



## **National Skill Competitions**

### **Skill- Plastic Die Engineering**

Category: Manufacturing & Engineering  
Technology



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## Section - A

### A. Preface

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#### **Skill & Role Explained:**

Plastic Die Engineers are engaged in the mass production of plastic products of high quality at low cost. This is achieved by producing a mould based on drawings created by a competent designer who understands design for manufacturing and assembly principles, having hands on injection moulding, mould making, plastic part design, and mould design software experiences.

The designing and processing of a mould is done with the help of CAD/CAM (Computer Aided Design/Computer Aided Machining) systems. Most of the machining is done on CNC (Computer Numerical Control) machining centres. The machined parts are then polished according to requirements and assembled as per drawing to keep them ready for trial. A completed mould will be then installed in an injection moulding machine. The raw plastic material is melted in the moulding machine and then injected into the mould, where it cools and solidifies into the final product.

This is a very rewarding profession. Plastic Die Engineers are increasingly in demand. An industrial market research consultancy specializing in plastic products and appliances, predicts that the world's use of commodity plastic will reach 510 million tons in 2020. Plastic Die Engineering is a fast-paced world which is highly creative and full of opportunities for skilled and talented people. It is an essential aspect of engineering because most plastic parts cannot be made without a die. Therefore, Plastic Die Engineers are a critical link in the overall plastic injection moulding process.

Light weight, availability of various designs, and cost reduction are the greatest advantages to industries. Since plastics are used in thousands of products that add comfort, convenience and safety to our lives the demand for plastic die engineering skills has significantly increased over the years. Plastic injection moulded components are used in telecommunications, medical, aerospace, and automobile industries, for home appliances, office automation, entertainment, and electronics. Thus the range of different fields of requirements provide many challenges, ranging from, designing an appropriate mould to programming for machining mould elements, working on machines, inspecting, polishing, matching, assembling of parts, moulding and trouble shooting of moulding defects for good mass production.

The skilled practitioner needs excellent levels of skill in numeracy, hand and machining skill, polishing, assembling, testing, and troubleshooting.

#### **Eligibility Criteria (for IndiaSkills 2018 and World Skills 2019):**

Competitors born on or after 01 Jan 1997 are only eligible to attend the Competition.

**Total Duration:** As per Module



## Section – B

### B. Test Project\*

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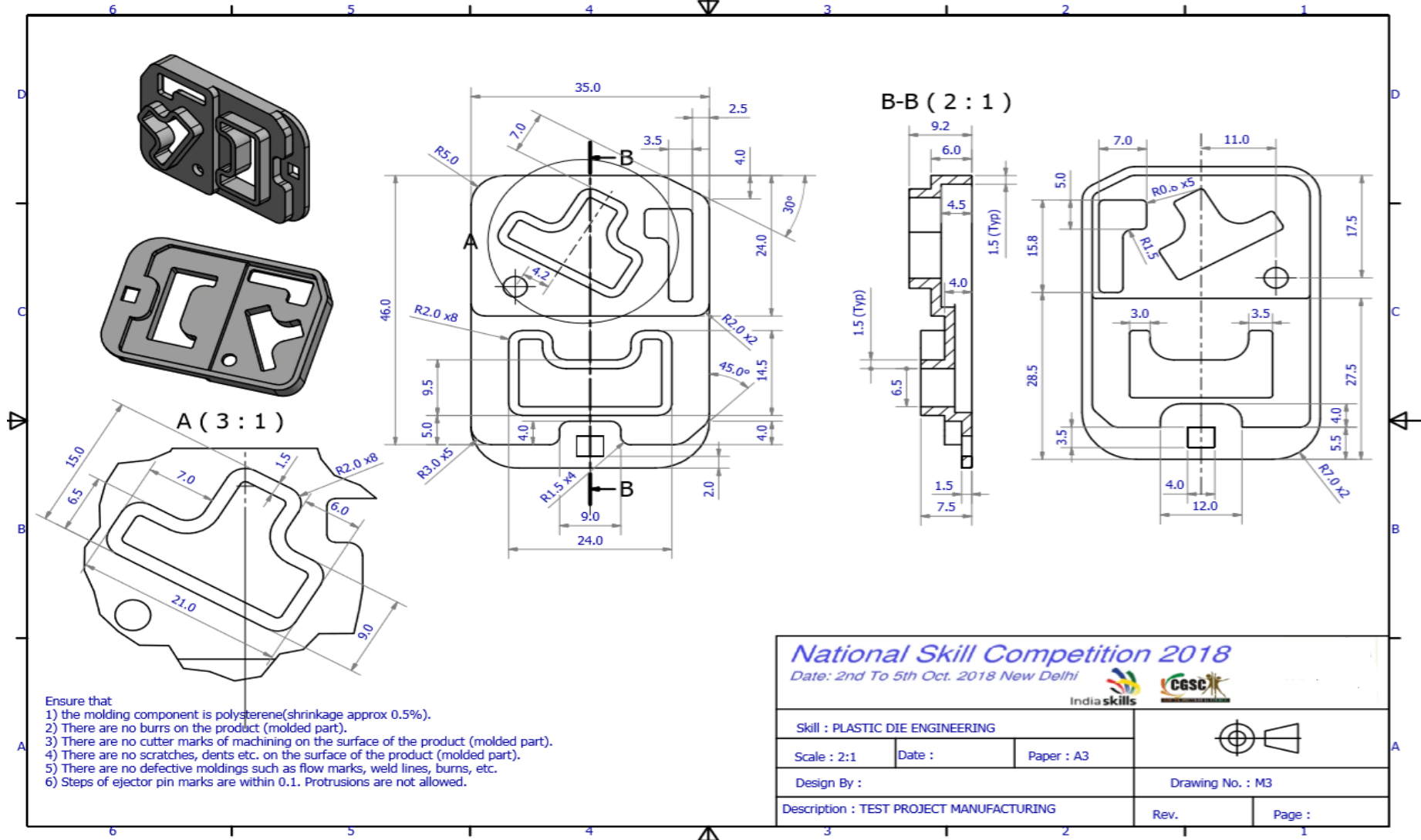
The Drawings of Test Project is mentioned below. The final Test Project has undergone upto 30% change including Main and Secondary Dimensions.







**Module 3\***



- Ensure that
- 1) the molding component is polystyrene (shrinkage approx 0.5%).
  - 2) There are no burrs on the product (molded part).
  - 3) There are no cutter marks of machining on the surface of the product (molded part).
  - 4) There are no scratches, dents etc. on the surface of the product (molded part).
  - 5) There are no defective moldings such as flow marks, weld lines, burns, etc.
  - 6) Steps of ejector pin marks are within 0.1. Protrusions are not allowed.

<b>National Skill Competition 2018</b>			Date: 2nd To 5th Oct. 2018 New Delhi			
Skill : PLASTIC DIE ENGINEERING						
Scale : 2:1	Date :	Paper : A3		Drawing No. : M3		
Design By :					Rev.	
Description : TEST PROJECT MANUFACTURING					Page :	

\*Base Skills Copy Right: World Skills International



## C. Marking Scheme

### Marking Scheme:

The Assessment is done by awarding points by adopting two methods - Measurement and Judgments.

- Measurement - One which is measurable
- Judgments - Based on Industry expectations

Aspects are criteria's which are judged for assessment

### ASSESSMENT AND MARKING USING JUDGEMENT

Judgment uses a scale of 0-3. The 0-3 scale to indicate:

- ❖ 0: performance below industry standard
- ❖ 1: performance meets industry standard
- ❖ 2: performance meets and, in specific respects, exceeds industry standard
- ❖ 3: performance wholly exceeds industry standard and is judged as excellent

### Example-Judgment Marking

If maximum marks for Judgment criteria is 1 and if all 3 Experts (Juries) give 3 points to a candidate, the candidate will get 1 mark for that aspect. If 2 Experts give 3 and 1 Expert gives 2 points, then candidate will get  $(3+3+2)/9*1 = 0.89$  marks for that aspect out of 1 mark.

### Marking Pattern

The marking format will follow the World Skills Marking Pattern

	Criteria	Mark
A	Part Modelling	15.00
B	Mould Design	20.00
C	Machining	30.00
D	Assembly & Injection Moulding	35.00



PDE\_Draft  
marking\_scheme.xlsx

## COMPLETION OF SKILL ASSESSMENT SPECIFICATION

### A — Mould Design

• 3D model: • Presence of part features; • Shrinkage added; • Placement of component; • Size of the insert; • Parting surface; • Creation of sprue, runner and gate; • Ejector pin holes; • Assembling all elements; • Converting 3D into 2D.

· Drawings and Presentation: • Assembly drawing title block (title block should contain title, designed by, date, scale, sheet no. etc.) • Assembly drawing in isometric shaded view; • Assembly drawing part list (all the parts should be included); • Assembly drawing balloons (all the parts should be ballooned); • Top view (core half - all visible details); • Section view (assembly as per section); • Top view (Cavity half - all visible details); • Dimensions (as required); • Tolerances (GD &T as required); • Surface finish (as required); • Visual clarity.

### B — Machined parts (die)

• Main dimensions of die: • Main dimensions are specified in the drawing and known to Competitor; • Secondary dimensions; • Secondary dimensions are specified in the drawing and known to Competitor; • The dimensions are calculated and indicated on drawings by the Competitors themselves in consideration of shrinkage of the product; • For the shrinkage percentage of the plastic material, the value indicated on the data sheet must be known to the Competitors.

· Use of material: • The Workshop Manager must prepare sufficient spare material for machining; • A Competitor has only one opportunity to request one piece of material per module; • There will be loss of marks for any additional material used.

### C — Assembly and injection moulding

• Assembly conditions: • Assembly condition of the die will be checked for completeness of assembly, proper tightening of screws, ejector working conditions, and appearance of the total die excluding the product moulding area; • Ejector working conditions; • Bolt tightening; • Scratch on surface excluding the product area. • Process: • Automatic moulding; • Teams of Experts must evaluate if an automatic moulding of the product is possible. Setting of the basic process parameters is the task of the Injection Moulding Machine Technician. If the Competitor makes a special request to the technician, the technician adjusts the parameters. Ten shots are taken to evaluate the process. For each shot, where the product falls without anybody pulling it out or kicking it off the ejector pins the Competitor gets one point. • A team of Experts assigned together with the Injection Moulding Machine Technician will evaluate the process; • The Competitor will select any two samples from the lot for product evaluation.

· Conformity to product forms product layout, etc. • Arc, round, fillet and chamfer size (only visual inspection); • Position of features (only visual inspection); • Main dimensions • Main dimensions are specified on the product and known to the Competitors. • Secondary dimensions • Secondary dimensions are specified on the product and known to the Competitors. • Surface quality (Experts visually inspect the product and looks for surface quality.) • Ejector pin unevenness; • Burn mark; • Scratch at ejection; • Weld mark; • Machine mark; • Burr.

## Section – D

### D. Infrastructure

- Workshop Installation-Tools & Equipment positioned by Organizers
- Tool Kit-Tool & Equipment allowed to be brought by competitors for competitions

The above will be decided during the Skill Manager & Jury. The details need to be worked out by candidates.

### Infrastructure

The students are advised to bring their Toolkit.  
The specifications of the machines and control panel details have been shared with participants along with the specifications of software and hardware.

<b>3. Plastic Die Engineering</b>			
S. No	Key Aspects	Machine Type-1	Machine Type-2
1	CNC Machine make and Model	<b>CNC MILLING MACHINE JYOTI PX-30</b> 1.Axis Traverse:- X-Axis Travel = 760mm Y-Axis Travel = 410mm Z-Axis Travel = 510mm 2.Table Size :- 915mm x 360mm 3. Table Loading Capacity: - 500Kg. 4.Spindle Motor Power :- 5.5/7Kw 5.Tool Adaptor :- BT-40 6.Rapid Traverse :- 25M/min 7.Cutting Feed :- 10000mm/min 8.Positioning Accuracy :- 0.010mm 9.Repeatability :- 0.005mm 10.USB Support :- Yes RPM: 8000 R.P.M	<b>CNC MILLING MACHINE BFW (SURYA)</b> 1.Axis Traverse:- X-Axis Travel = 800mm Y-Axis Travel = 350mm Z-Axis Travel = 380mm 2.Table Size :- 315mm x 1060mm 3. Table Loading Capacity: - 300Kg. 4.Spindle Motor Power :- 3.7/5.25Kw 5.Tool Adaptor :- BT-40 6.Rapid Traverse :- 10 m/min 7.Cutting Feed :- 5000 mm/min 8.Positioning Accuracy :- 0.010mm 9.Repeatability :- 0.005mm 10.USB Support :- Yes 11. RPM: 6000 R.P.M
2	CNC Programming Language	ISO	ISO
3	CNC Controller	SIEMENS 828D	SIEMENS 828D
4	Tools (HSS/Carbide)	Carbide (Participants can also bring and use their tools)	Carbide (Participants can also bring and use their tools)

5	Job Type	As per WSS; Also Refer Past WSC drawings	As per WSS; Also Refer Past WSC drawings
6	Software Available	<ul style="list-style-type: none"> <li>For designing the Core and Cavity- Auto Desk Inventor</li> <li>For Machining: Mastercam 2D-Version – MasterCAM-X9 and 2018(Participant can select)</li> </ul>	<ul style="list-style-type: none"> <li>For designing the Core and Cavity- Auto Desk Inventor 2018</li> <li>For Machining: Mastercam 2D-Version – MasterCAM-X9 and 2018(Participant can select)</li> </ul>
7	Raw Material of the Job	Aluminium & Steel	Aluminium & Steel
8	Allocation of Machines and Tools to Participants	Allocation of Machines and Tools to participants will be done by Lottery; Decision of Jury will be final in case of any other requirement/variation.	

Tough the specification of Machines may be different but the specifications such as RPM, feed etc are made similar.

## Section – E

### E. Instructions for candidates

#### Instruction for Competitors

- Interpret engineering drawings and follow the specifications
- All must have clear understanding of the drawing and the task before commencement
- In case of malfunctioning of the machines the competitor must report to the Jury
- The candidates should bring their standard PPE and Safety Shoes.
- Candidates should read, enquire and follow machine safety manuals.



## Section – F

### F. Health, Safety, and Environment

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1. All accredited participants, and supporting volunteers will abide by rules and regulations with regards to Health, Safety, and Environment of the Competition venue.
2. All participants, technicians and supporting staff will wear the required protective Personnel clothing. Protective clothing must be selected according to the activity and related risk. When working with rotating machines, individuals must ensure that close-fitting clothing is worn, in order to avoid clothing becoming entangled in the equipment. Jewellery and long hair are a safety hazard and shall be taken off or covered.
3. All participants will assume liability for all risks of injury and damage to property, loss of property, which might be associated with or result from participation in the event. The organizers will not be liable for any damage, however in case of Injury the competitor will immediately inform the immediate organizer for medical attention.