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|  | SARA SAE ENGINEERING SPECIFICATION |             |
|  | Section: SES 26 - 786              |             |
|  | Issue: "A"                         | Rev No: "0" |
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**EN 24 HARDENING ALLOY STEEL WITH HIGH TENSILE STRENGTH  
AND 95,000 PSI OF MINIMUM YIELD STRENGTH**

| Rev | Reason of Change | Date       | Made By | Reviewed By | Approved By | Status   |
|-----|------------------|------------|---------|-------------|-------------|----------|
| 0   |                  | 14-05-2015 | NS      | ND          | ^KKD        | Released |





## EN 24 HARDENING ALLOY STEEL WITH HIGH TENSILE STRENGTH AND 95,000 PSI OF MINIMUM YIELD STRENGTH

### 1.0 SCOPE

- 1.1 EN-24 high tensile alloy steel forgings/castings and wrought shapes heat-treated to 95,000 PSI minimum yield strength for standard service.
- 1.2 Product forms covered by this specification have good impact properties at low temperatures and suitable for a variety of elevated temperature application.

### 2.0 REQUIREMENTS

**2.1 Chemical composition:** Chemical composition limits are listed below. An analysis of each heat of steel be made by the manufacturer, preferably from a ladle sample taken at or near the time of pouring. The listed elements shall be reported in weight percent. Reporting of residual elements is not required, but total residuals must not exceed 1%.

| ELEMENTS       | COMPOSITION RANGE (%) |
|----------------|-----------------------|
| Carbon (C)     | 0.35-0.45             |
| Nickle (Ni)    | 1.30-1.80             |
| Manganese (Mn) | 0.45-0.70             |
| Silicon (Si)   | 0.10-0.35             |
| Sulphur (S)    | 0.05 (max.)           |
| Phosphorus (P) | 0.05 (max.)           |
| Chromium (Cr)  | 0.9-1.40              |

**Note:** The manufacturer shall provide a TC from an NABL certified lab for the Same.



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**2.2 Mechanical Properties:** The steel components are subjected to pr heat treatment processes till the desired properties are achieved. Each shall then be tested and the recorded mechanical properties sha reported.

| MECHANICAL PROPERTIES        | RANGE           |  |
|------------------------------|-----------------|--|
| TENSILE STRENGTH             | 850-1000 MPa    |  |
| YIELD STRENGTH               | 650 MPa         |  |
| 0.2 % PROOF STRESS           | 635 MPa         |  |
| ELONGATION IN 2" Gage Length | 13 %            |  |
| IMPACT KCV                   | 35 J (min.)     |  |
| BRINELL HARDNESS             | 248-302 Brinell |  |

**NOTE:** 1) The above mentioned mechanical properties are those that are recorded For En 24 steel components subjected to tempering.  
 2) The manufacturer shall provide a TC from an NABL certified lab for the Same.





| PROCESS          | TEMPERATURE  | PROCEDURE  |
|------------------|--------------|--|
| Forging          | 1000-1100 °c | Preheat carefully.<br>Do not forge the steel below 850-1100 °C   |
| Annealing        | 840-860 °C   | Soak well and allow to cool in the furnace to 580 °C before withdrawing.   |
| Stress Relieving | 650-670 °C   | Soak well before cooling in furnace or in air.   |
| Hardening        | 830-850 °C   | Annealed En 24 is heated and after adequate soaking quenched in oil.   |
| Tempering        | 660 °C       | Soak at this temperature for 2 hours per 25mm of ruling section and then cool in air (Tempering in the range 250-375 °C is not advised as can seriously reduce impact value) |

### TEMPERING CHART

| Tempering Temp. °C | Hardness (HRC) | Heating Time (Hrs) | Cooling Method. |
|--------------------|----------------|--------------------|-----------------|
| 150                | 54             | 1                  | Air             |
| 200                | 52             | 1                  | Air             |
| 250                | 50             | 1                  | Air             |
| 300                | 48             | 1                  | Air             |
| 350                | 45             | 1                  | Air             |
| 400                | 42             | 1                  | Air             |
| 450                | 38             | 1                  | Air             |
| 500                | 34             | 1                  | Air             |

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**NOTE:** 1) Heat treatment processes including rate of heating, cooling and soaking time will vary due to factors such as shape and size of each steel component. Other factors affecting are type of furnace, quenching medium and work piece transfer facilities. Therefore the above mentioned conditions are just for guidance and is left to the discretion of the heat treatment provider to achieve the required properties.

**2.3 Heat Treatment:** The guidelines to be followed during the heat treatment Processes that are to be carried out are as given below.

2) HTT curves shall be supplied.

