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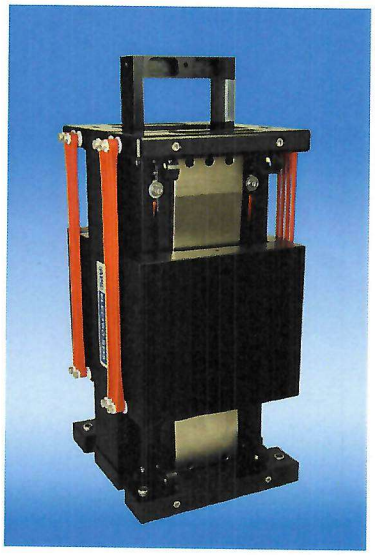
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INSTRUCTION MANUAL

APS 0112
REACTION MASS ASSEMBLY
FOR APS 113
ELECTRO-SEIS® SHAKER



APS Dynamics

Systems for Generating Controlled Vibration

a subsidiary of SPEKTRA

APS Dynamics, INC. c/o SPEKTRA Schwingungstechnik und Akustik GmbH Dresden
Heidelberger Str. 12, 01189 Dresden, Germany

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1 General Information

SCOPE

This Instruction Manual provides operation information for the APS 113 ELECTRO-SEIS® Shaker, including the HF version, equipped with APS 0112 - REACTION MASS ASSEMBLY. This allows either horizontal or vertical generated force to be applied through the shaker body to a horizontal surface on which the shaker is placed.

Two Reaction Mass Blocks attach to the armature support points on the shaker and provide sufficient reaction mass to obtain rated force down to 1.8 Hz in a free armature mode. See picture to the right for the APS 0112 - Reaction Mass Assembly. Refer to Section 5 for performance envelope and installation drawing.

The Reaction Mass Suspension System may be adjusted to center the Armature and Reaction Mass within the stroke range for all orientations of its force axis.



APS 113 Shaker equipped with APS 0112 - Reaction Mass Assembly

CHARACTERISTICS AND PERFORMANCE PARAMETERS

Armature weight including Reaction Mass..... 13.2 kg (29 lb)

Minimum frequency for 30 lb Force ..... 1.8 Hz

Total Shaker Weight including Reaction Mass ..... 47 kg (103 lb)

NOTES

2 Preparation for Use

GENERAL

The relevant installation drawings in Section 5, contain lists of all replaceable parts for the following Accessory. Nearly all accessories require the installation of Bearing Housing Clamps. These clamps are factory installed on the APS 113 armature if the accessory is ordered with the APS 113, otherwise, they are included in the box. Refer to "Installation of Bearing Housing Clamps" in this section for instructions of installation of the clamps. These clamps may remain in place if it is desired to use the shaker without the accessories. The clamps increase the basic armature weight to 2.35 kg (5.2 lb).

The Reaction Mass Blocks are packaged in a storage box, complete with all parts and tools required for installation and a laminated installation drawing.

INSTALLATION OF BEARING HOUSING CLAMPS

To install the four Bearing Housing Clamps (Item 1 in installation drawing 0112M) on the shaker armature, it is necessary to remove the side covers and corner covers. Proceed as follows:

1. Place the unit on a bench with the thrust axis in a vertical orientation with armature load attachment bridge upward.
2. Remove the four Corner Covers and Armature Suspension Bands, allowing the armature to rest on the rear rubber stops.
3. Loosen the four 1/4-28 x 1-1/4 Cap Screws in the forward end frame about 6 mm (1/4 inch). With care to prevent the side covers and slide guides from falling, raise the forward end frame.

   * CAUTION *

   DO NOT ATTEMPT TO PLACE THE UNIT IN A HORIZONTAL POSITION FOLLOWING REMOVAL OF THE END FRAME. DAMAGE TO THE ARMATURE COIL MAY RESULT.

4. Lift off the side covers and suspension slide guides. Refer to Figure 2-1.

NOTES

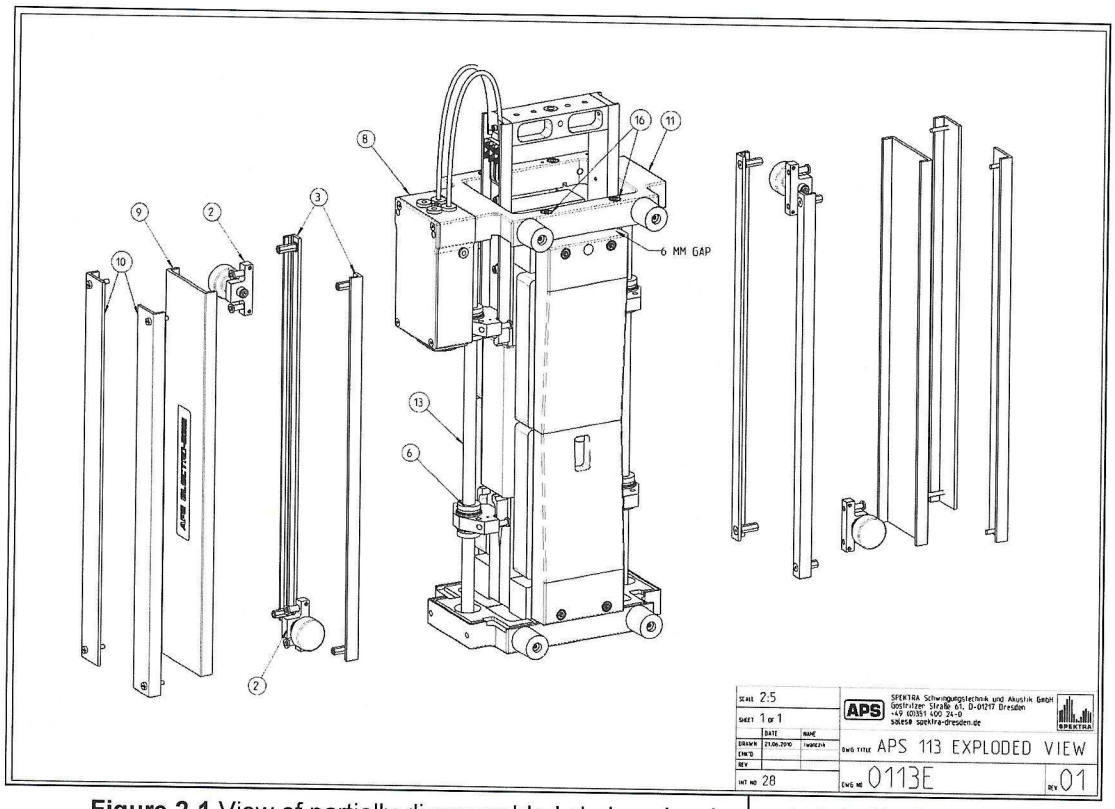


Figure 2-1 View of partially disassembled shaker showing parts listed in Section 5

5. Re-attach the upper End Frame. Without replacing the side covers, corner covers, or slide guides, seat the four upper End Frame Cap Screws.

6. Place the shaker in a horizontal position.

7. Between the two bearings place a Bearing Housing Clamp, (Item 1 in installation drawing 0112M) over one of the rear bearings, open side outward, oriented such that the two tapped holes in the side of the clamp face rearward and in alignment with the holes in the Bearing Housing Block. Install two 10-24 Torx Button Head Screws and *finger tighten only.*

8. Then, with tapped holes facing forward, install a second Bearing Housing Clamp against the bottom of the forward Bearing Housing on the same side.

9. Repeat Steps 7 and 8 for the other side of the shaker.

10. Place the two Reaction Mass Spacers (Items 5 & 6, right and left hand) on top of the clamps. Place a Reaction Mass Block (Item 10) in position on the spacers. Insert the four Socket Head Cap Screws (Item 9) down through the block and rotate them several turns to engage the threads. *Do not tighten.*

11. Adjust the vertical positions of the four clamps so that there is no rocking of the Reaction Mass Block on the Reaction Mass Spacers, and *tighten* the eight screws in the Clamps.

12. Temporarily remove the Reaction Mass Block and spacers.

13. Return the shaker to the vertical position and loosen the upper End Frame Cap Screws and End Frame about 6 mm (1/4 inch).

14. Replace the Slide Guides and Side Covers into the rear and forward End-Frames. *Be certain all pieces are in their proper location before replacing the End Frame Cap Screws.*

15. Re-tighten four 1/4-28 x 1-1/4 End Frame Cap Screws and gradually seat the screws.

16. Replace the suspension slides, suspension bands, and corner covers.

17. Return the shaker to the horizontal position, resting on its feet, and check for free travel of the armature. Tighten the screws to 14 Nm (130 in-lb) The unit is now ready for operation.



Figure 2-2 APS 113 Shaker equipped with APS 0112 - Reaction Mass Assembly

NOTES

INSTALLATION OF REACTION MASS BLOCKS

Refer to installation drawing, 0112M in Section 5 of this manual and Figure 2-2 of the APS 113 Shaker equipped with APS 0112 - Reaction Mass Assembly. Replace the knob-type suspension adjustment assemblies with the alternative adjustment assemblies (socket head cap screw type) as follows:

1. Place the shaker in a vertical position.
2. Remove corner covers, bands and knob-type assemblies.
3. Replace with alternative assemblies (Item 2) placing a pair at each end and replace the suspension bands.
4. Replace the corner covers.

The following procedure provides instructions for attaching the Feet Extension Bars and Handles/Mass Support Bars to the shaker body.

1. Place the shaker in a vertical position.
2. Remove the four rubber feet supplied with the APS 113 and store for future use.
3. Attach the Feet Extension Bars and Handles (Items 3 and 4) with the eight Socket Head Cap Screws (Item 9) referenced in the installation drawing. For vertical operation, place the handles on top. For horizontal operation, reverse the location for one pair of handle/feet.

Use the following procedure for attaching the Reaction Mass Blocks to the Armature:

1. Place the shaker in a horizontal position.

2. Locate a Reaction Mass Block (Item 10) and Reaction Mass Spacers (Items 5 and 6) over the four Bearing Housing Clamps and fasten with the four Socket Head Cap Screws (Item 9) referenced in the installation drawing. Be sure to place the spacer block suspension pins towards the bottom end.

3. Rotate the shaker 180 degrees and attach the second Reaction Mass unit. *Operation of the shaker with a single Reaction Mass unit installed is not recommended.*

Place the shaker in the vertical position and install the external suspension bands. Use a combination of Heavy Bands (Item 7A) and Extra Heavy Bands (Item 7B) to support and center the load using the maximum number of bands. Place the bands over the suspension points located on the Handles and Reaction Mass Block Spacers. Fine adjustment for centering the mass may be done with the internal Suspension Adjustment Assemblies. When used horizontally, four bands are recommended. See Figure 2-3 for the configuration of the various modes of operation.

The Feet Extension Bars are faced with a non-skid surface. If a more rigid support is required or to compensate for an uneven surface, cap screws located in the feet may be extended.

Set the Power Amplifier for operation in the Voltage Mode. Operation in the Current Mode will result in large amplitude and possible over-displacement near the reaction mass suspension resonance. The Current Mode may be used for operation above 5 Hz. The force level may be monitored by any of the following:

1. Visual measurement of armature/mass displacement and calculation of acceleration and force.

2. Measurement of armature/mass acceleration with an accelerometer. A 10-32 tapped hole in each reaction mass block is provided for an accelerometer.

* CAUTION *

DO NOT RESHIP THE APS 113 SHAKER WITH REACTION MASS ATTACHED. EXCESSIVE TRANSPORTATION SHOCK LOADS MAY DAMAGE THE SHAKER GUIDANCE BEARINGS.

NOTES

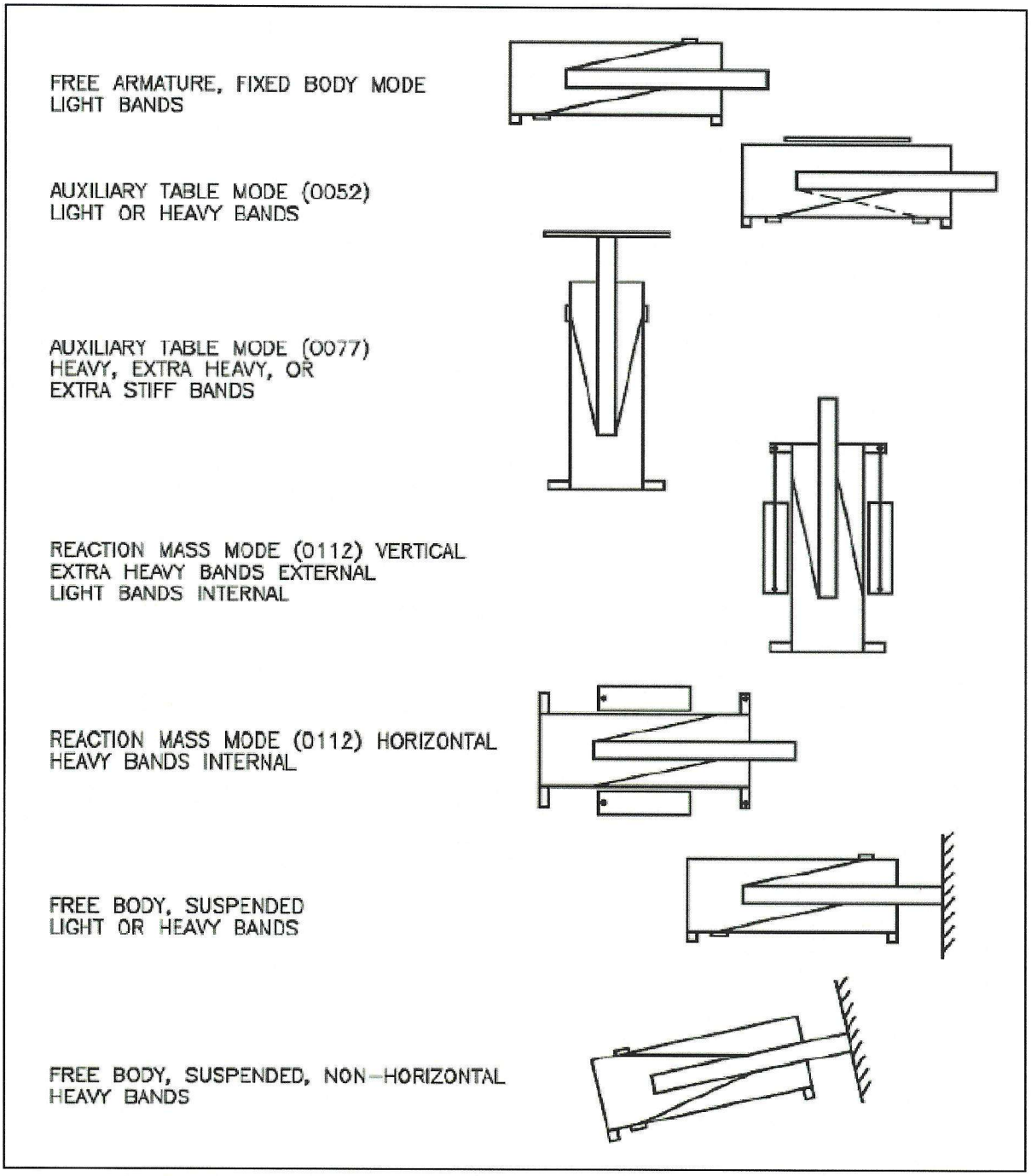


Figure 2-3 Configuration of suspension bands for various modes of operation

3
Principles of Operation

GENERAL

The APS 113 Shaker is a versatile source of mechanical force for long stroke, low frequency excitation. With its body mounted on a rigid bench or floor, the shaker may be used to support and vibrate loads attached to its armature in a shaker table mode. Auxiliary tables are available for such applications. Refer to the "Accessory Information" in Section 1 of the APS 113 Manual. Its primary application, however, is in the excitation of resonant modes of large structures. To accommodate a diversity of resonance or modal test configurations, the shaker has been designed specifically to operate in three primary modes. These modes are termed: Fixed Body, Free Body, and Free Armature.

FREE ARMATURE MODE

Many large test structures having horizontal surfaces such as floors require vertical force applied to these surfaces to excite resonant modes of vibration. The APS 113 Shaker may be used in a vertical Free Armature Mode by resting the rear end frame of the shaker on the horizontal surface of the test structure. In this mode, the armature provides reaction mass and allows the generated force to be applied through the shaker body to the horizontal surface on which the shaker is placed.

With the armature experiencing maximum acceleration, rated force is applied to test structure through the shaker body. Without additional mass attached to the armature, the armature stroke limits the generated force. Below this frequency, the stroke-limited force is proportional to the square of frequency.

The purpose of the APS 0112 - Reaction Mass Assembly is to lower the stroke-limited crossover frequency. Thereby gaining rated force output to a lower frequency and to lower the armature velocity minimizing the amplifier voltage requirement.

NOTES

4 Maintenance

REPAIR/REPLACEMENT ACTION

If a problem occurs in the operation of the shaker or part repair/ replacement action becomes necessary, contact:

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SPEKTRA Schwingungstechnik und Akustik GmbH Dresden
Heielberger Str. 12
01189 Dresden, Germany

Phone: +49 351 40024 0
FAX: +49 351 40024 99
E-Mail: sales@spektra-dresden.com

Be prepared to give the serial number of the unit, the part numbers involved, and a complete description of the nature of the problem.

NOTES

5
Support Documentation

This section contains the following Support Documentation:

PERFORMANCE ENVELOPE..... 5-2

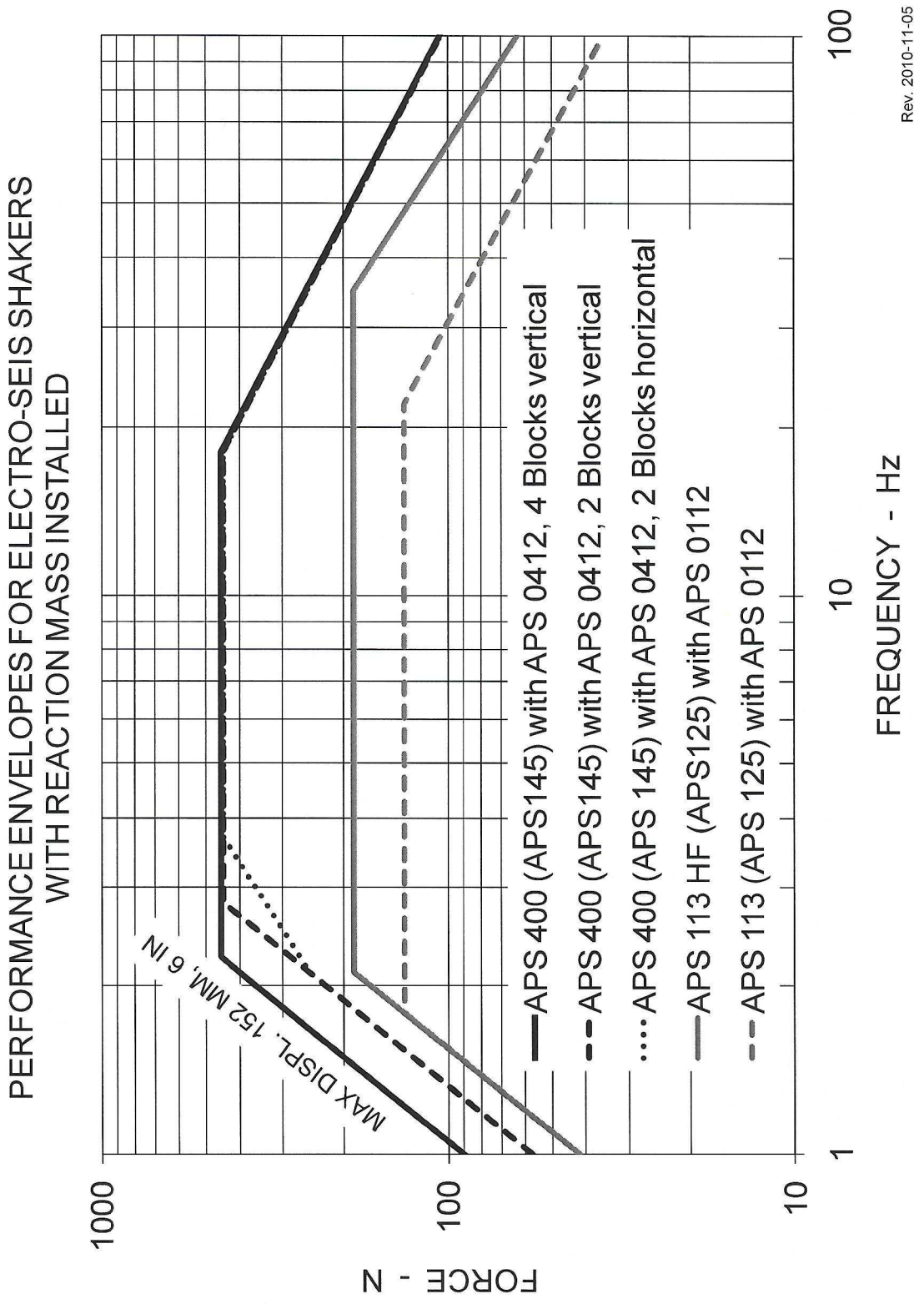
APS 113 OUTLINE AND INSTALLATION DRAWING 0113M 5-3

REPLACEABLE PARTS LIST
(APS 113 ELECTRO-SEIS® SHAKER) 5-4

APS 0112 - REACTION MASS ASSEMBLY INSTALLATION
DRAWING 0112M..... 5-5 / 5-6

WARRANTY / REVISION INFORMATION

NOTES


PERFORMANCE ENVELOPES FOR ELECTRO-SEIS SHAKERS
WITH REACTION MASS INSTALLED
MAX DISPL. 152 MM, 6 IN
APS 400 (APS145) with APS 0412, 4 Blocks vertical
APS 400 (APS145) with APS 0412, 2 Blocks vertical
APS 400 (APS 145) with APS 0412, 2 Blocks horizontal
APS 113 HF (APS125) with APS 0112
APS 113 (APS 125) with APS 0112
FORCE - N
1000
100
10
1
10
100
FREQUENCY - Hz
Rev. 2010-11-05

REPLACABLE PARTS LIST

APS 113 ELECTRO-SEIS® SHAKER

Item	Total Qty	Part Description	APS Part No.
1.	1	Armature Assembly	2801
2.	4	Suspension Slide Assembly	2802
3.	4	Slide Guide Assembly	2803
4.	4	Rubber Foot Assembly	2804
5.	2	Pole Piece Assembly (2 pairs)	2805
6.	4	Linear Ball Bushing Assembly	2806
7.	4	Bearing Housing Assembly	2807
8.	1	Electrical Junction Box Assembly	3306
9.	2	Side Cover	28080001
10.	4	Corner Cover	28080002
11.	1	Forward End Frame	28080003
12.	1	Rear End Frame	28080004
13.	2	Bearing Shaft, Stainless Steel	28080005
14.	4	Suspension Band (heavy)	28080007
15.	4	Suspension Band (light)	28080008
16.	8	Cap Screw, Socket Head, 1/4-28 x 1-1/4	28080016
17.	4	Brass Bushing	28080021
18.	1	Wooden Shipping Box	28080022

REF	DESCRIPTION	PART NO	QTY
1	BEARING HOUSING CLAMP	4453	4
2	SUSPENSION SLIDE	4459	4
3	FEET EXTENSION BAR	4460	2
4	HANDLE/MASS SUPPORT	4461	2
5	REACTION MASS SPACER (L)	4462	2
6	REACTION MASS SPACER (R)	4463	2
7A	SUSPENSION BAND HEAVY	28080007	4
7B	SUSPENSION BAND EXTRY HEAVY	44030001	4
8	BTN HD SCREW 10-24 X 0.75	44010006	8
9	SOC HD SCREW 1/4-20 X 2.5	44010008	16
10	REACTION MASS BLOCK	44060001	2
-	HEX KEY 3/16	44010005	1
-	TORX KEY NO. 25	44010007	1
-	W OODEN CASE 445 X 375 X 225 MM	44060002	1
-	HEX KEY 5/16	44060003	1

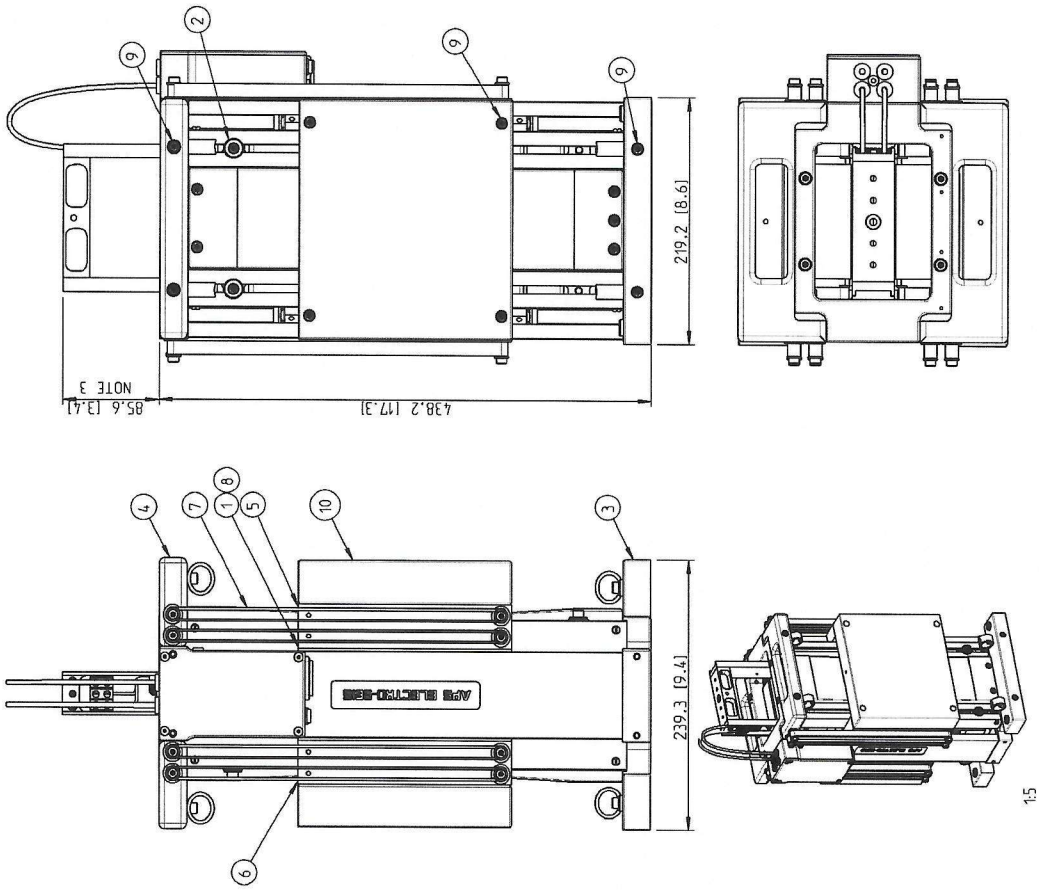
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1. ITEMS 7A AND 7B AS REQUIRED
2. ITEMS 1 AND 8 FACTORY INSTALLED WHEN ORDERED WITH SHAKER
3. MID POINT OF ARMATURE STROKE
4. VERTICAL ORIENTATION

SCALE 3:10
SHEET 1 OF 2

	DATE	NAME
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CHK'D		
REV		
INT NO 4406		

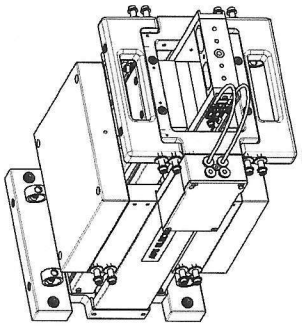
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+49 (0)351 400 24-0
sales@ spektra-dresden.de

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DWG NO 0112M REV 01

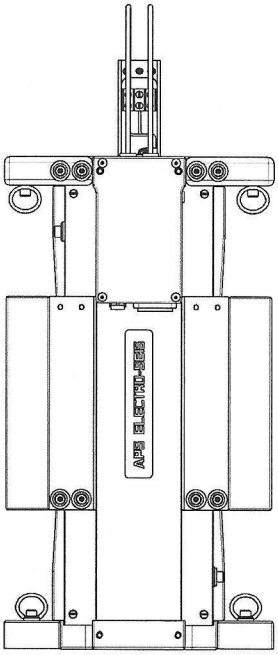


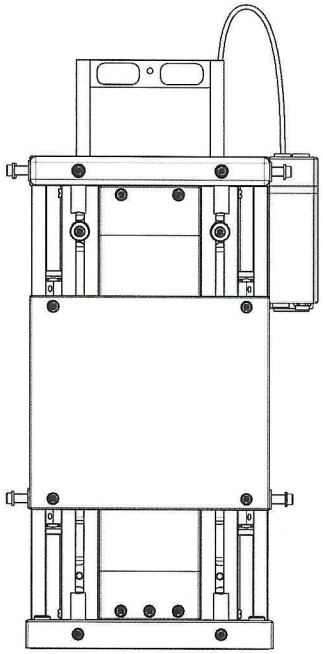
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NOTES: 1. HORIZONTAL ORIENTATION



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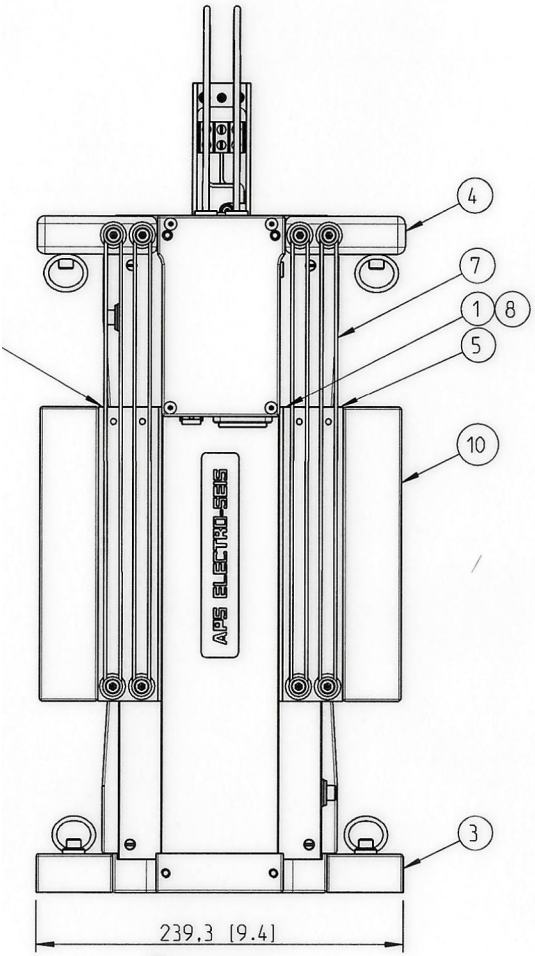
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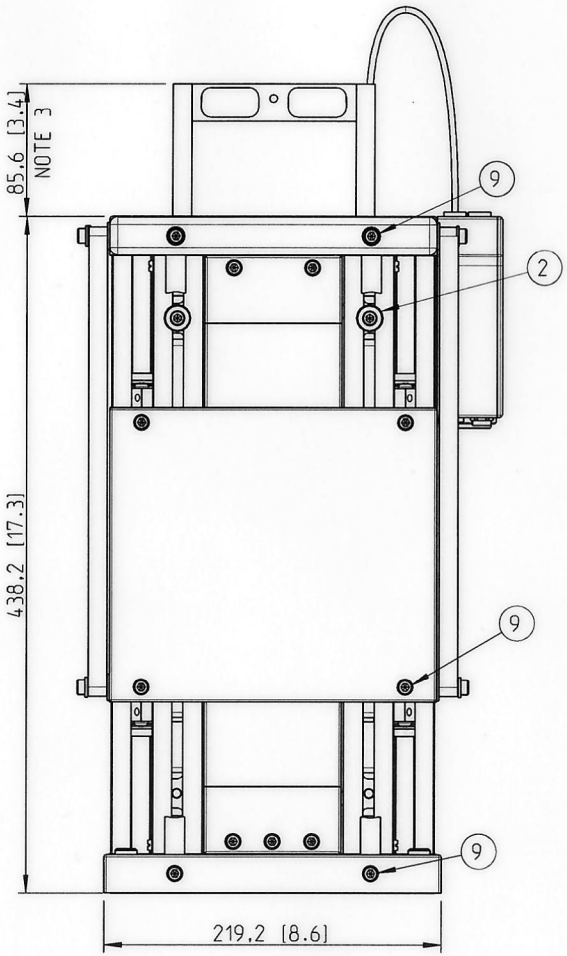
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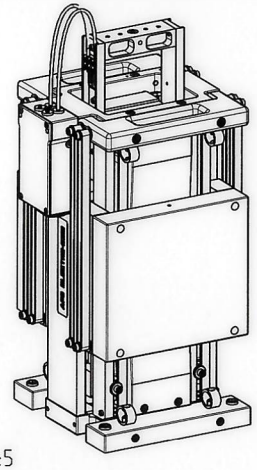
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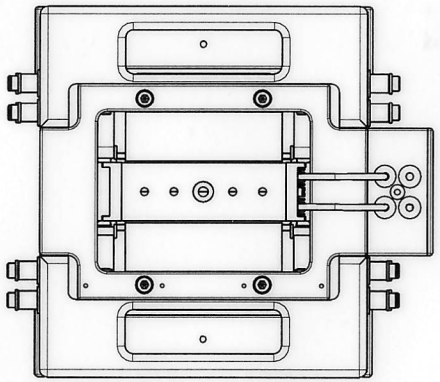
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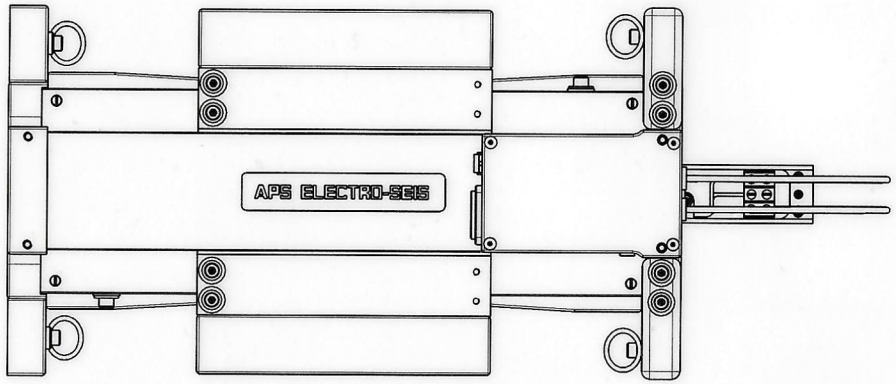
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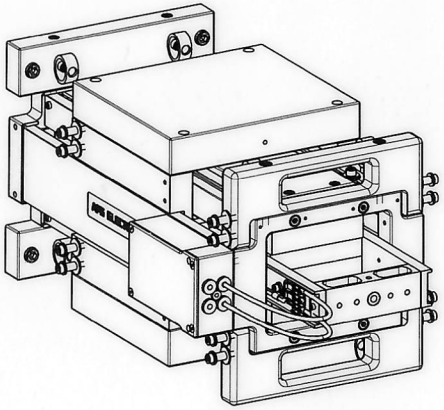
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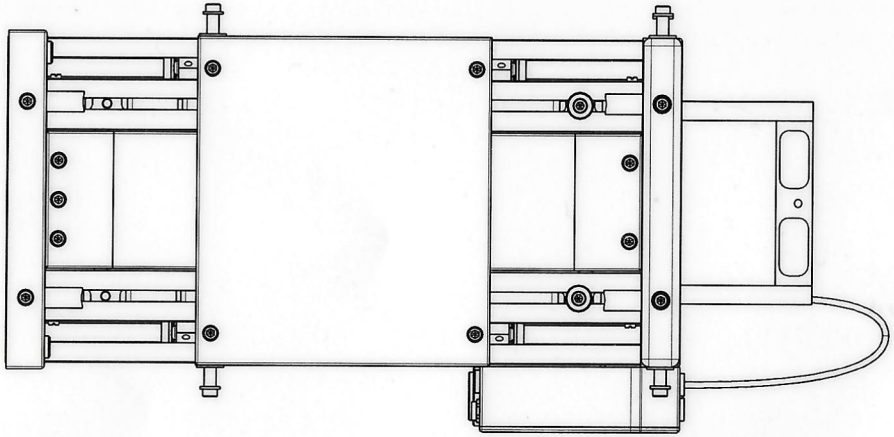
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NOTES: 1. HORIZONTAL ORIENTATION





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