Harvard Miniature Compaction Apparatus

General

This test determines the relationship between the moisture content of soils and resulting densities (oven-dry weight per cubic foot) when the soil is compacted in the laboratory with this apparatus. Selection of the most appropriate number of layers, number of tamps per layer and tamping force depends on the type of material and the intended use to which the compacted material will be put. In general, at least five layers and ten tamps per layer are required to produce homogeneous test specimens.

Unpacking

All parts of the H-4165 are packed carefully to prevent damage during shipment. It is suggested that you make sure you have removed all the parts before throwing packing away. The Harvard apparatus consists of the following:

Specimen ejector and collar remover with spacer plate

1/454 cu. ft. (129 m^3)-volume mold, collar and mold clamp

Compaction tamper

20 lb. (9.07kg) spring and spacer

37.5lb. (17kg) spring and spacer

40lb (18.2kg) spring and spacer

Hex wrench for installing spring

Assembly

Mold: Mold Assembly comes assembled. Be aware of how it is assembled when you take it apart. Refer to Drawing #2 for reference.

Compaction tamper: Refer to Drawing #3 for reference. Using the included hex wrench, remove the two cap screws from the Tamper cylinder and remove the Plunger cap.

Place the washer located on the Plunger shaft against the Roll pin on the shaft. Place one of the three springs included onto the Plunger shaft against the washer and Roll pin. Slide the Plunger shaft back through the Plunger cylinder, threaded side first, so that the threaded end can be seen on the opposite end. It's helpful to hold the Plunger in a vertical position with the Cylinder up. And, while pushing down on the plunger, slide the corresponding spacer onto the threaded side of the plunger and securing it with one of the jam nuts.

At this point, while holding the assembly horizontally, slide the Plunger cap back onto the plunger, matching the screw threads with the cap screw holes. Hold the Plunger assembly in one hand with your fingers holding the Plunger cap in place. With your other hand screw one of the Cap screws into its hole and the plate and secure. Once this is in place, do the same with the second Cap screw. The Plunger should now be secure with the spring in place inside.

Once this is accomplished, once again, hold the Plunger vertically and apply downward pressure against the plunger until the bottom of the threaded section is reveled above the spacer. Screw the Jam nut to the bottom of the threaded section. Add the second Jam nut and tighten the two nuts against each other to lock them in place. The Plunger is now ready for use.

Sample Preparation

Air-dry to a slightly damp condition a 2 to 3 lb. sample of soil taken from a portion of the material passing the No. 4 (4760-micron) sieve. Mix thoroughly to break up the lumps and insure a homogeneous mixture. Then divide into six to eight portions, such that each portion contains slightly more than enough material for one test. To each portion add approximately the required amount of water to obtain the desired range of moisture contents. After thorough mixing, place each portion in a small glass jar with tight fitting cover and store overnight or until ready for testing. For soils that mix readily with water and have low dry strengths, it is satisfactory to add water and mix the specimen immediately prior to testing. It is important that a compacted specimen not be remixed and used over again.

Test Procedure

1. With the mold and collar clamped to the base, place the desired amount of loose soil in the mold. For five layers, two slightly heaping teaspoonfuls will be required for each layer. Level the surface by pressing lightly with a wood plunger.
2. Insert the tamper in the mold until it is in contact with the surface of the soil and press down firmly until one feels that the spring is starting to compress. Releasethe force and shift the tamper to a new position. Each of the first four tamps should be applied in separate quadrants and adjacent to the mold. The fifth tamp should be in the center, making one complete coverage. This cycle is then repeated until the desired number of tamps has been applied. The tamps should be applied at the approximate rate of 10 tamps per 15 sec.
3. Add the next layer and repeat the procedure until the required number of compacted layers has been placed. The top layer should extend at least ½ in. into the extension collar.
4. Remove mold from clamp. Insert spacer disc in collar remover and ejector. Place mold into device with lugs on the remover in the groove provided in the collar. Press down firmly on the piston and on the lever arm at the back, prying the collar free of the compacted soil.
5. Remove the mold from the base and carefully trim away the excess soil from the top of the mold and from the bottom, if any.
6. Weigh the mold containing the compacted soil to the nearest 0.1g. It is convenient to use a rare weight equal to the weight of the empty mold, as then the resulting net weight in grams is numerically equal to the wet unit weight of the compacted soil, in pounds per cubic foot.

7. Remove the specimen from the mold with the sample ejector and place in a suitable container for drying and determination of moisture content.
8. Compact additional specimens until points have been established on both sides of the optimum moisture content.

Calculations

Calculate the moisture content and the dry weight of the soil as compacted for each trial,

as follows:

$$w = \frac{A - B}{B - C} \times 100$$

And

$$W = \frac{W^1}{W + 100} \times 100$$

Where:

w = Percentage of moisture in the specimen

A = weight of container and wet soil

B = weight of container and dried soil,

C = weight of container

W = dry weight, in pounds per cubic foot of compacted soil and

w^1 = wet weight, in pounds per cubic foot

Moisture-Density Relationship

The calculations in above shall be made to determine the moisture content and corresponding oven-dry weight (density) for each of the compacted soil samples. The oven-dry weights per cubic foot (densities) of the soil shall be plotted as ordinates and corresponding moisture contents as abscissas.

Optimum Moisture Content

When the densities and corresponding moisture contents for the soil have been determined and plotted as indicated in paragraph, it will be found that by connecting the plotted points with a smooth line, a curve is produced. The moisture content corresponding to the peak of the curve shall be termed the "optimum moisture content" of the soil under the above compaction.

Maximum Density

The oven-dry weight per cubic foot of the soil at "optimum moisture content" shall be termed "maximum density" under the above compaction.

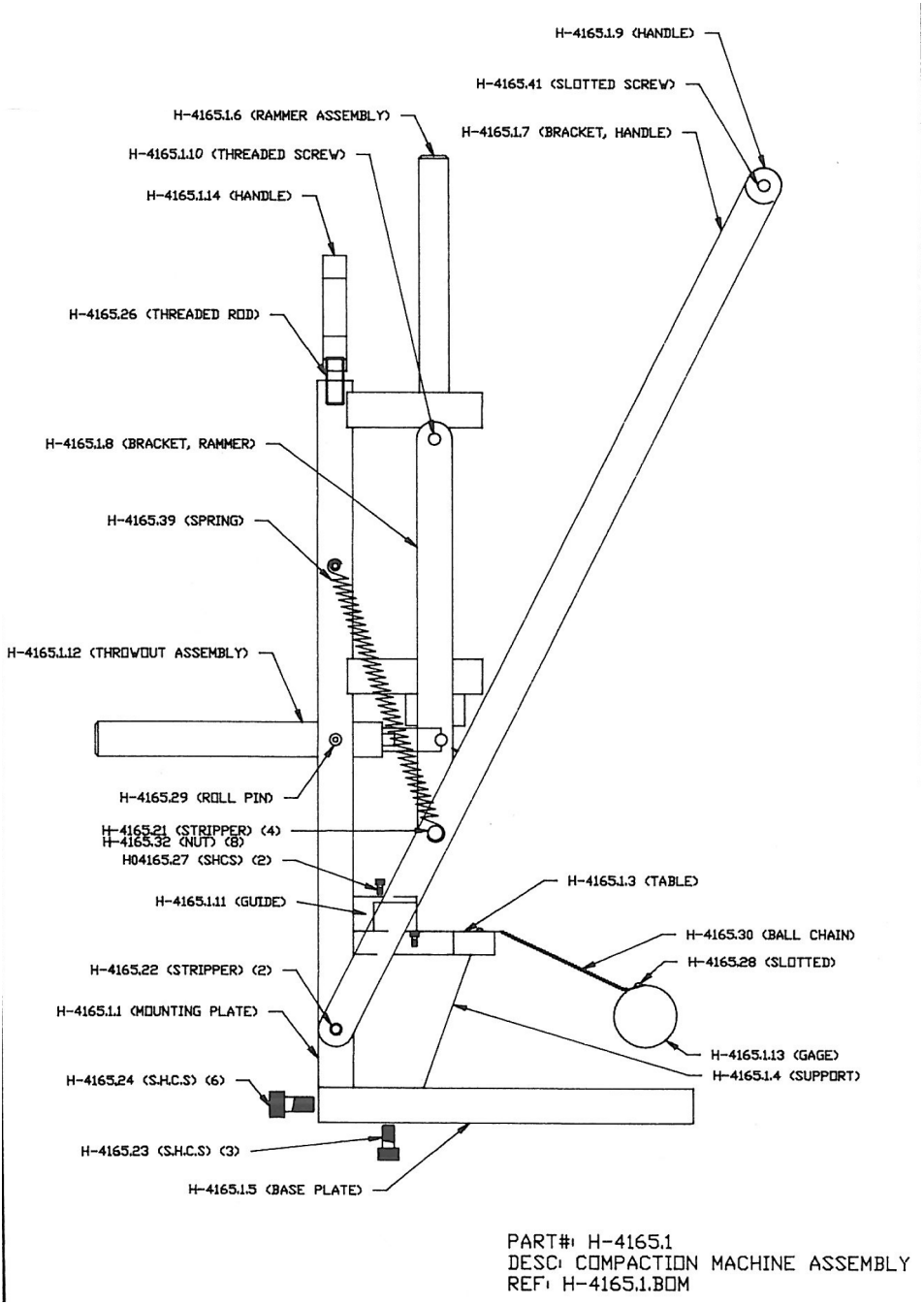
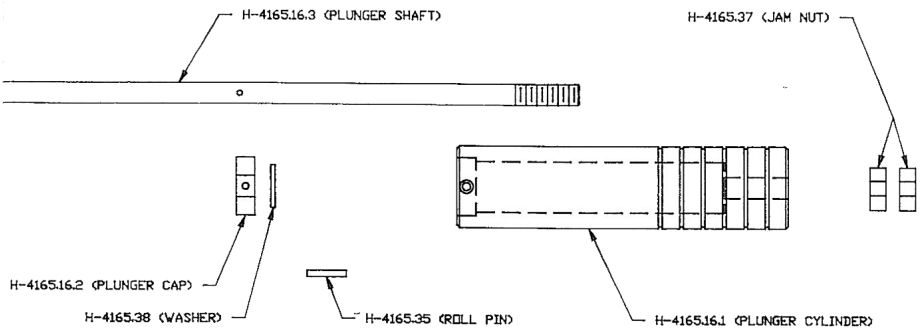
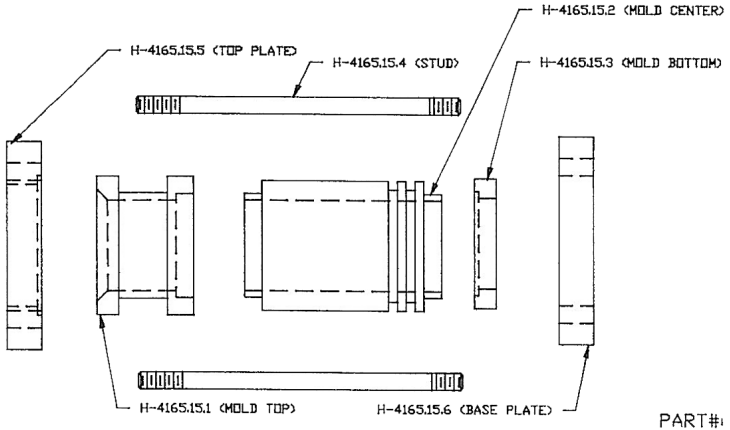

H-4165.1.9 (HANDLE)
H-4165.41 (SLOTTED SCREW)
H-4165.1.6 (RAMMER ASSEMBLY)
H-4165.1.7 (BRACKET, HANDLE)
H-4165.1.10 (THREADED SCREW)
H-4165.1.14 (HANDLE)
H-4165.26 (THREADED ROD)
H-4165.1.8 (BRACKET, RAMMER)
H-4165.39 (SPRING)
H-4165.1.12 (THROWOUT ASSEMBLY)
H-4165.29 (ROLL PIN)
H-4165.21 (STRIPPER) (4)
H-4165.32 (NUT) (8)
H04165.27 (SHCS) (2)
H-4165.1.3 (TABLE)
H-4165.1.11 (GUIDE)
H-4165.30 (BALL CHAIN)
H-4165.28 (SLOTTED)
H-4165.22 (STRIPPER) (2)
H-4165.1.1 (MOUNTING PLATE)
H-4165.1.13 (GAGE)
H-4165.1.4 (SUPPORT)
H-4165.24 (S.H.C.S) (6)
H-4165.23 (S.H.C.S) (3)
H-4165.1.5 (BASE PLATE)
PART#: H-4165.1
DESC: COMPACTION MACHINE ASSEMBLY
REF: H-4165.1.BOM

Figure 1



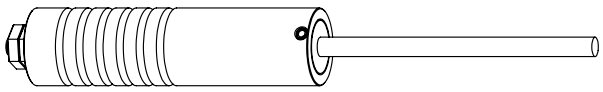
PART#: H-4165.16
DESC: TAMPER ROD ASSEMBLY
REF: H-4165.16 BOM



PART#: H-4165.15
DESC: MOLD ASSEMBLY
REF: H-4165.15.BOM

Figure 2

ITEM NO.	PART NUMBER	QTY.
1	H-4165.16.1 PLUNGER CYLINDER	1
2	H-4165.16.2 PLUNGER CAP	1
3	H-4165.16.3 PLUNGER SHAFT	1
4	H-4165.SPR SPACER	1
5	H-4165.20 SPRING	1
6	H-4165.35 ROLL PIN	1
7	H-4165.37 JAM NUT	2
8	H-4165.38 WASHER	1
9	10-32 SHCS	2



SCALE 1:3

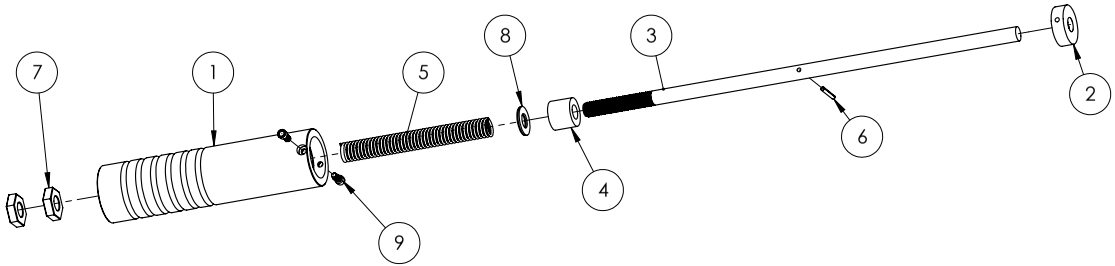


Figure 3

REVISION				
LTR	DESCRIPTION	DRN	BY	DATE
A	RELEASE	---	AC	11-09-17

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/64
ANGULAR: ±
TWO PLACE DECIMAL ±0.01
THREE PLACE DECIMAL ±0.002

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL

FINISH

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	AC	11-09-17
CHECKED	MK	11-09-17
ENG APPR.		
MFG APPR.		
Q.A.		

NOTE:

HUMBOLDT

TITLE: TAMPER ROD ASSEMBLY (SPRING LOADED)

SIZE	DWG. NO.	REV
A	H-4165.16A	A

SCALE: 1:4 | WEIGHT: | SHEET 1 OF 1

Warranty

Humboldt Mfg. Co. warrants its products to be free from defects in material or workmanship. The exclusive remedy for this warranty is Humboldt Mfg. Co., factory replacement of any part or parts of such product, for the warranty of this product please refer to Humboldt Mfg. Co. catalog on Terms and Conditions of Sale. The purchaser is responsible for the transportation charges. Humboldt Mfg. Co. shall not be responsible under this warranty if the goods have been improperly maintained, installed, operated or the goods have been altered or modified so as to adversely affect the operation, use performance or durability or so as to change their intended use. The Humboldt Mfg. Co. liability under the warranty contained in this clause is limited to the repair or replacement of defective goods and making good, defective workmanship.

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