# Data Sheet

SOREL FORGE

## PREHARDENED HOLDER BLOCK SF-5

### ■ GENERAL :

**Delivery Condition:**
Hardened and tempered
Hardness Range

| BHN | Rc |
|---|---|
| 269-321 | 28-34 |

**SF-5** is a modified AISI-4130 alloy steel with higher chromium and molybdenum contents.

**SF-5** is a prehardened holder steel for molds and dies applications.

**SF-5** is melted by electric arc furnace, ladle refined and vacuum degassed to ensure superior quality.

Typical Analysis (%)

| C | Mn | Si | Cr | Mo |
|---|---|---|---|---|
| .35 | .60 | .50 | 1.25 | .30 |

**SF-5** is forged using a 5000 ton press, a special densifying process assures optimum consolidation of centers.

**SF-5** is available in standard incremental sizes in premachined condition.

**SF-5** is supplied in quenched and tempered condition.

**SF-5** machinability is excellent and offers good polishability characteristics.

**SF-5** with its homogeneity and the good balance of sulfur content, lends itself to texturing.

**SF-5** is compatible with the EDM process. We recommend to remove the white oxide layer prior to finishing or to temper the mold. (Temper to 900° F (482°C)).

## TYPICAL APPLICATIONS :

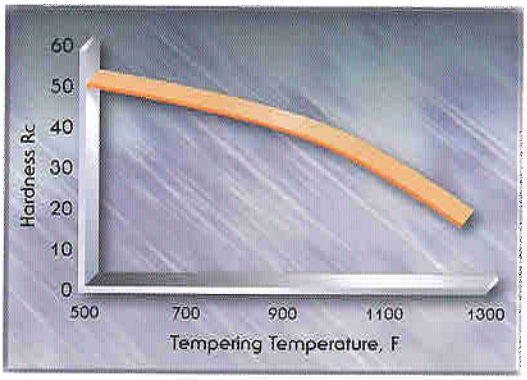
- Backers for forging dies
- Brake dies
- Die holders
- Frame for plastic molds
- Holders for forging dies
- Molds requiring non-critical finish

## PROPERTIES

- **Attainable Hardness of SF-5**

When oil quenched from 1550°F (816 °C) and tempered 4 hours
Size of section - 4"X 4" (101.6 mm x 101.6 mm)

| Tempering temperature °F | (C°) | Hardness (Rc) | °F | (°C) | Hardness (Rc) |
|---|---|---|---|---|---|
| As hardened | | 50-52 | | | |
| 600 | (316) | 48-50 | 1050 | (566) | 30-32 |
| 700 | (371) | 44-46 | 1100 | (593) | 28-30 |
| 800 | (427) | 41-43 | 1150 | (621) | 20-22 |
| 900 | (482) | 38-40 | 1200 | (649) | 19-21 |
| 1000 | (538) | 35-37 | 1250 | (677) | 16-18 |




- **Mechanical Properties**

At room temperature, for hardened and tempered to 300 BHN (32 Rc) material.

| Yield Strength | Tensile Strength | Elongation | Red. Area |
|---|---|---|---|
| 100 Ksi | 125Ksi | 17% | 35 % |

## HEAT TREATMENT

- **Flame & Induction Hardening:**

SF-5 can be selectively hardened by either flame or induction hardening. While oil/ water quenching is preferred, this requires special equipment and generally is confined to small parts.

Water-quenching is the most frequently used method and gives satisfactory performance when the following precautions are observed:

1. The surface should be flame heated to 1450-1500°F (788-816°C).
2. Adjusting quenching fixture so that water floods heated surface after the surface has cooled to approximately 1400°F (760°C).
3. The quench is discontinued after the surface temperature has reached approximately 600°F (316°C).

It is generally recommended that parts be tempered after solution hardening by local flame heating or preferably furnace heating.

• **Carburizing**
It is necessary to exercise caution during heating to the carburizing temperature. Heat slowly to 1200°F (649°C) as in stress relieving, soak for 1/2 hour per inch (25.4 mm ) and resume heating to the carburizing temperature of 1600°F (871°C) for a sufficient time to produce the depth of case required. Cool in the pack or chamber to 1450 to 1500°(788-816°C) and oil quench to approximately 125°F (52°C) or until warm to the touch. Temper immediately to the desired hardness, hold at temperature one hour per inch (25.4mm) of total thickness with a minimum holding time of two hours.

• **Hard-chromium plating**
After hard-chromium plating, the mold should be tempered for a minimum of four (4) hours at 350°F (180°C) in order to avoid hydrogen embrittlement. The mold should be tempered only after it has been stripped for replating.

• **Tempering:**
After hardening, temper immediately to the desired temperature based on hardness and/or mechanical properties.

The usual tempering range is 900-1300°F (482-705°C). Tempering time of two hours is generally recommended, but sections over two inches (50.8mm) in total thickness should be tempered a minimum of one hour per inch (25.4mm) of section.

• **Stress Relieving:**
Molds may be finish machined or hobbed to final dimension. Heat finished die at a rate of one hour per inch (25.4mm) of maximum thickness to 850 to 900°F (454-482°C). Hold at temperature for one hour per inch (25.4mm) and air cool.

**Note:** *Massive and complicated molds require accurate control of steel temperatures and holding times.*

## ■ EDM (Electric Discharhe Machining)

This method of machining is widely used on prehardened SF-5. However, precaution should be taken since this method of machining leaves a rehardened surface layer on the mold. It is advisable to remove this layer, or at least temper at 900°F (482°C) subsequent to EDM machining in order to transform this white surface layer back to its original condition.

## ■ WELDING

Good results can be achieved if proper precautions are taken: elevate working temperature, good joint preparation and proper choice of consumables.

## Standard Procedure for Welding of SF-5

- **1- Cleaning:** remove all oil, dirt, rust from block and welding rod.
- **2- Gouging:** remove all sharp corners, 1/8" (3 mm) radius min.
- **3- Preheating:** The whole block if practical or locally with torch if not, to approximately 900/1000 °F (482° - 538°C)
- **4- Welding:**

  **A-** use TIG with D.C positive polarity

  **B-** use AWS ER70S-7 (87HP) or CSA W48OS-7 (87HP) welding rod or equivalent

  **C- Welding conditions**

| Electrode Dia. (mm) | Filler Rod Dia. (mm) | Welding AMPS | Argon Flow lt/min | Nozzle Dia.(mm) |
|---|---|---|---|---|
| 1.0 | 1.0 | 15-80 | 4-8 | 8 |
| 1.6 | 1.6 | 70-150 | 6-9 | 8-10 |
| 2.4 | 2.4 | 100-250 | 7-10 | 8-10 |
| 3.2 | 3.2 | 250-400 | 10-15 | 8-10 |

**D-** Manipulate the electrode after a molten pool of sufficient size has formed.

**E-** When beads of weld are overlapped, make sure pool of molten metal is sufficient before adding welding rod.

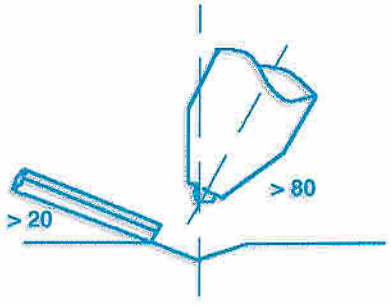
**F-** At end of bead make sure a large enough volume of weld remains to eliminate cratering.

**G-** If molten metal forms on end of electrode, regrind tip to a sharper point.

**H-** When welding large area or long length stagger passes and bead length to eliminate uneven thermal stress.

**I-** If large amounts of weld or multi-layers are required locally, pean beads between passes.

- **5-** Clean up and semi finish; Watch for discoloration of prehardened layer at base metal and weld edge. Locally with torch, draw back rehardened layer. Slowly cool down the mold to 350°F (177°C) before postheat.
- **6-** If small pits or holes are found from dirt or blowhole (caused by Argon blanket failure), locally regauge and repeat welding steps 4, A through D and 5.
- **7-** Postheat, retemper 300/900°F (149-482°C) one hour per inch (25.4mm) of weld depth plus one additional hour - double temper if possible.
- **8-** Finish as desired.

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