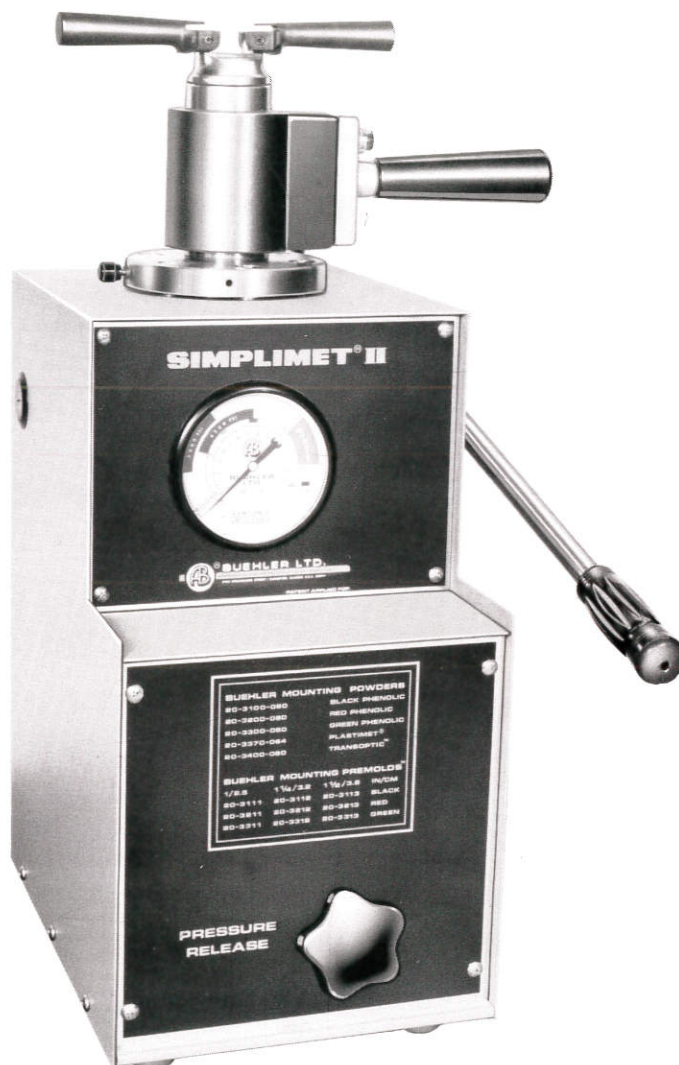


# operating and maintenance instructions



20-1320 SIMPLIMET® II MOUNTING PRESS

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**BUEHLER LTD.**

APPARATUS FOR MICROSTRUCTURAL ANALYSIS

2120 GREENWOOD STREET / EVANSTON, ILLINOIS U.S.A. 60204

### **WARRANTY**

This unit is guaranteed against defective material and workmanship for a period of one (1) year from date of receipt by customer. Warranty is void if inspection shows evidence of abuse, misuse or unauthorized repair. Warranty covers only replacement of defective materials.

If, for any reason, this unit must be returned to our plant for warranty service, please apply for prior authorization with shipping instructions, and include the following information: Customer Purchase Order Number; Buehler Ltd. Invoice Number and Date; Serial Number; and reason for return.

# 20-1320 SIMPLIMET® II MOUNTING PRESS

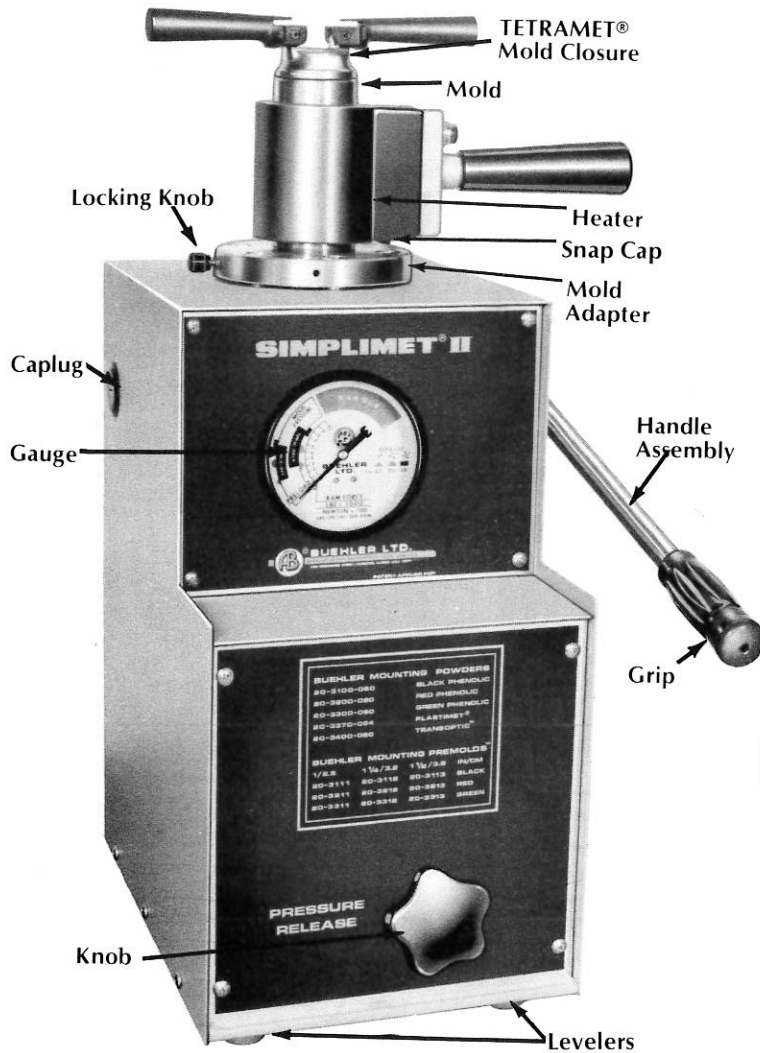


Figure 1. 20-1320 SIMPLIMET® II PRESS

## UNPACKING:

Carefully unpack and check contents. If any components are missing or damaged, save the packing list and material and advise the carrier and Buehler Ltd. of the discrepancy. For your warranty protection and our permanent file, please complete and return the enclosed Equipment Registration Card.

## ASSEMBLY:

The SIMPLIMET® II Press is shipped assembled except for the Automatic Heater, TETRAMET®\* Mold Closure and Cooler (not shown), Handle Assembly, and Levelers. (Figure 1). Also included with each Press are a pair of 20-3040 Gloves, a tube of PREMOLDST™, samples of Phenolic and PLASTIMET® powders, a 6 ounce container of 20-3046 Silicone Mold Release, a scoop and a scraping tool. The 20-2104 Mold Assembly for preparing 1" (2.5 cm) mounts, the 20-2105 Mold Assembly for 1 1/4" (3.2 cm) mounts, and the 20-2109 Mold Assembly for 1 1/2" (3.8 cm) mounts must be ordered separately and will be packed separately.

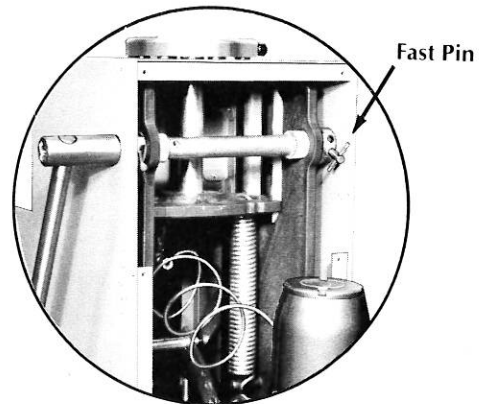


Figure 2

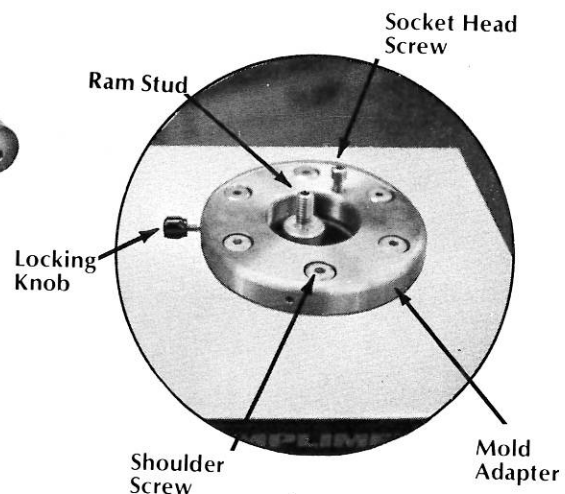


Figure 3

To assemble, first remove the plywood board on which the SIMPLIMET® II is mounted for protection in shipment. Install the Levelers into the threaded holes provided in the bottom frame and adjust to level position.

The neoprene pads prevent damage of the work surface. The innovative linkage system provides complete stability during the pumping operation so that no bolting down is required for the SIMPLIMET® II Press.

Locate the Press in a convenient position with access to a standard voltage grounded-type electrical outlet for the Mold Heater. Remove the back cover by loosening the six (6) screws which hold it in place. Remove the Fast Pin (Figure 2) from the side of the machine you wish to locate Handle Assembly. Insert the Handle Assembly, replace the Fast Pin and press the Caplug into the open hole on the opposite side of the Cabinet. Replace the back cover.

## ASSEMBLY (Continued)

To install the Mold Assembly:

1. Screw Lower Ram (Figure 4) onto Ram Stud (Figure 3) and tighten with moderate pressure.
2. Pull out on Locking Knob (Figure 3) and turn  $\frac{1}{4}$  turn until it catches in out position.
3. Screw Mold Cylinder (Figure 4) clockwise into Mold Adapter (Figure 3) as far as it will go.
4. Turn Locking Pin until it releases.
5. Turn Mold Cylinder counterclockwise until Locking Pin slips into Mold Cylinder detent; check for locking by trying to unscrew Mold Cylinder.

To assemble the TETRAMET® Closure (Figure 4), hold it in the palm of one hand, grasp and compress the Retain Spring with the thumb and first finger. With your free hand, remove the "U" Spring which holds the assembly together. Slip the Upper Ram over the end of the Stem as far as it will go and secure by pressing the "U" Spring into twin holes of the Upper Ram.

For detailed instructions on the proper operation of the TETRAMET® Mold Closure, see separate instruction sheet at the back of this manual.

Check your Heater to confirm that its voltage and current requirements match those of your electrical outlet. Place Heater over Mold Assembly.

## OPERATION:

Operation of the SIMPLIMET® II Press is, as the name implies, simple. The Press is designed to produce high quality metallographic mounts, using any of the compression molding materials listed on page 10, provided the recommended conditions are observed. Although the operation of the Press is basically the same regardless of the molding compound used, other parameters such as heat, pressure or time will vary depending upon the mounting material selected. TRANSOPTIC™, for example, must be heated under minimum pressure and cooled under full pressure below the melting point before ejection. Thermosetting resins such as

the phenolics become permanently solid after the recommended time at the correct heat and pressure and may, therefore, be ejected hot.

## MOLDING:

Heat is provided by a thermostatically controlled Heater which may be removed for faster cooling of the Mold. An even faster cooling rate may be obtained by using either a solid chill cooler block (furnished) or a 20-2323 Water-Cooled, Cooler, 2" (5.1 cm) ID (Optional). Use of these rapid cooling methods are particularly helpful in mounting with TRANSOPTIC™ Powder.

Pressure is applied by turning the Knob clockwise to its furthest travel and operating the Pump Handle in an up and down stroke. Pressures on the Gauge Dial can be read in either ram force or in actual mold pressure.

## GAUGE CALIBRATIONS:

The Pressure Gauge indicates the Mold Pressure in various international units. The inner arc of numbers indicates the Ram force exerted by the Press in KSI (thousands of pounds per square inch) times 1,000 or Newtons times 200. Actual pressure values for specific mold diameters are shown on the outer two arcs for standard mold pressures of 3 KSI (21 MPa-Megapascals) and 4.2 KSI (29 MPa). Pump to the correct setting according to the symbol representing the Mold diameter in use.

- ▲ = 1" (2.5 cm) I.D. Mold
- ◐ =  $1\frac{1}{4}$ " (3.2 cm) I.D. Mold
- =  $1\frac{1}{2}$ " (3.8 cm) I.D. Mold

See Table 1, "Recommended Molding Schedule" to select the correct molding conditions for each specific mounting resin.

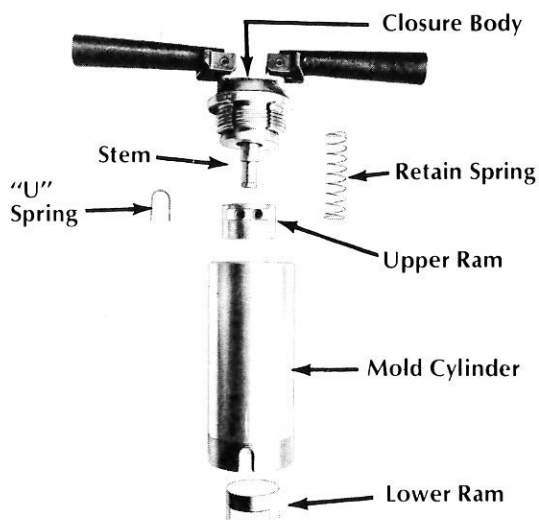


Figure 4. MOLD AND TETRAMET® MOLD CLOSURE










(WARNING: DO NOT ALLOW PRESSURE TO REACH THE DANGER RANGE (RED AREA).)



**TABLE 1. RECOMMENDED MOLDING SCHEDULE**

Material	Temperature	Pressure	Time					
			1" Mold (2.5cm) ▲		1 1/4" Mold (3.2cm) ▒		1 1/2" Mold (3.8cm) ■	
Phenolic resin	280°-300°F (138°-149°C)	4.2 KSI (29 MPa)	Powder 5 min.	PREMOLD™ 3-4 min.	Powder 7 min.	PREMOLD™ 5-6 min.	Powder 9 min.	PREMOLD™ 7-8 min.
Diallyl Phthalate	280°-290°F (138°-143°C)	3.0 KSI (21 MPa)	7-8 min.	—	9-10 min.	—	11-12 min.	—
PLASTIMET®	285°-300°F (140°-149°C)		4 min.	—	5 min.	—	6 min.	—
TRANSOPTIC™ Powder (Heating Cycle)	Room Temp. to 280°-300°F (138°-149°C)	.1 KSI (0.7 MPa)	Approximately 20 min.					
(Cooling Cycle)	Maximum to 100°F (38°C)	4.2 KSI (29 MPa)	Approximately 20 min.					

**TABLE 2. POSSIBLE COMPRESSION MOLDING DEFECTS**

Phenolic Resins, Diallyl Phthalate and PLASTIMET®		
DEFECT	CAUSE	REMEDY
 Radial Split	Too large a section in the given mold area. Sharp cornered specimens.	Increase mold size. Reduce specimen size.
 Edge Shrinkage	Excessive shrinkage of plastic away from sample.	Decrease molding temperature. Choose lower shrinkage resin. Cool mold slightly prior to ejection.
 Circumferential Split	Absorbed moisture. Entrapped gasses during molding.	Preheat powder or premold. Momentarily release pressure during fluid state.
 Burst	Too short a cure period. Insufficient pressure.	Lengthen cure period. Apply sufficient pressure during transition from fluid state to solid state.
 Unfused	Insufficient molding pressure. Insufficient time at cure temperature. Increased surface area of powdered materials.	Use proper molding pressure. Increase cure time. With powders — quickly seal mold closure and apply pressure to eliminate localized curing.
TRANSOPTIC™ Powder		
DEFECT	CAUSE	REMEDY
 Cottonball	Powdered media did not reach maximum temperature. Insufficient time at maximum temperature.	Increase holding time at maximum temperature.
 Crazing	Inherent stresses relieved upon or after ejection.	Allow cooling to a lower temperature prior to ejection. Temper mounts in boiling water.

## SPECIMEN MOUNTING:

### Molding Procedure for Thermosetting Compounds

SIMPLIMET® II is designed to produce consistently good mounts with a minimum of operator assistance or concern. All three standard size mounts—1" (2.5 cm), 1¼" (3.2 cm)

and 1½" (3.8 cm) may be made with this Press. To consistently achieve the most efficient operation, the sequence suggested below should be followed except where modified by thermoplastic molding recommendations:



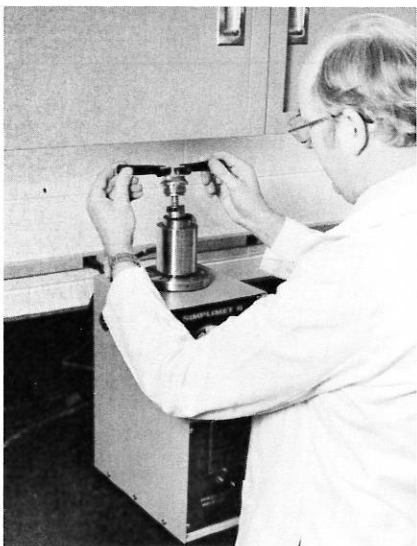
Begin with Closure removed and zero pressure. Raise Ram to top edge of the Mold wall by turning knob clockwise to full closure and operating Pump Handle.



Place specimen on the Ram face and lower the Ram by releasing the pressure (turning pressure release Knob in counterclockwise direction).



Add an appropriate amount of powder or a PREMOLD™ to the Mold Cylinder.



Replace Closure by hand. Turn ¼ turn counterclockwise to gain a thread start; then finger tighten in clockwise direction until threads are fully engaged—AVOID EXCESSIVE FORCE.



After applying ½ pressure, release and quickly reapply two ram force units more than the full recommended pressure for mold size used.



No additional operator attention should be required until the end of the curing period when specimen is ready for removal from the Mold.

After the recommended cure time, release the pressure long enough to allow the Pump Handle to drop, then close the valve. Grasp one of the TETRAMET® Mold Closure handles firmly in each hand and, with a quick jerking motion, turn counterclockwise (viewed from above). Unscrew the Closure until the threads are fully disengaged. Operate the

pump to elevate the Ram, raising the Closure and specimen out of the Mold cavity. Remove the Closure and set aside. Remove the completed mount from the lower or upper Ram. Heat resistant gloves may be needed to handle the hot mount; the TETRAMET® Closure handles remain cool and may be handled without gloves.

## SPECIMEN MOUNTING (Continued)

### Molding Procedure for TRANSOPTIC™ Powder

Load the specimen and the molding powder at room temperature. Apply .1 KSI pressure and turn on the Heater. When the Heater has reached the proper molding temperature of 280–300°F (138–150°C), increase pressure to 4.2 KSI. (Monitor temperature with 20-3052 Metal Thermometer inserted into TETRAMET® Closure.) Switch off Heater and slide it off the Mold Cylinder by raising the TETRAMET® Closure arms to the fully upright position. Allow the mount to cool under full pressure to 100°F (38°C) before ejecting. To reduce the time required to produce TRANSOPTIC™ mounts, use the Cooler supplied. For faster cooling, remove the Cooler and immerse it in cool water for one minute at 10 minute intervals. Fastest cooling is obtained by using the 20-2323 Water-Cooled Cooler which requires cold water and a drain. Cooling time is reduced by as much as  $\frac{2}{3}$  when this device is used instead of the standard Cooler.

Consistently good, defect free mounts are produced with the SIMPLIMET® II Press regardless of the Buehler molding material used to make them.

Consult Table 2 "Possible Compression Molding Defects" if necessary.

## MAINTENANCE:

### General

The SIMPLIMET® II has been carefully designed, constructed, and inspected and should, with cleanliness and care in use, give years of trouble-free service. Frequently wipe away flash, dirt and grit, especially inside and outside the Mold Assembly.

**CAUTION: The 20-2117 TETRAMET® closure and mold assembly parts must be kept free of accumulated mounting material. The frequency of cleaning will depend upon usage but failure to clean periodically may result in a reduction of the closing force. This could cause the TETRAMET to "blow-out" of the mold, possibly causing severe injury.**

### Hydraulic

The Jack Assembly has been thoroughly tested but in the event of malfunction the following procedures may be helpful.

For removal of the 5 ton Hydraulic Jack to check the oil level or for replacement:

1. Disconnect and remove Mold Heater.
2. Release pressure on the Jack by turning Knob counterclockwise (Figure 1) and remove TETRAMET® Mold Closure.
3. Unscrew Mold Cylinder by pulling Locking Knob outward and turning Cylinder counterclockwise (Figure 7).
4. With an open end or adjustable wrench, unscrew Lower Ram (Figure 4) from Ram Stud (Figure 5).
5. Screw Jack Removal Tool, female end, onto Ram Stud (Figure 5).
6. Replace Mold Cylinder with care to avoid contact between Jack Removal Tool and inside of Mold Cylinder.
7. Place Washer over exposed thread of Jack Removal Tool and screw on Nut to hand tightness (Figure 5).
8. Release set screw and remove Pressure Release Knob. Remove four (4) front panel screws and front panel (Figure 1).
9. Unhook Spring from the Angle Bracket at base of Hydraulic Jack and remove Screw and Angle Bracket from base (Figure 7).
10. With a small prying tool, remove two (2) "E" Rings on shaft, holding Jack Lever Arms at center of shaft. Slide Jack Lever Arms off shaft outward towards sides of the cabinet (Figure 7).
11. Turn Press 180° and remove six (6) screws holding back cover in place and remove back cover.
12. Remove Screw from base of Jack (Figure 6).
13. Tighten Jack Removal Tool Nut until Guide Bar is free from Jack Ram (Figure 5).
14. Carefully and slowly remove Jack from rear of Press. As Jack is moved the adapter will be released (front of unit). Coiled Tubing will extend as the Jack is moved. Place Jack on table immediately behind Press. Do not stretch Tubing more than necessary. To disconnect copper pressure Tube from Jack, close pressure release valve by turning Knob clockwise until it stops. Disconnect Tubing from Jack by loosening Connector (Figure 6).
15. Remove Oil Filler Screw (Figure 6) on side wall of Jack body above the fitting in base. Tip Jack (hole side) sideways until oil appears. If Jack must be tipped more than 10 degrees oil level is low.
16. To add oil, tip Jack in opposite direction and add Buehler 20-3016 Simplex Hydraulic Oil in small amounts. After filling, tip Jack in opposite direction (hole side) again. If oil appears in the hole as the Jack is tipped not over 10 degrees, replace Screw in the Jack.

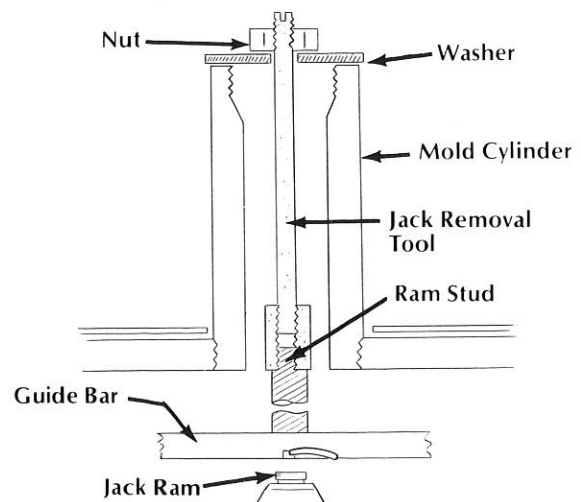
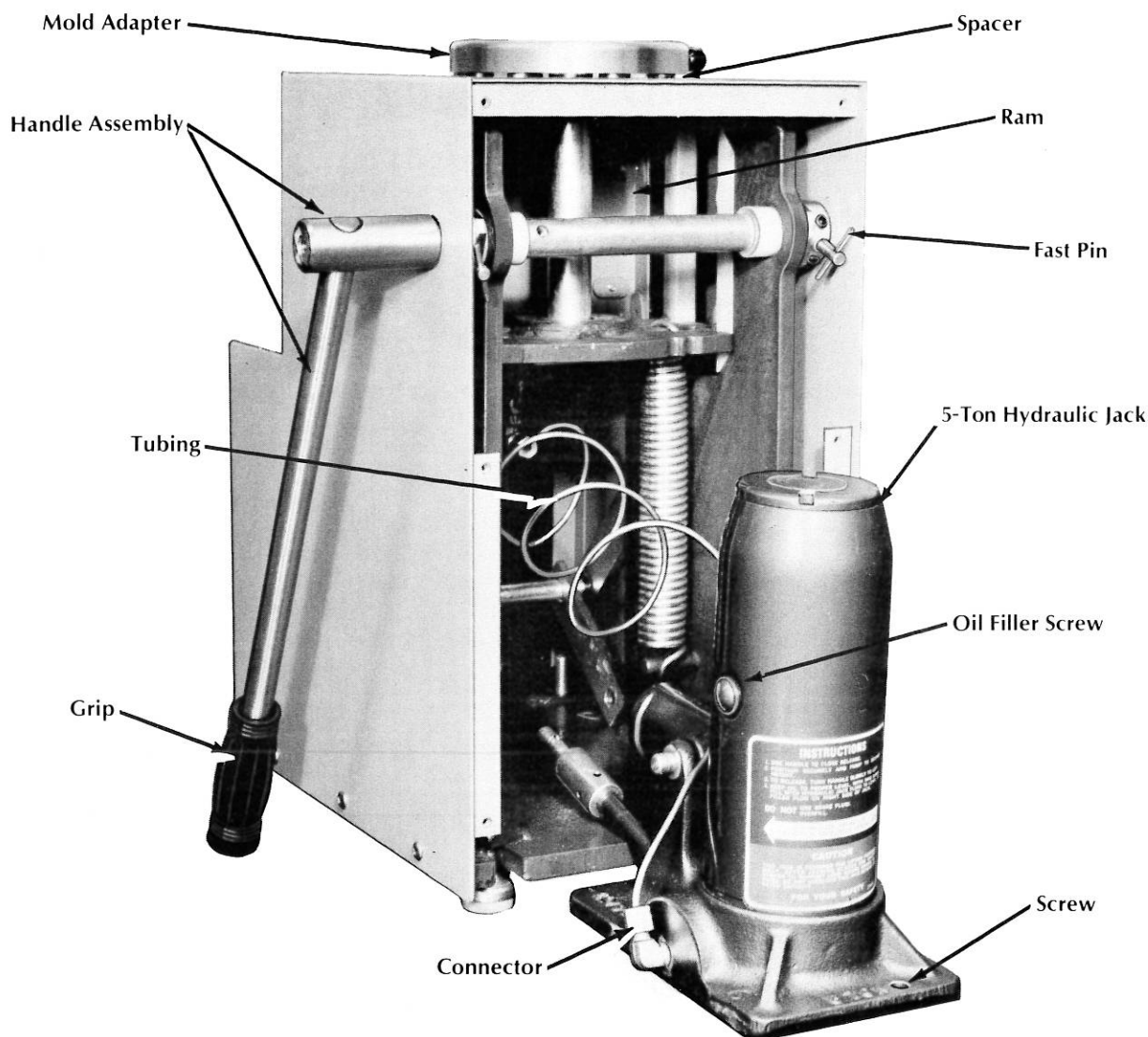


Figure 5. USE OF JACK REMOVAL TOOL



**Figure 6. SIMPLIMET® II**  
(With back panel removed and Jack brought forward)

17. To replace Jack in the unit, reverse process of removal. Slowly slide Jack into the unit. You will have to assist Tubing coil to nest to the front. As Jack is returned into the unit, Adapter will have to be placed into Jack Handle socket.
18. After Jack, Adapter and Tubing are in position replace Screw and Angle Bracket into the base of Jack. Hook Spring to the Bracket and slide Jack Levers toward the center and on to shaft, snapping two "E" rings on the outside of Jack levers.
19. Turn Jack Removal Tool Nut counterclockwise, lowering guide bar onto the Jack Ram. Remove Nut, Washer, Mold Cylinder and Jack Removal Tool.
20. Replace back cover and lower front cover and Knob. Turn Knob clockwise, rotating release valve. Pump up Jack and release. Apply additional pressure downward on Ram to evacuate air from the Jack. After air has been evacuated, pump the Jack up until Ram guide contacts inside frame. Pump the unit until pressure reading on Gauge reaches

Ram Force 7 and holds to a maximum loss of 100 pounds per minute for a period of five (5) minutes.

21. If pressure fails to hold, contact Buehler Ltd. for instructions.

#### **Bleeding the Hydraulic System**

If the Mold Ram fails to rise, or responds erratically when the Handle is pumped, "air lock" is normally the cause and the system requires bleeding. Allow the unit to remain dormant for at least one-half hour. Open knob several turns counterclockwise and operate the Handle through its full range fifteen or twenty times at a moderate rate. Tilt Press about 25 degrees backward and repeat. Tilt Press forward about 25 degrees and repeat. As the Pump receives oil a resistance will be felt in the Handle. Close Knob and operate the Handle to raise Mold Ram to full height. Wait ten minutes. Open Knob. Repeat several times if necessary.



### Mechanical

Extreme care must be exercised when handling Mold Assemblies. Nicks will destroy the precision lapped fit and cause severe scoring. Clean and coat all Mold parts with 20-3046 Silicone Mold Release or 20-3048 Powdered Mold Release before using. To remove Mold Assembly release pressure and lower the Mold Ram. Disengage the spring loaded Locking Knob and unscrew the Mold Cylinder from the Adapter ring by turning counterclockwise. Lift the Mold Cylinder straight up. The Mold Ram is removed by unscrewing counterclockwise. To replace, reverse the procedure. Tighten firmly to prevent damage to threads when pressure is applied.

### Electrical

Your automatic Heater has been factory preset to deliver 300°F.  $\pm$  2°F. (150°C) under actual molding conditions. For necessary temperature adjustments perform the following steps:

1. Remove the Snap Cap from the Terminal Block. (See Figure 1, Page 1)
2. Use an insulated handle screwdriver to adjust the thermostat adjusting screw in increments of 1° or 2° of an arc.
3. Turn adjusting screw clockwise to increase temperature, counter-clockwise to decrease temperature.

After each adjustment allow sufficient time for the temperature to stabilize.

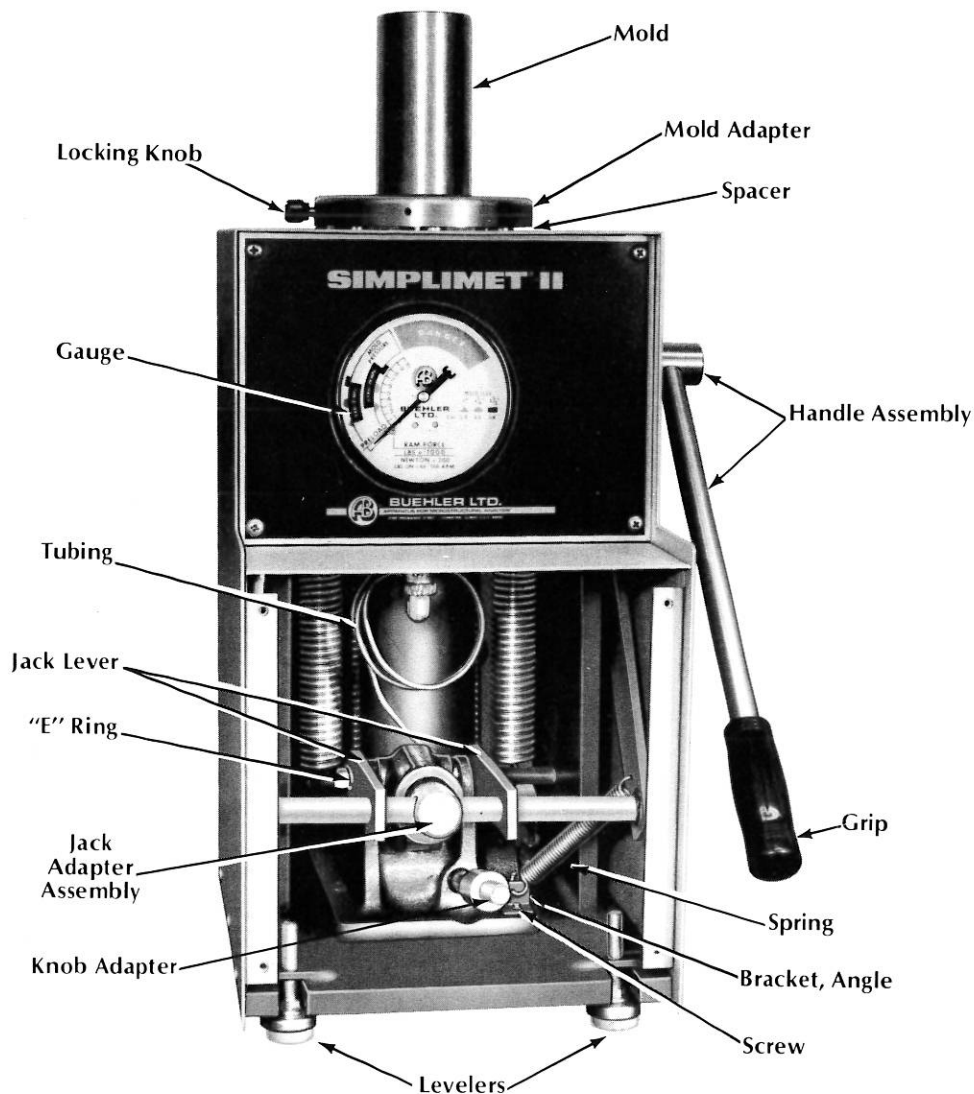


Figure 7. SIMPLIMET® II WITH FRONT PANEL REMOVED

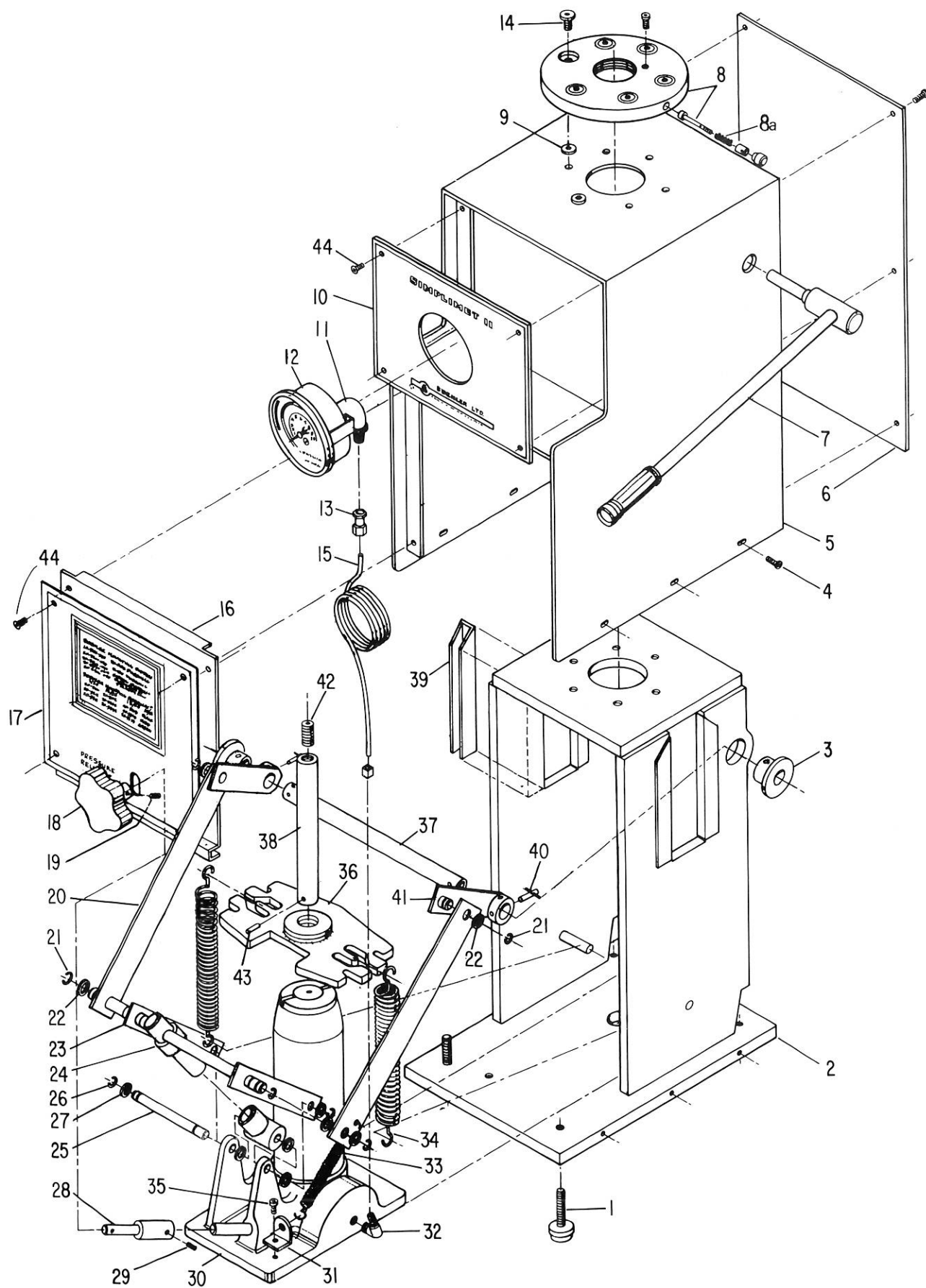


Figure 8. SIMPLIMET® II ASSEMBLY DETAIL

## 20-1320 SIMPLIMET® II PARTS LIST

REF. NO.	PART NO.	NO. REQ.	DESCRIPTION
1	R-2749	4	Leveler
2	8727-S00600	1	Frame
3	R-2926	2	Nylon Flange Bearing
4	R-1663 PPH	6	Screw, Ph. Pan Hd. 10-32 x 1/4"
5	8727-S00100	1	Cover
6	8227-S00200	1	Cover Back
7	8727-S03000	1	Handle Assembly
8	1390-S024	1	Mold Adaptor Assembly
8a	R-2763	1	Spring
9	1303-S25	6	Spacer
10	8727-S00300	1	Control Panel
11	R-0252	1	Reducing Elbow, 1/4"
12	8727-S055	1	Gauge
13	1303-S14E	1	Conn. Male
14	1303-S26A	6	Shoulder Screw
15	8727-S05000	1	Tubing
16	8727-S00400	1	Panel
17	8727-S054	1	Lower Front Panel Facing
18	R-2779	1	Knob
19	R-1193	1	Screw, Socket Set, 1/4-20 x 1/4"
20	8727-S00700	2	Top Lever
21	R-2772	6	Grip Ring
22	R-2769	8	Nylon Washer, 1/2" x 3/4" x 1/32"
23	8727-S00800	2	Jack Lever
24	8727-S01700	1	Jack Adaptor Assembly
25	8727-S01000	1	Jack Pin
26	R-2773	2	E Ring
27	R-2770	4	Nylon Washer, 3/8" x 5/8" x 1/32"
28	8727-S02100	1	Knob Adapter
29	R-1182	2	Screw, Socket Set, 10-32 x 3/16"
30	1315-S19	1	Jack
31	8727-S04900	1	Angle Bracket
32	1330-S52	1	Connector
33	R-2760	1	Spring
34	8727-S01200	2	Spring
35	R-0737	2	Screw, Socket Set, 1/4-20 x 1"
36	8727-S01500	1	Guide Plate
37	8727-S02500	1	Top Lever Tube
38	8727-S01600	1	Ram
39	8727-S03100	2	Channel
40	R-2753	2	Fast Pin
41	8727-S01100	2	Lever Arm Assembly
42	1303-S19E	1	Ram Stud
43	R-2755	1	Dowel Pin, 1/4 x 1 3/4"
44	R-1645TPH	14	Screw, Ph. Truss Hd. 8-32 x 3/8"

## ACCESSORIES AND SUPPLIES FOR SIMPLIMET® II MOUNTING PRESS

### MOLDS AND ACCESSORIES

Mold Size	Mold Assembly All 2" OD (5.1 cm)	TETRAMET® Mold Closure	Heater	Cooler	Water-Cooled Cooler
1" ID (2.5 cm)	20-2104	20-2117	20-2223 2" ID (5.1 cm)	20-2303 2" ID (5.1 cm)	20-2323 2" ID (5.1 cm)
1¼" ID (3.2 cm)	20-2105				
1½" ID (3.8 cm)	20-2109				

### COMPRESSION MOLDING SUPPLIES

#### POWDERS:

Material	Color	Filler	1 lb. (0.45 kg)	5 lbs. (2.27 kg)
Phenolic	Black	Wood Fiber		20-3100-080
Phenolic	Red	Wood Fiber		20-3200-080
Phenolic	Green	Wood Fiber		20-3300-080
Diallyl Phthalate	Blue	Mineral		20-3330-080
Diallyl Phthalate	Blue	Short-Glass Fiber		20-3340-080
Diallyl Phthalate	Blue	Short-Glass Fine Fiber		20-3350-080
Epoxy	Copper	Copper Powder	20-3360-016	20-3360-080
TRANSOPTIC™	Transparent	None		20-3400-080
PLASTIMET®	Black	Proprietary	4 lbs. (1.8 kg.) 20-3370-064	

\*TRANSOPTIC™ Powder is a thermoplastic material while all the others are thermosetting.

#### PHENOLIC PREMOLDS™:

Color/Size	Per 100	Per 500	Per 1000
<b>Black:</b>			
1" (2.5 cm)	20-3111-100	20-3111-500	20-3111-000
1¼" (3.2 cm)	20-3112-100	20-3112-500	20-3112-000
1½" (3.8 cm)	20-3113-100	20-3113-500	20-3113-000
<b>Red:</b>			
1" (2.5 cm)	20-3211-100	20-3211-500	20-3211-000
1¼" (3.2 cm)	20-3212-100	20-3212-500	20-3212-000
1½" (3.8 cm)	20-3213-100	20-3213-500	20-3213-000
<b>Green:</b>			
1" (2.5 cm)	20-3311-100	20-3311-500	20-3311-000
1¼" (3.2 cm)	20-3312-100	20-3312-500	20-3312-000
1½" (3.8 cm)	20-3313-100	20-3313-500	20-3313-000

#### ADDITIONAL SUPPLIES FOR BUEHLER PRESSES:

- No. 20-3016 SIMPLEX HYDRAULIC OIL, pt. (0.47 l)
- No. 20-3032 SIMPLEX HYDRAULIC OIL, qt. (0.95 l)
- No. 20-3040 GLOVES, per pair
- No. 20-3046 SILICONE MOLD RELEASE, in convenient spray can, per 6 oz. (.17kg)
- No. 20-3048 POWDERED MOLD RELEASE, 1.6 oz. (45 g)
- No. 20-3052 WESTON METAL THERMOMETER (0-250 °C) for PNEUMET® and SIMPLIMET®
- No. 20-3060 TIMER, 1 to 30 minutes
- No. 20-3900 PHENOLIC POWDER DISPENSER
- No. 20-8190 METCOAT™, Specimen Protective Lacquer in spray can, per 6 oz. (.17kg)