

**MATERIAL AND EQUIPMENT STANDARD**  
**FOR**  
**ROTATING ELECTRICAL MACHINES**  
**DIRECT CURRENT MOTORS**

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## 1. SCOPE

This Standard Specification covers the minimum technical requirements for design manufacture, quality control, testing and finishing of low voltage d.c. motors.

It specifies mechanical and electrical requirements covering dimensions of foot mounted, series, shunt or compound d.c. motors; excited compositely or separated.

The voltage and rating will be specified in data sheet.

Only the general requirements of d.c. motor are given in this Standard Specification, the specific requirements of individual motors will be given in pertinent data sheets and or requisition.

This Standard Specification shall be used for preparation of requisitions and purchase orders, and subsequently as a guideline for the manufacturers of the equipment described.

## 2. REFERENCES

The edition of the following Standards and Codes that are in effect at time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the vendor/consultant.

### IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 27	"Letters, Symbols to be used in Electrical Technology"
IEC 34.1	"Rotating Electrical Machines Part 1 Rating and Performance"
IEC 34.2	"Method of Determining Losses and Efficiency of Rotating Electrical Machinery from Test Excluding Machines for Traction Vehicle"
IEC 34.5	"Part 5 Classification of Degrees of Protection Provided by Enclosures for Rotating Machines"
IEC 34.6	"Part 6 Method of Cooling Rotating Machines"
IEC 34.7	"Part 7 Symbols for Type of Construction and Mounting Arrangements of Rotating Electrical Machine"
IEC 34.8	"Part 8 Terminal Marking and Direction of Rotation of Rotating Machines"
IEC 34.9	"Part 9 Noise Limits"
IEC 34.11	"Built in Thermal Protection"
IEC 34.13	"Part 13 Specification for Mill Auxiliary Motor"
IEC 34.14	"Part 14 Mechanical Vibration of Certain Machines with Shaft Height 56 mm and Higher-Measurement, Evaluation and Severity"
IEC 50	"International Electrotechnical Vocabulary"

IEC 72A	"Dimensions and Output Ratings for Foot Mounted Electrical Machines with Frame Numbers ( Where Applicable)"
BS 4999	"General Requirements for Rotating Electric Machine part 143. Specification for Tests"

## **ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)**

ISO 31/111	"Quantities and Units of Mechanics"
ISO 775	"Cylindrical and 1/10 Conical Shaft Ends"

### **Note:**

Where standards other than IEC are used manufacturer shall submit the pertinent deviations from IEC Standard Specification.

## **3. UNITS**

International system of units (SI) in accordance with IPS-E-GN-100 shall be used.

## **4. ENVIRONMENTAL CONDITIONS**

See Attachment 1.

## **5. BASIC DESIGN**

### **5.1 Construction**

The motor shall be horizontal and have its feet down, unless specified otherwise in data sheet.

### **5.2 Dimensions and Tolerances**

The mounting dimensions and tolerances associated with particular frame size shall be generally in accordance with Table 1 and Fig. 1 page 27 of IEC 34.13.

### **5.3 Enclosure and Cooling**

Motors shall have a degree of protection IP 41 for indoor and IP 54 for outdoor as defined in IEC 34.5, and shall have one of the following enclosures and method of cooling as defined in IEC 34.6:

- a) Totally enclosed (frame surface cooled with free convection IC 40).
- b) Duct ventilated (inlet duct circulated by independent coolant system, IC 17), if specified in data sheet.

### **5.4 Connection Leads**

The standard position of connecting leads shall be fixed vertical on top of the motor.

Alternatively conduit or terminal boxes may be provided when specified by purchaser.

## 5.5 Shaft Extension

The shaft taper shall be 1:10 to ISO/R 775.

A shaft extension key, a locking device and a nut shall be provided on drive end only.

A shaft guard (thimble) shall be provided on the non drive end.

The dimensions for the shaft extensions and key shall be in accordance with Table II of IEC 34.13.

### Note:

**It is recommended that the armature construction shall enable the motor shaft to be replaceable.**

## 5.6 Armature End Play

The axial end play of the armature shall not exceed 5 mm.

## 5.7 Rated Values

Motors shall be rated in accordance with the information listed in Table III of IEC 34.13. When tested on a direct current supply having no appreciable ripple (e.g. that obtained from a rotating generator source).

## 5.8 Motors Supplied from Rectified Power Supplies

Motors shall be suitable for satisfactory operation at the rated outputs listed in Table III of IEC 34.13 when supplied from rectified power source.

The manufacturer/supplier shall explain in his quotation the safe guards implemented in design of his d.c. motors against the ill effects of the ripple current and the high % of the phase control of rectified d.c. sources for power supply of d.c. motor(s), and precautions that shall be taken by user when ordering the required rectifier.

## 5.9 Field Voltage

The standard rated voltage for the field windings of separately excited motors shall be as specified in data sheet. Other voltages may be agreed between the manufacturer and the purchaser.

## 5.10 Winding and Insulation

Unless otherwise specified, the insulation of the windings shall be class "F", but the temperature rise of the machine shall be limited to that applicable to class "B" insulation.

All winding shall be adequately supported, braced and blocked to provide sufficient rigidity during normal conditions of service.

## 5.11 Ambient Temperature and Altitude

Motors shall be suitable for operation at temperature and altitude given in data sheet.

**Note:**

Manufacturer shall give his derating chart for other values of temperature and altitude.

## **5.12 Field Standstill Heating**

When supplied at the rated voltage, the separately-excited field windings of shunt and compound motors shall be capable of full continuous excitation at standstill without exceeding the design temperature rise.

## **5.13 Speed Regulation**

### **5.13.1 Adjustable speed motors**

The regulation of adjustable speed motors from no-load to the basic 60 min. rating for totally enclosed motors or at the continuous rating for ventilated motors shall not exceed the values given below as appropriate.

<b>Base speed (%)</b>	<b>Maximum regulation (%)</b>
<b>100</b>	<b>15</b>
<b>200</b>	<b>20</b>
<b>300</b>	<b>25</b>

### **5.13.2 Compound motors**

At the 60 min. rating for totally-enclosed motors or at the continuous rating for ventilated motors, the excitation shall be 50% shunt and 50% series to within the nearest whole number of series turns.

## **5.14 Variation in Speed Due to Heating**

The variation in speed from full load cold to full load hot during a run of rated duration shall not exceed 20% of the rated speed for totally-enclosed machines or 15% of the rated speed for ventilated machines.

## **5.15 Variation from Rated Speed**

At normal operating temperature, rated load and voltage, and at full field, the variation above or below the rated full field speed shall not exceed 7.5% .

## **5.16 Direction of Rotation**

All motors shall be capable of operation in either direction of rotation.



### 5.17 Moment of Inertia of Armature

The moment of inertia (I) of the armature in terms of  $mr^2$  (m = mass; r = mean radius of gyration) shall not exceed the appropriate value given in Table III of IEC 34.13.

**Note:**

The moment of inertia is defined in ISO Standard 31/III-1978, No. 3-9.1.

### 5.18 Maximum Speed

The motor shall be capable of running without damage at the appropriate maximum safe operating speed given in Table III of IEC 34.13.

### 5.19 Half Coupling

Design of half coupling shall be fully coordinated with manufacture of driven equipment whose address will be put in disposal of motor manufacturer.

### 5.20 Rating Plate Marking

The following minimum information shall be given on all rating plates.

- 1) The manufacturer's name, and order No.
- 2) The year of manufacture which may be included in the serial number.
- 3) The manufacturer's serial number.
- 4) The manufacturer's type designation.
- 5) The frame designation and shaft taper.
- 6) The number and date of the specification.
- 7) The rated d.c. voltage and current.
- 8) The rated power, and efficient.
- 9) The time rating at rated load.
- 10) Type of bearing.
- 11) The speed at rated output (rev/min.).
- 12) The maximum safe operating speed (rev/min.).
- 13) Field winding connections (shunt, compound, or series, and separate or composite excitation).
- 14) The excitation voltage.
- 15) The class of insulation.
- 16) The mass of the motor (kg).
- 17) The type of enclosure (as supplied).
- 18) The airflow ( $m^3/s$ ) and pressure (Pa) for continuous rating, ventilated.

## 6. INSPECTION, QUALITY CONTROL AND QUALITY RECORD

See Attachment 2.

## **7. TEST AND CERTIFICATION**

The tests shall consist of but shall not necessarily be limited to the following:

### **7.1 Type (Basic) Test**

The manufacturer/supplier shall submit documentary evidence of certificate of type (Basic) tests showing compliance with relevant section of IEC publication 34 or BS 4999 part 143 for following tests:

- Resistance of winding (cold)
- No load losses and current
- Temperature rise
- Test to establish efficiency
- Momentary overload
- Commutation
- High voltage
- Vibration

### **7.2 Routine Tests**

The following routine tests and checks shall be carried out before dispatch:

- Resistance of winding (cold)
- No load losses and current
- Commutation
- High voltage
- Noise measurement
- Examination of bearing
- Examination of accessories.

## **8. FINISH**

Manufacturer standard finish is acceptable, provided that it is compatible with specified environmental conditions mentioned in Attachment 1 unless otherwise stated in data sheet.

## **9. INFORMATION FOR MANUFACTURER/SUPPLIER**

See data sheet in Appendix A.

## **10. DOCUMENTATION/LITERATURE TO BE SUPPLIED BY MANUFACTURER/SUPPLIER**

### **10.1 At Quotation Stage**

**10.1.1** Supplier shall submit the following:

**10.1.1.1** Report of experience background, major clients, and annual sale for the similar equipment.

**10.1.1.2** Reference list showing the successful operation of equipment offered in major oil industries.

**10.1.1.3** Typical type tests certificate of similar equipment.

**10.1.2** Declaration of confirmation with the set standards and or clear indication of deviations from the standards and the specification.

**10.1.3** Drawings and documents ticked under column "required with quotation" in Appendix B.

**10.1.4** Performance characteristic curves.

**10.1.5** Specification for recommended starter and controller.

## **10.2 At Ordering Stage**

Information ticked under heading of "certified information with order" in Appendix B.

## **11. PACKING**

For general requirements see Attachment 4.

## **12. SHIPMENT**

For general requirements see Attachment 5.

## **13. GUARANTEE**

See Attachment 6.

## **14. SPARE PARTS**

See Attachment 7.

## **15. LANGUAGE**

See Attachment 8.

## **16. COORDINATION RESPONSIBILITY WITH OTHERS**

See Attachment 9.

## APPENDICES

## APPENDIX A

## EXAMPLE OF DATA SHEET FOR DIRECT CURRENT MOTORS

PROJECT NAME.....

SPECIFICATION  
NUMBER..... NUM-AREA CLASSIFICATION TO IEC 79  
.....

MOTOR TITLE.....

FRAME  
SIZE.....

MOUNTING : horizontal / vertical.....

SITE RATING.....kW (See environmental condition)

RATED VOLTAGE.....VOLT±10%

## SOURCE OF SUPPLY:

d.c. generator  
tor.....rectifier.....,,.....voltage of field winding of separately excited motor  
tor.....

## METHOD OF EARTHING:

.....

..

SPEED.....rpm

## TYPE OF MOTOR :

Series.....compositeexcitation.....separateexcitation

shunt.....compositeexcitation.....separateexcitation

compound.....compositeexcitation.....separateexcitation

## TYPE OF DUTY:

Continuous.....intermittent.....short  
time.....

## TYPE OF BEARING :

## DIRECTION OF ROTATION :

clock-  
wise.....Anticlockwise.....

**CLASS OF INSULATION:**

**PERMISSIBLE NOISE LEVEL:**.....dB  
(A).....

**DEGREES OF INGRESS PROTECTION TO IEC 34.5:**.....

(to be continued)

**APPENDIX A (Continued)**

**MEANS OF COOLING TO IEC 34.6:**.....

**THE POSITION OF TERMINAL BOX VIEWED FROM THE DRIVE END:**.....

.....

.

**THE ORIENTATION OF TERMINAL BOX:**.....

.....

..

**DESCRIPTION OF:**

Cable and core.....cable gland.....

Conduit and wire.....

**ACCESSORIES:**

Drain plug.....

Lifting eye bolt.....

Earthing bolt.....

**MOMENT OF INERTIA ( $I = mr^2$ ) OF DRIVEN MACHINE**.....kgm<sup>2</sup>

**NATURE OF LOAD:**.....

.....

.

**ISSUE OF HALF COUPLING:**.....

.....

.

**APPENDIX B**  
**LIST OF DRAWING, DOCUMENTS, MANUALS AND CERTIFICATES TO BE SUBMITTED**  
**BY MANUFACTURER/SUPPLIER IN NUMBERS AND THE TIMES**

DESCRIPTION		REQUIRED WITH QUATATION	CERTIFIED INFORM. REQ. WITH ORDER			NUMBER OF WEEKS BEFORE DELIVERY
			N0. OF COPIES		NUMBER OF WEEKS AFTER ORDER	
			REPRO-DICIBLES	PRINTED MATTER		
A	DRAWING AND OTHER DOCUMENTS:					
	a) ELECTRICAL EQUIPMENT:					
	1. DIMENSIONED OUTLINES AND FOUNDATION DETAILS					
	INCLUDING: CABLE ENTRIES AND CLEARANCES					
	2. DETAILS AND CROSS-SECTIONAL ARRANGEMENT					
	3. MOUNTING DETAILS					
	4. PERFORMANCE DATA (TYPICAL)					
	5. PARTS / MATERIAL LIST					
	6. RELEVANT CATALOGUES					
	7. NAME PLATES					
	8. LIST OF FINAL LABELS					
	b) TERMINATION:					
	1. CONNECTION DIAGRAM					
	2. TERMINAL BOX ARRANGEMENT					
	3. CONNECTION AND TERMINAL DESIGNATION					
	c) ELECTRICAL REFERENCE DOCUMENTS:					
	1. GENERAL DESCRIPTION					
	2. EQUIPMENT SPECIFICATION					
	3. PERFORMANCE DATA (ACTUAL)					
	4. DRAWINGS / PARTS / MATERIALS LIST					
B	INSTRUCTION MANUALS : (FOR ALL REQUIRED ITEMS)					
	1. INSTALLATION, COMMISSIONING AND INSPECTION					
	2. OPERATION AND MAINTENANCE					
C	SPARE PARTS REQUIREMENTS:					
	1. ILLUSTRATED SPARE PARTS					
	2. RECOMMENDED COMMISSIONING SPARE LIST					
	3. RECOMMENDED SPARES FOR THREE YEARS OPARATION					
D	CERTIFICATION:					
	1. PERFORMANCE TEST, MATERIALS CERTIFICATES AND					
	CURVES					

**ATTACHMENTS (General)****ATTACHMENT 1  
ENVIRONMENTAL CONDITIONS**

- 1.1** Site elevation : ----- meters above sea level.
- 1.2** Maximum ambient air temperature : ----- degrees centigrade. (Bare metal directly exposed to the sun can at times reach a surface temperature of ----- degrees centigrade.
- 1.3** Minimum air temperature : ----- degrees centigrade.
- 1.4** Relative humidity : ----- percent.
- 1.5** atmosphere : saliferous, dusty corrosive and subject to dust storms with concentration of 70 -1412 mg/cubic meter, H<sub>2</sub>S may be present, unless otherwise specified in data sheet.
- 1.6** Lightning storm isoceraunic level : ----- storm days/year.
- 1.7** Maximum intensity of earthquake ----- richters.

**Note:**

**Blanks to be filled by client.**



**ATTACHMENT 2**  
**INSPECTION, QUALITY CONTROL AND QUALITY RECORDS**

**2.1 Inspection, Quality Control**

**2.1.1** The purchaser's inspector, or his authorized representative shall have free access to the manufacturing plant engaged in the manufacture of the equipment, to carry out necessary inspection at any stage of work.

**2.1.2** Inspection may include the visit to quality control laboratories, work shops, testing bay etc.

**2.1.3** The supplier shall make available technical data, test pieces and samples that the purchaser's representative may require for verification in conjunction with pertinent equipment.

If required the supplier shall forward the same to any person or location that the purchaser's representative may direct.

**2.2 Quality Records**

**2.2.1** The supplier shall maintain appropriate inspection and test records to substantiate conformance with specified requirements.

**2.2.2** Quality record shall be legible and relevant to the product involved.

**2.2.3** Quality records that substantiate conformance with the specified requirements, shall be retained by manufacturer and made available on request by purchaser.

**2.2.4** The supplier shall establish and maintain procedure for identification collection, indexing, filing, storage, maintenance and disposition of quality records.

**2.2.5** Supplier shall submit to purchaser: reports, test schedules, and test certificates (in ----- copies) on completion of tests.

**Note:**

**Blanks to be filled by client.**

### **ATTACHMENT 3 TESTS AND CERTIFICATION**

#### **3.1 General Requirements**

**3.1.1** Test procedure as proposed by the supplier shall be agreed upon, and approved by the purchaser before any test is carried out.

**3.1.2** Purchaser may require witnessed tests to be carried out in the presence of his nominated representative who should be informed at least ----- weeks in advance of the date of the tests and confirmed ----- weeks before the tests.

**3.1.3** Test certificates and test reports shall refer to the serial No. of the equipment tested and must bear the purchaser's name, order No. and manufacturer's name and seal. The certificates shall be approved by the purchaser before shipment instruction are given.

**3.1.4** Approval by the purchaser's inspector or representative shall not relieve the vendor of his commitments under the terms of this specification or any associated order.

**3.1.5** The equipment may be rejected if measurement and inspection reveal any discrepancies between quoted figures resulting in purchase order and those measured actually.

**3.1.6** Any charges incurred by the tests quoted under heading of specific requirements for tests to be quoted as a separate item and are not to be included in the cost of the equipment.

**Note:**

**Blanks to be filled by client.**

## **ATTACHMENT 4**

### **PACKING**

**4.1** Equipment must be carefully packed to provide necessary protection during transit to destination and shall be in accordance with any special provision contained in the order.

**4.2** Special attention must be given to protection against corrosion during transit, and silica gel or similar dehydrating compound shall be enclosed.

**4.3** The method of cleaning preserving and the details of packing including moisture elimination, cushioning, blocking and crating shall be such that to protect the product against all damages or defects which may occur during handling, sea shipment to the port and rough road haulage to site and extended tropical open air storage generally as client general conditions of purchase see Attachment 10.

**4.4** All bright and machined parts must be given the protection against corrosion.

**4.5** Ancillary items forming an integral part of the equipment should be packed preferably in a separate container if the equipment is normally cased or crated.

Alternatively the ancillary items should be fixed securely to the equipment and adequate precautions taken to ensure that the item do not come loose in transit or be otherwise damaged.

**4.6** The supplier shall provide methods of handling to prevent damage and or deterioration during transit.

**4.7** Where deemed necessary each shipping section shall be furnished with removable steel angles.

**4.8** The requirements of above items shall not relieve the supplier of any of his responsibilities and his obligations for delivery of equipment in a sound undamaged and operable conditions at site.

#### **4.9 Identification for Shipment**

The marking and labels of products should be legible, durable and in accordance to specification.

Identification should remain intact from the time of initial dispatch at work to the final destination.

Marking shall be adequate for identifying a particular equipment in the event that a recall or inspection becomes necessary.

**ATTACHMENT 5**  
**SHIPMENT**

**5.1** If equipment shipped in separate parts each shipping section of stationary structures shall be provided with a permanently attached readily visible identification tag bearing the equipment number of the assembly to which it is a part.

**5.2** The greatest care must be taken to ensure that shipping and associated documents with exact description for customs release are accompanied with the shipment.

## **ATTACHMENT 6 GUARANTEE**

### **6.1 Clearance of Defects**

The supplier shall guarantee his equipment during commissioning and for one year operation starting from the completion of seven days continuous service test in site at full load against the following defects:

- All operational defects
- All material defects
- All constructional and design defects

### **6.2 Replacement of Defective Parts**

All defective parts shall be replaced by the supplier in the shortest possible time free of charge including dismantling reassembling at site and all transportation cost. The above mentioned period shall not however be longer than 18 months from the date of dispatch from the manufacturer's works.

### **6.3 Supply of Spare Parts**

Furthermore the supplier shall guarantee the provision of spare parts to the purchaser for a minimum period of ----- years from the date of dispatch.

### **6.4 After Sale Technical Services**

#### **6.4.1 Commissioning**

**6.4.1.1** The supplier shall quote if required for the services of competent engineer(s) and or technician(s) to assist in installation commissioning and testing of the equipment at site on a per diem basis.

**6.4.1.2** The quoted rates shall be irrespective of duration and frequency and the supplier shall guarantee the services of the engineer(s) and technician(s) on the specified date within a minimum of ----- weeks advance notice by the purchaser.

#### **6.4.2 Training**

**6.4.2.1** The purchaser may require the supplier to arrange for training of his personnel in the manufacturing plant and or in site for the operation and maintenance of the equipment offered.

**6.4.2.2** The supplier shall quote (if required) for the cost of any of above mentioned services on a per person per diem basis. The program for the training shall be prepared by mutual agreement. An advance notice of ----- weeks minimum, is required by purchaser for the commencement of training program.

**Note:**

**Blanks to be filled by client.**

**ATTACHMENT 7**  
**SPARE PARTS**

**7.1** All spare parts shall comply with the same standards, specification and tests of the original equipment and shall be fully interchangeable with the original parts without any modification at site.

**7.2** They shall be correctly marked in accordance with client reference and manufacturer part numbers, giving also the purchaser's order number.

**7.3** Spare parts shall be preserved to prevent deterioration during shipment and storage in humid tropical climate.

**7.4** List of recommended spare parts and interchangeability with spare parts of similar equipment shall be submitted by supplier.

**ATTACHMENT 8**  
**LANGUAGE**

**8.1** All correspondence drawings, documents, certificates, including testing operation and maintenance manuals and spare part lists etc. shall be in English.

**8.2** Offers in other languages will not be considered.

**ATTACHMENT 9**  
**COORDINATION RESPONSIBILITY WITH OTHERS**

**9.1** In case the equipment ordered should be mounted on, aligned, connected, adjusted, or tested with the equipment of other manufacturer(s) the supplier shall contact directly the said manufacturer(s) and supply and obtain all dimensional and technical informations and arrange for any interconnecting equipment and combined test that may be required.

**9.2** The supplier shall be responsible for correct and timely communication with the said manufacturer(s) and for any delay and/or cost claims arising from such communications.

**9.3** Copies of all correspondence should be sent to purchaser.


**9.4** The name and address of the manufacturer(s) will be given as soon as their orders have been confirmed.



**ATTACHMENT 10  
GENERAL CONDITIONS OF PURCHASE**

This document will be submitted by purchaser at the time of ordering.

**ATTACHMENT 11**  
**SAMPLES OF PURCHASER'S DRAWING TITLE BLOCK**

<b>DRAWING NO.</b>	<b>DESCRIPTION</b>				
<b>REFERENCE DRAWINGS</b>					
<b>D</b>					
<b>C</b>					
<b>B</b>					
<b>A</b>					
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>REF</b>	<b>CHK</b>	<b>APP</b>
<b>THE NAME OF RELEVANT COMPANY</b>					
<b>DRAWING TITLE :</b>					
<b>DRN. BY</b>	<b>SCALE</b>	<b>MICRO FILM CODE</b>	<b>PROJECT NO.</b>	<b>CHK. BY</b>	<b>APP. BY</b>
<b>JOB NO.</b>	<b>AREA CODE</b>	<b>DWG. NO.</b>	<b>SHEET</b>	<b>REV.</b>	

**Note:**

Appropriate Nomenclature and Registered mark shall be used for quotation and order.

**ATTACHMENT 12**  
**INSTRUCTIONS OF PURCHASER ABOUT PERTINENT DRAWINGS**

**12.1** Purchaser's drawing title block, "the sample of which is given in Attachment 11 shall be shown in the right lower corner of the drawings.

**12.2** Drawings are to be protected and packed. Negatives must be dispatched in a strong card board cylinder.

**12.3** Drawings must be rolled and not folded.

**12.4** All drawings, documents and literatures shall be forwarded under cover of a fully detailed letter to purchaser whose addresses given in Attachment 14.

**Note:**

**Blank to be filled by client.**

### ATTACHMENT 13

#### MATERIAL, LAYOUT AND LETTERING OF LABELS

Label material to be "Traffolite" 5 mm. Thick having two outer letter to be engraved into the white layer to give black lettering on a white background.

TYPE	HEIGHT	WIDTH mm	STROKE	CASE		LETTERS / 25 mm	SAMPLE
A	5	WIDE	LIGHT	UPPER	CASE	$7\frac{1}{2} \pm 1.2\text{mm. TOL}$	ABCDEFGHIJKLM
B	5	WIDE	HEAVY	"	"	$7\frac{1}{2} \pm 1.2\text{mm. TOL}$	
C	5	NARROW	LIGHT	"	"	$11 \pm 2.5\text{mm. TOL}$	
D	5	NARROW	HEAVY	"	"	$11 \pm 2.5\text{mm. TOL}$	
E	3	WIDE	LIGHT	"	"	$10 \pm 1.2\text{mm. TOL}$	
F	3	WIDE	HEAVY	"	"	$10 \pm 1.2\text{mm. TOL}$	
G	3	NARROW	LIGHT	"	"	$15 \pm 1.2\text{mm. TOL}$	
H	10	WIDE	HEAVY	"	"	$3\frac{1}{2}$	
J	12	WIDE	HEAVY	"	"	$2\frac{1}{2}$	

**Note:**

Height is in millimeters.

(to be continued)

ATTACHMENT 13 (continued)

<b>LAYOUT 1</b>				
LETTER TYPE	G	LETTERS MAX / LINE	28	
	E & F		19	
<b>LAYOUT 2</b>				
LETTER TYPE	G	LETTERS MAX / LINE	28	
	E & F		19	
<b>LAYOUT 3</b>				
LETTER TYPE	A & B	LETTERS MAX / LINE	22	
	C & D		23	
	E & F		30	
	G		45	
<b>LAYOUT 4</b>				
LETTER TYPE	A & B	LETTERS MAX / LINE	22	
	C & D		23	
	E & F		30	
	G		45	
<b>LAYOUT 5</b>				
LETTER TYPE	H	LETTERS MAX / LINE	15	
	J		10	
<b>LAYOUT 6</b>				
LETTER TYPE	A & B	LETTERS MAX / LINE	28	
	C & D		40	
	E & F		40	
	G		58	
<b>LAYOUT 7</b>				
LETTER TYPE	A & B	LETTERS MAX / LINE	28	
	C & D		40	
	E & F		40	
	G		58	

ALL DIMENSIONS ARE GIVEN IN mm.

MIN = MINIMUM

**ATTACHMENT 14  
FULL ADDRESS OF PURCHASER**

.....  
 .....  
 .....  
 .....

**P.O.BOX      No.....                      CODE No.....**

**TELEPHONE   No.....**

**TELEX           No.....**

**FACSIMILE    No.....**

**Note:**

**Blanks to be filled by client.**