hardness lower than HRB 0
G	1/16" Ball	150	Red	Copper-Nickel-Zinc and Cupro- Nickel alloys, Malleable irons	HB 120-280	30-90 for hardness slightly > than HRB 100 Upper limit = G92
H	1/8" Ball	60	Red	Lead, Zinc, Aluminum Magnesium alloys	HB 30-50	70-100
K	1/8" Ball	150	Red	Bearing metals, very soft or thin metals	HB 100-200	40-100
L	1/4" Ball	60	Red	Plastic materials: Bakelite, Vulcanized Fibre		Variations in hardness Reduced by testing with the largest indentor Consistent with overall hardness of the material
M	1/4" Ball	100	Red	Nylon, Polystyrene, Flexiglass		See Above
P	1/4" Ball	150	Red			
R	1/2" Ball	60	Red	Rigid sheet metal & plate Materials used for Electrical insulation are tested by M & L scales		Moulded Finish will give a higher reading than a machined face
S	1/2" Ball	100	Red			
V	1/2" Ball	150	Red			

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