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APPROVAL REPORT

**EASY 1-B, EASY 1- S, and EASY 1- F POWDER
COATING EQUIPMENT
FOR USE IN
ELECTROSTATIC FINISHING APPLICATIONS**

Prepared for:

**ITW Gema
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**Project ID. 3010607
Class 7260
Date: March 11, 2002**

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**EASY 1-B, EASY 1- S, and EASY 1- F
POWDER COATING EQUIPMENT
FOR USE
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from

**ITW Gema AG
MÖVENSTRASSE 17
CH-9015 St. GALLEN / SWITZERLAND**

I INTRODUCTION

- 1.1 ITW Gema AG requested Factory Mutual Research to evaluate if the EASY series powder coating equipment meets the intent of Factory Mutual Research Standards, Class 7260.
- 1.2 The equipment must be installed, operated, and maintained in accordance with the National Electrical Code and the manufacture's instructions.
- 1.3 This Report may be freely reproduced only in its entirety and without modification.
- 1.4 Standards

Title	Factory Mutual Research No.	Issue Date
Electrostatic Finishing Equipment	Class No. 7260	March 1996
Nonincendive Electrical Equipment for Use in Class I and Class II, Division 2, and Class III, Division 1 and 2 Hazardous (Classified) Locations	Class No. 3611	October 1999
Electrical and Electronic Test, Measuring and Process Control Equipment	Class No. 3810 Includes Supple. No. 1	March 1989 July 1995
Electrical Equipment for Use in Hazardous (Classified) Locations General Requirements	Class No. 3600	November 1998

- 1.5 Listing The product will appear in the Approval Guide as follows;

EASY 1-B, EASY 2-B, EASY 1-F, EASY 2-F, EASY 1- S, EASY 2- S Powder Coating Equipment. P/N MB 01-1, MB 01-2, MF 01-1, MF 01-2, MS 01-1, MS 01-2 Mobile Trolleys respectively. P/N GM 01 EasySelect Manual Spray Gun. P/N CG 01 EasyTronic Control Unit, suitable for CL. II, Div. 2 locations. P/N 379107, 379140 Electrode holder.

II DESCRIPTION

EASY 1-B, EASY 1- S, and EASY 1- F are manually operated electrostatic powder coating equipment. The spray equipment consist of the model MB 01, MS 01, and MF 01 series mobile trolleys, with manual spray gun GM 01 and control unit CG 01. The electrostatic powder coating equipment draws the powder from the hopper into the gun where the powder is electrostatically charged at the nozzle. The charged powder is then propelled from the gun to a grounded object and adhere to the surface of the object.

The MB 01-x, MS 01-x and MF 01-x equipment differ only in the way that the powder is processed before it is conveyed to the manual spray gun. The B-Equipment has a vibrating surface, on which a carton is positioned and powder can be supplied directly from it. The S-Equipment has a stirring mechanism, which processes the powder by mixing it. In the F-Equipment the powder is fluidized in a special hopper. All three equipment variants are capable of being converted for operation with two guns, and two control units, when required. This is identified by selecting either a 1 or 2 for the option "x", Example MB 01- 2 is the two gun and two control unit trolley with the vibrating equipment.

Accessories are also available for the manual spray gun for differing uses. These include the electrode holder in the Flat jet nozzle set and the electrode holder in the Round jet nozzle set, which consist of the central electrode design and the double electrode design. A cup container for the guns are also available.

III EXAMINATIONS AND TESTS

- 3.1 General –Samples of the equipment as detailed below were submitted for examination and testing. The samples were considered to be representative of the product line and were examined, tested, and compared to the manufacture's drawings. All data is on file at Factory Mutual Research along with other documents and correspondence applicable to this program.
- 3.2 Examination – The following evaluation verifies that the products listed in section 1.4 are suitable for electrostatic finishing applications using Class II spray material.
 - 3.2.1 Drop Test – The model GM 01 is a manual spray applicator and thus is required to be subjected to a drop test prior to the spark ignition test. After the drop test, the applicator was examined to determine if it became electrostatically energized as to be a source of electric shock. The results were satisfactory, in that the applicator did not become energized as a result of dropping it. Also after the drop test the applicator was subjected to a spark ignition test, as outlined in section 3.2.4 of this report. The results were satisfactory.
 - 3.2.2 Impact Test – The model GM 01 manual spray applicator is required to be subjected to a impact test prior to the spark ignition test. The applicator was subjected to an impact energy of 2.0 ft-lb. (2.7 Joule) magnitude. The impact was obtained by dropping a 4 pound (1.8 Kg) weight from a vertical height of 6 in. (150 mm) onto the applicator, on all sides. The test mass was a steel hemispherical tip of 1 in. (25 mm) diameter. After the impact test, the applicator was examined to determine if it became electrostatically energized as to be a source of electric shock. The results were satisfactory, in that the applicator did not become energized as a result of the impact. Also after the impact test, the applicator was subjected to a spark ignition test, as outlined in section 3.2.4 of this report. The results were satisfactory.
 - 3.2.3 Arc Carbonization Test – The model GM 01 manual spray applicator is required to be subjected to an arc carbonization test prior to the spark ignition test. Arc carbonizing was conducted by drawing electrical discharges form the energized applicator electrode across the applicator's front

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surfaces to a 1 inch grounded stainless steel ball. After the arc carbonization test, the applicator was subjected to a spark ignition test, as outlined in section 3.2.4 of this report. The results were satisfactory.

- 3.2.4 Spark Ignition Test – The test apparatus consisted of a test gas mixture of air and methane with a concentration by volume of 12.0% methane. An ignition chamber of non-conductive material was constructed with a polyethylene membrane containing the test gas mixture. This provided the appropriate test environment in which to produce a spark discharge from the spray applicator. Energy from the spray applicator was discharged during the test period using a grounded test probe consisting of a 1 inch grounded stainless steel ball on a handle. Spark discharge occurred from the energized spray applicator by manipulating the grounded test probe. The test was performed using a spray applicator with its current limiting resistors value at their low end tolerance. The duration of the test was 10 minutes during which time the test gas mixture was passed continuously through the chamber.

This test was performed before the applicator was subjected to the required preconditioning test and the results were found to be satisfactory, in that no ignition of the test gas mixture occurred during testing. After all of the preconditioning of the applicator was completed, the spark ignition test was performed, in accordance with Factory Mutual Research standard Class 7260. The results of the spark ignition tests were satisfactory.

- 3.2.5 High Voltage Dielectric Test – A high voltage dielectric test, on the model GM 01 manual spray gun applicator, as outlined in clause 5.4 of FM standard class 7260 was performed. A test medium of air instead of oil was used. The test voltage used was 120 kV for one minute. Results were satisfactory, base on the fact that there was no breakdown of the spray gun applicator dielectric material.
- 3.3 Nonincendive Evaluation – The following test verify that the product listed in section 1.5 is a suitable for use in Class II & III, Division 2, Groups F & G hazardous (classified) locations. The focus of this portion of the evaluation was on the applicator's switches.
- 3.3.1 Make/ Break Evaluation –The trigger for the spray applicator consists a Reed relay to energize the applicator. The power supplied to the applicator from the control unit is not at an energy level which is ignition capable. In addition to the nonincendive energy levels of the output from the control unit, the power cable from the control unit to the spray applicator is tool secure to the applicator. No testing was required.
- 3.3.2 Temperature Evaluation – The client requested that the temperature rating of these units be evaluated for a maximum operating ambient temperature of 40°C. The dust-tight enclosure of the control unit and the vibrator prevent combustible dust from coming in direct contact with the units' components. Therefore, the outside temperature of the units' enclosures were the temperature of concern. The control unit and the vibrator were each operated under normal conditions and the outside of their enclosures were measured with the infrared detector. There was a temperature rise of less than 5K total on the outside of the enclosures during this test. Adding a measurement uncertainty of 5K, per FM class 3600, with an ambient temperature of 40°C yields a temperature code of T6 for the units for Division 2 operation. The temperature code is not required to be on the product, based on this temperature code.
- 3.4 Enclosure Evaluation – The following test verify that the product listed in section 1.5 is suitable for use in Class II & III, Division 2, Groups F & G hazardous (classified) locations. The focus of this portion of the evaluation was on the CG 01 control unit and the vibrator unit. The vibrator used is the model BM 50/3/M-G manufactured by O.M.B. srl.
- 3.4.1 Impact Testing – The model CG 01 control unit and the vibrator were subjected to impact energy of 2.0 ft-lb. (2.7Joule) magnitude. The impact was obtained by dropping a 4-lb (1.8-Kg) weight

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from a vertical height of 6-in. (150 mm) onto all sides of the enclosure. The test mass was a steel hemispherical tip of 0.98 inch (25 mm) diameter. The results were satisfactory in that no damage to the enclosure occurred which would comprise the enclosure's ability to exclude the ingress of dust.

- 3.4.2 Dust Exclusion Testing – The gasket for the control unit's enclosure is poured in place and therefore was subjected to the Aging Test as outlined in clause 14.1.4 of FM standard class 3611, prior to performing a dust test on the enclosure. The model CG 01 control unit was also subjected to a impact test prior to the dust test, as outlined in section 3.4.1 of this report. The enclosure of the CG 01 control unit was then subjected to the dust test as outlined in clause 14.3 in FM standard class 3611. The results of the dust test were satisfactory in that the sample excluded the entry of dust in accordance with the test requirements.

The model BM 50/3/M-G vibrator manufactured by O.M.B. srl. was also subjected to an impact test prior to the dust test. The enclosure of the vibrator was then subjected to the dust test as outlined in clause 14.3 of FM standard class 3611. The results of the dust test were satisfactory in that the sample excluded the entry of dust in accordance with the test requirements.

- 3.5 Protection Against Electrical Shock, Fire, and Injury – Electrical equipment acceptability is based on the ability of the equipment to minimize the risk of electrical shock, fire, and personal injury.
- 3.5.1 Accessible Parts – The highest operating voltage for the vibrator is 240 VAC, which is considered to be above hazardous live voltage potential. The only accessible conductive parts are the control unit's enclosure, however, the enclosure spacing from the input power of 240 V meets the requirement of 0.5 mm or greater and the enclosure is grounded. This is satisfactory.
- 3.5.2 Temperature Test – Based on the results of the temperature test performed in section 3.3.2 of this report, it was determined that no heating occurred which could cause a fire and the outer side surface of the enclosure did not exceed 100°C. This is satisfactory.
- 3.5.3 Motor Test – The model BM 50/3/M-G vibrator manufactured by O.M.B. srl. was prevented from starting while fully energized, as part of the single-fault testing requirements. The results were satisfactory, since the metal enclosure of the vibrator did not exceed 70°C and is not consider to be a burn hazard.
- 3.5.4 Stability Test – The MS 01 mobile trolley equipment, which uses a stirring device was used as the representative sample to perform this test. The trolley had a force applied at its top of 250 N, in all directions except upwards. The results were acceptable because the trolley did not become overbalance and tip over.

IV MARKING

The following information appears on the apparatus identified in Section 1.5 and meets Standard requirements:

- Manufacturer's name and manufacturing location.
- Type number
- Maximum input and output ratings
- The Factory Mutual Research mark of Approval

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V REMARKS

- 5.1 Installations shall comply with the relevant requirements of the latest edition of the National Electrical Code (ANSI/NFPA 70).
- 5.2 Corrective maintenance should be performed in accordance with the manufacture's instructions and by trained service personnel.

VI FACILITIES AND PROCEDURES AUDIT

The manufacturing sites in St. Gallen, Switzerland is subject to follow-up audit inspections. The facilities and quality control procedures in place have been found to be satisfactory to manufacture product identical to that examined and tested as described in this report.

VII MANUFACTURERS RESPONSIBILITIES

- 7.1 Documentation considered critical to this Approval is on file at Factory Mutual Research and listed in the Documentation File, Section VII of this report. No changes of any nature shall be implemented unless notice of the proposed change has been given and written authorization obtained from Factory Mutual Research. The Approved Product Revision Report, Form 797, shall be forwarded to Factory Mutual Research as notice of proposed changes.
- 7.2 The manufacturer shall provide a users manual with each unit.
- 7.3 On 100% of production the subject equipment the manufacturer shall perform an inspection to ensure that the protective grounding terminals are provided.
- 7.4 On 100% of production, the control units shall be subjected to routine dielectric tests. This test is to be conducted as a proof of workmanship verification procedure to assure that each production item retains the design quality intended to reduce the likelihood of electrical shock or fire. The test voltage is 820 Vr.m.s. or 1150 Vdc and shall be conducted between the mains terminals connected together and the enclosure of the control unit. The test voltage will be applied for 2 seconds. The test results are acceptable if there is no breakdown of the insulation between test points.

WARNING: The dielectric test required may present a hazard of injury to personnel and/or property and should only be performed under controlled conditions, and by persons knowledgeable of the potential hazards of such testing to minimize the likelihood of shock and/or fire.

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VIII DOCUMENTATION

Concerning the EASY 1-B, EASY 1- S, and EASY 1- F powder coating equipment, the documentation listed below are applicable to this Approval and are considered to be controlled documents, on file at Factory Mutual Research.

<u>Document No.:</u>	<u>Revision</u>	<u>Title</u>
132171	A	LABEL, FM EASY 1-B/ 2-B
132173	A	LABEL, FM EASY 1-F/ 2-F
132173	A	LABEL, FM EASY 1-S/ 2-S
MHB02-T026-2	03.10.2001	VIBRATOR OMB
MHB07-A001-4	6238	BLOCKSCHEMA CG 01
MHB07-A002-4	6238	STROMLAUFPLAN
MPC07-A001-3	6291	GM01 NEGATIV/ POSITIV
MHB07-A008-4	6725	CG01 MAINBOARD V3.0
MPC07-A007-4	10.05.01	GM01 OSC BOARD V3.0
MPC07-A003-4	6731	GM01 REMOTE CONTROL BOARD V3.0
MHB07-A009-4	6725	CG01 DISPLAY V3.0
MHB07-A005-4	6266	SWITCH PANEL CG01
MPC01-T008-2	A	DECKEL KPL
MPC01-Z001-2	-	HANDPISTOLE
MPC02-T005-3	A	FLACHSTRAHLDUSE KPL.
MHB01-T006-2	D	FRONTPLATTE VORMONTIERT
MHB01-T009-2	-	FRONTPLATTE KOMPLETT
MHB01-Z001-1	I	PISTOLENEINHEIT KPL.
MHB00-Z010-2	A	HANDGERAT MB01-1 KOMPLETT
MHB00-Z013-2	A	HANDGERAT MF01-1 KOMPLETT
MHB00-Z003-3	A	HANDGERAT MS01-1 KOMPLETT
MHA03-T040-3	-	GETRIEBEMOTOR KPL.
MHA03-T038-3	H	RUHRWERKSTEUERUNG KPL.
MPC02-T007-3	A	RUNDSTRAHLDUSE KPL.
MPC02-T010-3	-	RUNDSTRAHLDUSE KPL.

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IX CONCLUSION

The apparatus described in 1.5 meets Factory Mutual Research requirements. Approval is effective when the Approval Agreement is signed and received by Factory Mutual Research.

PROJECT DATA RECORD:

ID 3010607

TEST PERFORMED BY:


Aaron Coleman and John Wooley

ATTACHMENTS:

<u>Document No.:</u>	<u>Revision</u>	<u>Title</u>
132171	A	LABEL, FM EASY 1-B/ 2-B
132173	A	LABEL, FM EASY 1-F/ 2-F
132175	A	LABEL, FM EASY 1-S/ 2-S

REPORT BY:

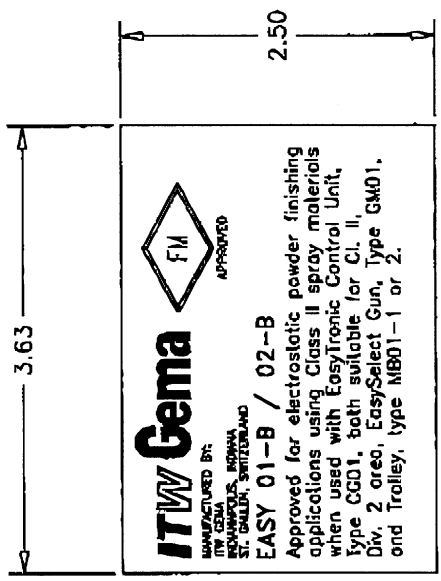
REPORT REVIEWED BY:


Aaron E. Coleman, Engineer
Electrical Group
Approvals Division


Donald E. Major, Tech. Team Manager
Electrical Group
Approvals Division

REV.	REVISION	DATE	CHGD	CHKD	APP.	E.C.N.	M
A	RELEASE TO MANUFACTURING	2/14/02	MSS	MRA	MJT	---	

132171



7. INK STAMP PART NO. 132171 AND LATEST REVISION LETTER OF THIS DRAWING ON REVERSE SIDE OF LABEL

6. LINES, LETTERS, NUMBERS, AND SYMBOLS TO BE BLACK; BACKGROUND TO BE CLEAR.

5. MAT'L: ADHESIVE BACKED CLEAR INLAR, .010 THK

THIS PART IS IN AN F.M. APPROVED ASSEMBLY THIS PART CANNOT BE CHANGED WITHOUT SUBMITTING TO F.M. FOR APPROVAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.	DRAWN M.S. SMITH	DATE 2/14/02
NEXT ASSEMBLY	CHECKED M.R. MCCLUNG	DATE 2/14/02
FINISH	ENG. APP. M.J. THIES	DATE 2/14/02
MATERIAL REFER TO NOTE #5.	THIS PRINT INCLUDING THE PRINCIPLE OF DESIGN IS THE PROPERTY OF AND IS SUBMITTED BY GEMA WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED FOR ANY PURPOSE WITHOUT WRITTEN PERMISSION FROM GEMA.	

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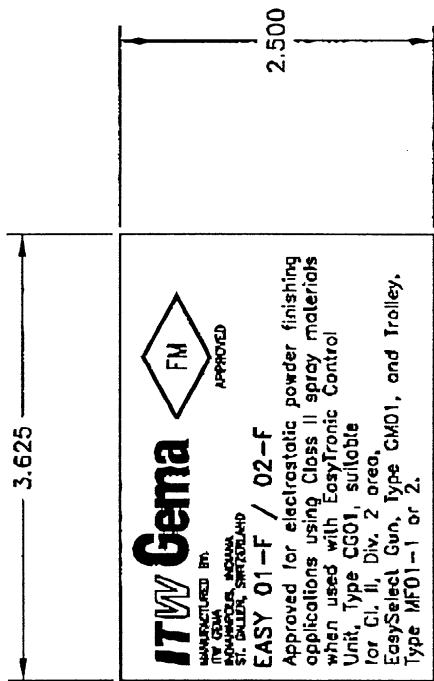
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EASY 1-B / 2-B

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ACAD REF. 132171			SHEET 1 OF 1

2/3

REV.	REVISION	DATE	CHGD	CHKD	APP.	E.C.N.	M
A	RELEASE TO MANUFACTURING	2/14/02	MSS	MRM	MJT	---	

132173



7. INK STAMP PART NO. 132173 AND LATEST REMSON LETTER OF THIS DRAWING ON REVERSE SIDE OF LABEL

8. LINES, LETTERS, NUMBERS, AND SYMBOLS TO BE BLACK, BACKGROUND TO BE CLEAR.

9. MAT'L: ADHESIVE BACKED CLEAR MYLAR, .010 THK

THIS PART IS IN AN F.M. APPROVED ASSEMBLY THIS PART CANNOT BE CHANGED WITHOUT SUBMITTING TO F.M. FOR APPROVAL

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NEXT ASSEMBLY	CHECKED M.R. MCCLUNG	DATE 2/14/02
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MATERIAL REFER TO NOTE #5.	THIS PRINT INCLUDING THE PRINCIPLE OF DESIGN IS THE PROPERTY OF AND IS SUBMITTED BY GEMA WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED FOR ANY PURPOSE WITHOUT WRITTEN PERMISSION FROM GEMA.	

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TITLE LABEL, FM
EASY 1-F / 2-F

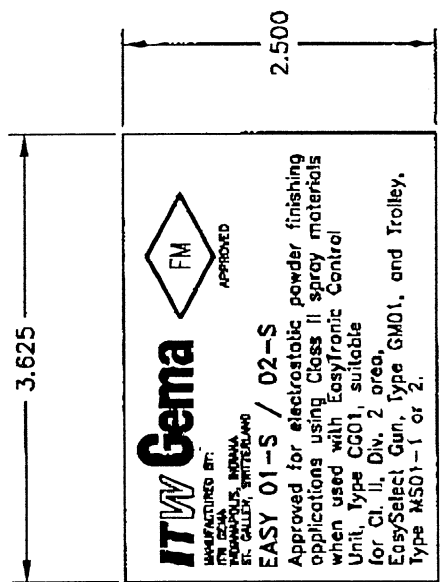
SCALE	SIZE	DRG. NO.	REV.
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ACAD REF. 132173 | SHEET 1 OF 1

3/3

REV.	REVISION	DATE	CHGD	CHKD	APP.	E.C.N.	M
A	RELEASE TO MANUFACTURING	2/14/02	WSS	MRM	MJT	---	

132175



7. INK STAMP PART NO. 132175 AND LATEST REVISION LETTER OF THIS DRAWING ON REVERSE SIDE OF LABEL

6. LINES, LETTERS, NUMBERS, AND SYMBOLS TO BE BLACK. BACKGROUND TO BE CLEAR.

5. MAT'L: ADHESIVE BACKED CLEAR MYLAR, .010 THK

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.	DRAWN M.S. SMITH	DATE 2/14/02
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TITLE LABEL, FM
EASY 1-S / 2-S

SCALE 1=1	SIZE B	DWG. NO. 132175	REV. A
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ACAD REF. 132175 | SHEET 1 OF 1