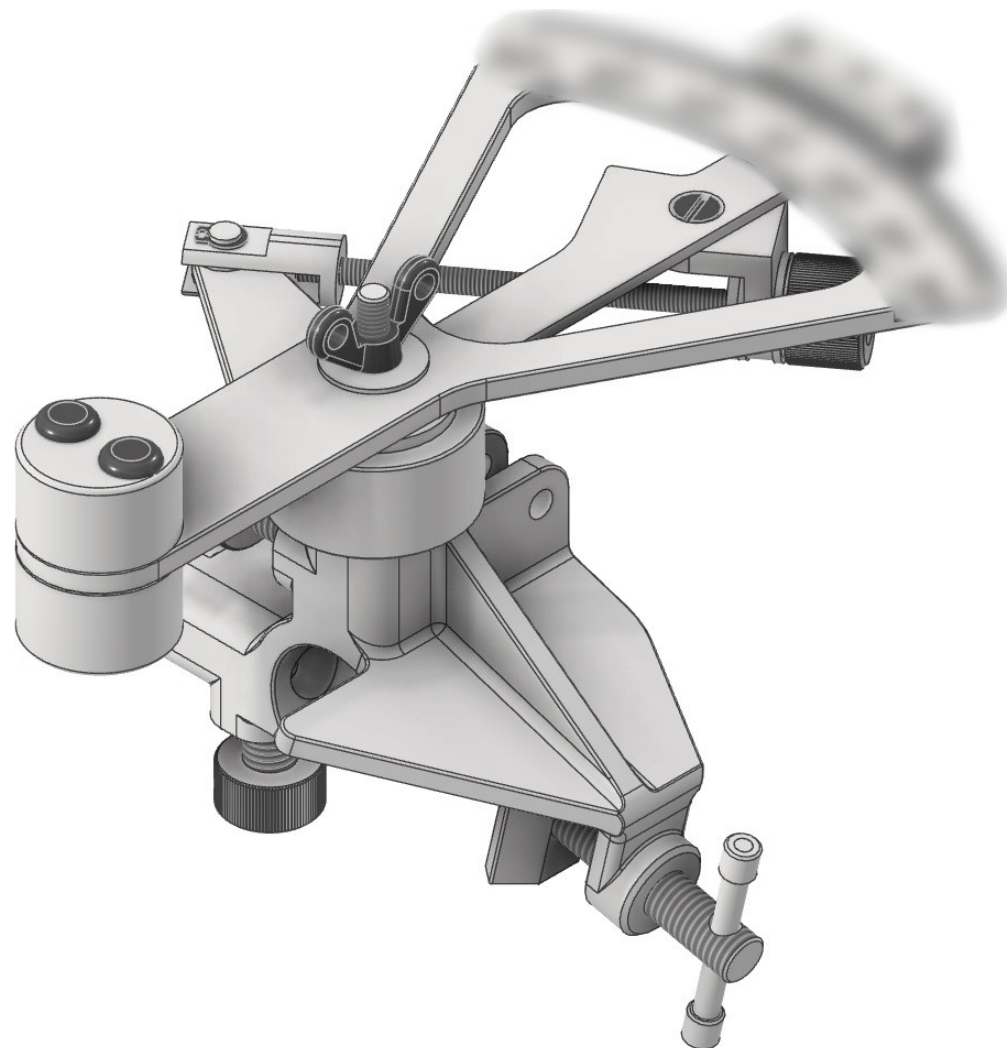


SU-30MKI TOOLBOX

INDIGENIZED GROUND EQUIPMENT



A foreign-made ground toolbox for the Su-30MKI, studied piece by piece and rebuilt in India to lower its cost to the Indian Air Force.

Built using Autodesk Inventor

5/16

Devices showcased
From the complete toolbox

205

Part designs
Across all 16 devices

25+

Sets delivered
Made by a HAL vendor

6

Critical systems
Ailerons, canards, rudder, control stick, pedals and RBF pins

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The fleet's ground tools were imported and costly to replace. **We rebuilt them for local manufacturing.**

01 STUDY

Foreign-made samples from the Su-30MKI toolbox, examined device by device through NDT and careful teardown.

02 MEASURE

Every feature photographed against a scale, then measured by hand. No 3D scanning was used.

03 MODEL

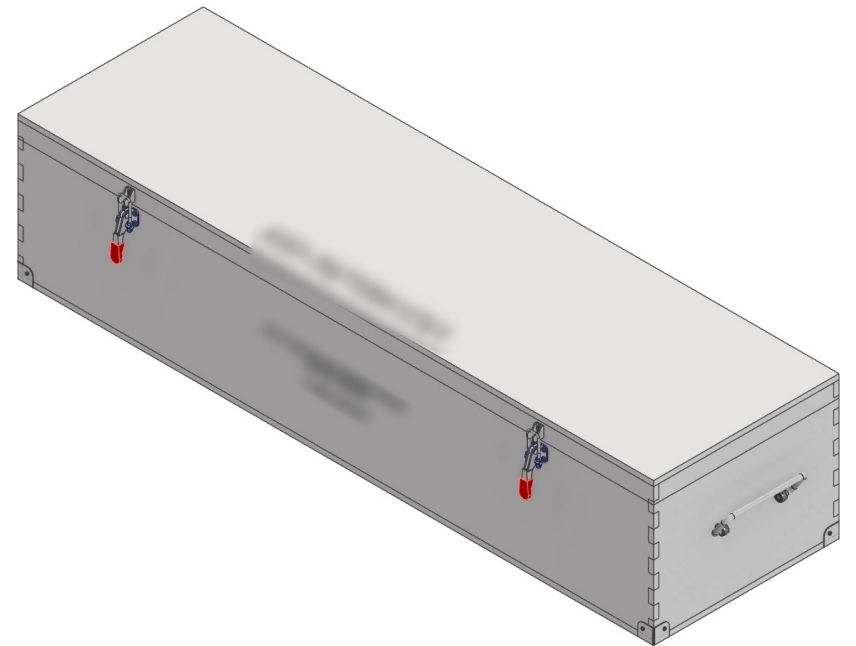
Each device parametrically rebuilt in CAD, part by part, with a drawing for every part.

04 APPROVE

Models, drawings and inspection reports taken through HAL's approval process, over months of refinement.

05 PROVE

Prototypes made and tested on the aircraft before the sets were manufactured.



WHAT THE TOOLBOX HOLDS

Ground equipment that maintenance crews use to set up and check the aircraft's flight controls. Each device had to be an exact replica of the original in form and function, giving the same readings.



01

MEASUREMENT SCALES

Scales that sit on the airframe and read angles or positions directly with moving indicators.

02

DYNAMOMETERS

Force gauges that measure the effort needed to move the stick and pedals.

03

CALIBRATION

Protractors and gauges that check the travel and deflection of each control surface.

04

CASINGS

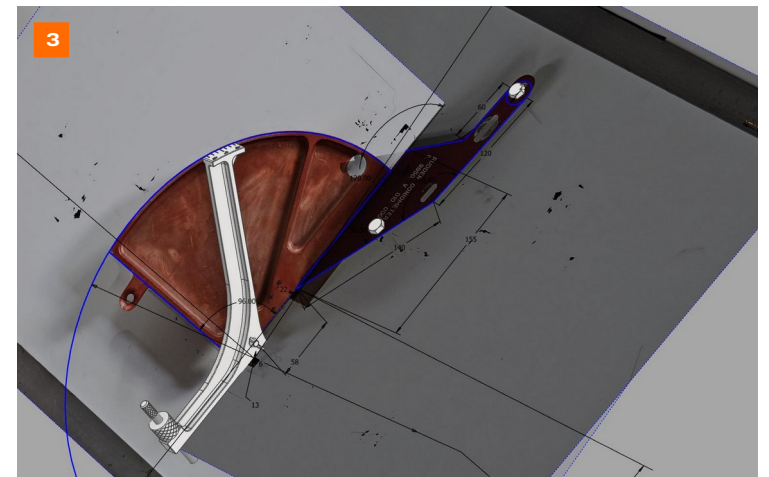
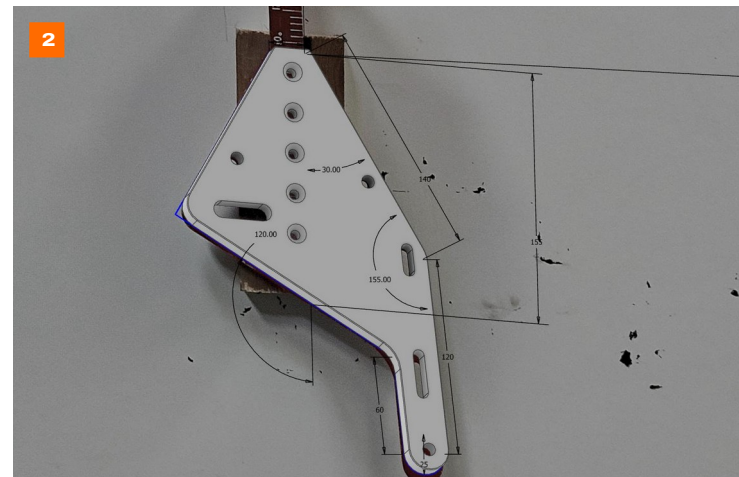
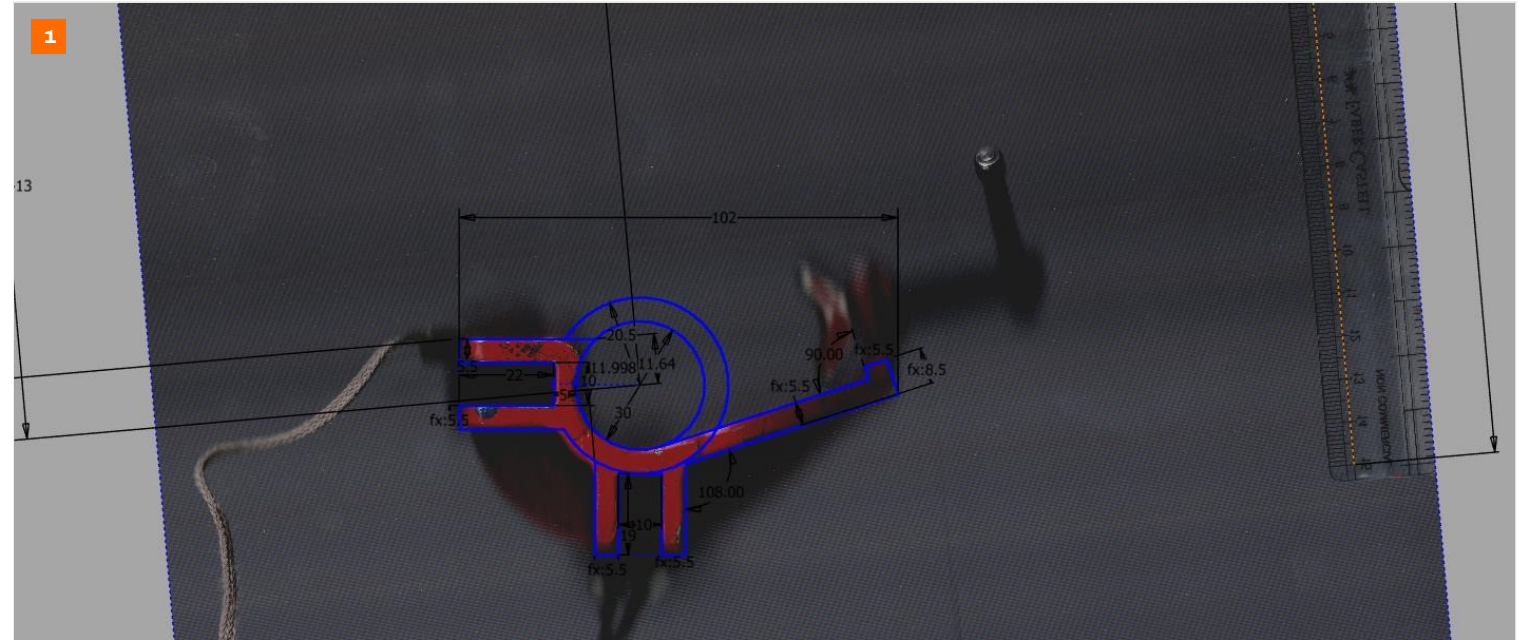
Cases and housings that carry and protect the devices and their components.

05

RBF PINS

Remove-before-flight pins that lock the ailerons, control stick, rudder and other parts on the ground.

There was no documentation to start from, only the field samples. Each part was photographed square to the lens beside a reference, and the photo was scaled in CAD to trace its outline. Every hole, slot, radius and thickness was then measured on the sample and checked against the model. This kept the work moving before a 3D scanner was available.

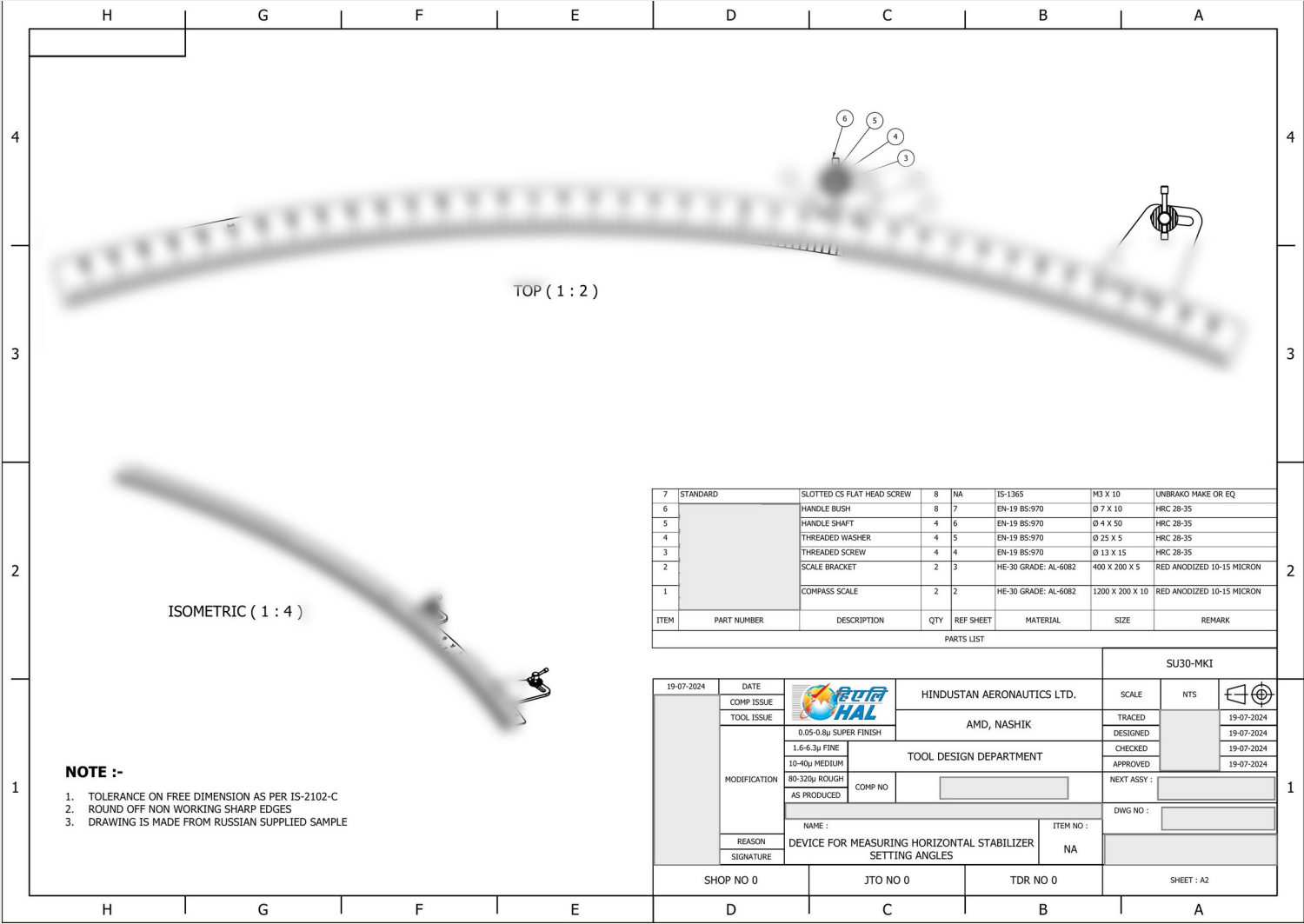


- 1 Pivot arm traced over its photo
- 2 Mounting plate, dimensioned
- 3 Scale arm and quadrant

STABILIZER SETTING RULER

A curved, graduated ruler that sits on the horizontal stabilizer and reads its setting angle. It is made as a left and right pair, one the mirror of the other.

PARTS	6 part designs, made in LH/RH
SHEETS	7
MATERIAL	EN-19, 6082 aluminum

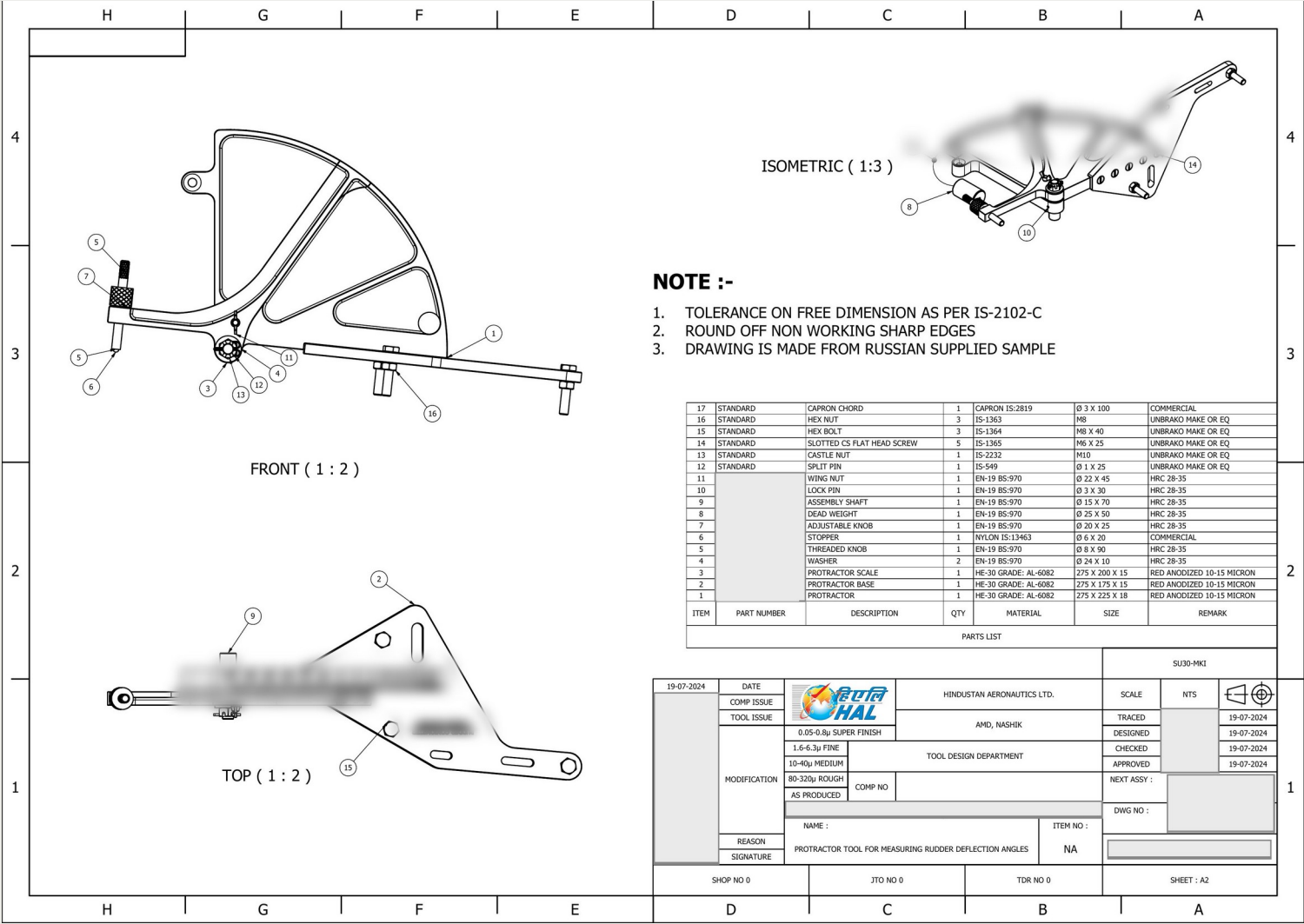
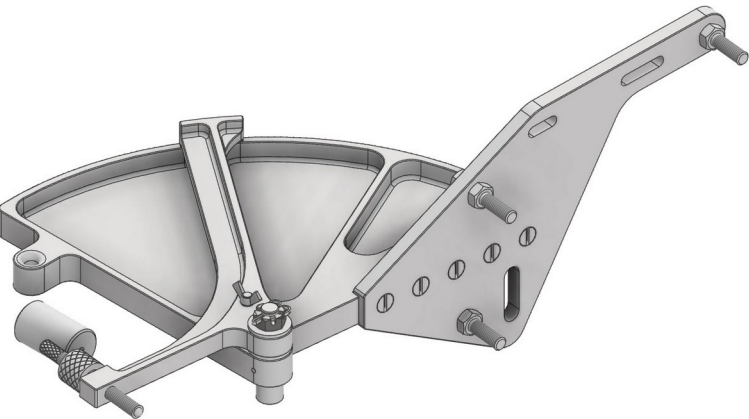


ASSEMBLY DRAWING, SHEET 1 OF 5

RUDDER PROTRACTOR

Reads the rudder's deflection angle either side of neutral. A quadrant scale mounts on the fin and a pointer follows the rudder as it moves.

PARTS	11 part designs
SHEETS	12
MATERIAL	EN-19, 6082 aluminum, nylon



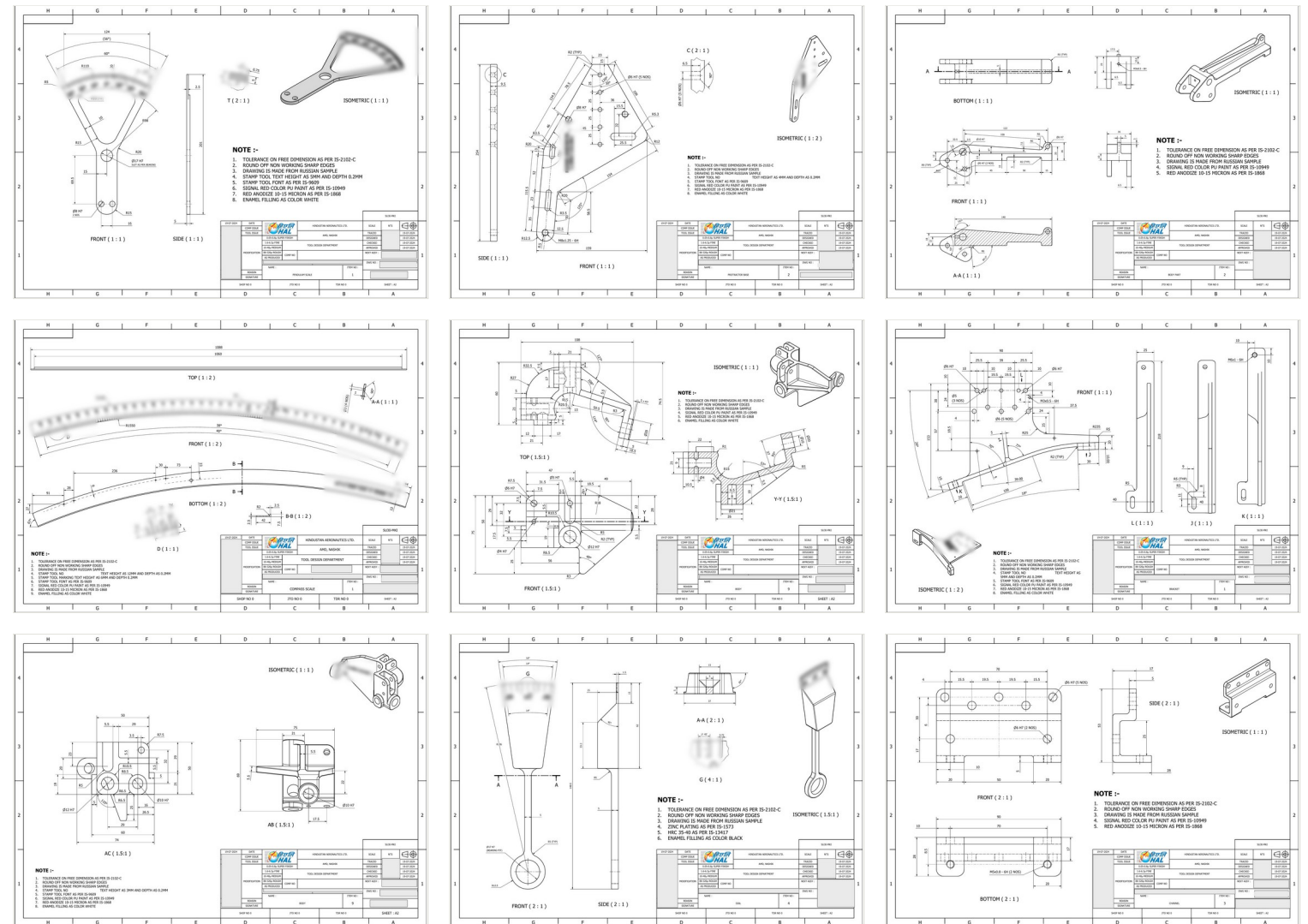
ASSEMBLY DRAWING, SHEET 1 OF 6

This diagram shows an exploded view of a mechanical assembly. The main component is a large, L-shaped bracket with a curved section. A long, thin rectangular plate is positioned horizontally, with several screws and a small cylindrical pin being inserted into it. A separate cylindrical rod is shown above the plate. Two small, T-shaped components are positioned to be inserted into slots on the right side of the plate. The diagram illustrates the assembly process for a mechanical part.



A DRAWING FOR EVERY PART

Each part has its own shop-floor sheet: views, dimensions and tolerances, material and stock size, hardness, plating or anodizing, and the markings to stamp and paint.



COMPLIANCE IS 2102-C, IS 10949, IS 1868, IS 6057, IS 2932, IS 1573, IS 13417, IS 9609, IS 816, BS 970, BS 2751

STEEL EN-19 and EN-24, HRC 28 to 35

ALUMINUM 6082, anodized 10 to 15 μm

MARKING Stamped scales, PU paint, embossing

Every device went through HAL's design approval process,
then field trials on the aircraft.

01**02****03****04****05****3D MODEL**

The complete device, modeled from the sample, then reviewed and approved.

2D DRAWINGS

Assembly and part drawings, checked sheet by sheet against the samples.

PROTOTYPE

Made to the approved drawings and inspected on a CMM.

FIELD TRIALS

Prototypes used on the aircraft by the crews who need them, with the results cross-checked.

SETS ORDERED

With the trials passed, multiple sets were cleared for manufacture and delivered by the vendor.

MACHINED, CAST, PRINTED & MORE

The prototypes were CNC machined and refined over several iterations, each checked against the samples. Complex shapes that would be slow or costly to machine from solid were 3D printed as patterns, sand cast, then machined to size. Finishes such as glass-bead blasting, anodizing, enamel coating and laser engraving were chosen to suit how the sets are used in service.

1 Machined prototype parts

2 SLA printed pattern for a cast part



When a tool or spare has no drawings, we can rebuild it for you.

- 01** STUDY Samples of tools, fixtures or parts, examined and photographed in detail.
- 02** MEASURE Feature by feature, by hand or with a 3D laser scanner.
- 03** MODEL Complete assemblies in CAD, every part recreated as it will be made.
- 04** DRAW Shop-floor drawings to your standards and title block, ready for approval.
- 05** PROVE Prototypes machined, printed or fabricated, then tested and revised.



REPRESENTATIVE PHOTOGRAPH

LET'S BUILD THE NEXT ONE

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