



Medium Carbon, Alloyed Steel Barstock

1 Scope

This specification defines the metallurgical requirements for a continuously cast, aluminum killed, vacuum degassed, fine grained steel barstock to be used for camshafts with roller lifters. This material will be vanadium grain refined. Bars purchased to this specification will be hot rolled, normalized, straightened, stress relieved, turned and polished. Material conforming to this specification will be induction hardenable, machinable and have a controlled level of internal inclusions to assure part durability.

1.1 Material Description. Medium carbon alloyed steel barstock.

1.2 Symbols. Not applicable.

1.3 Applicability. Steel camshafts with roller lifters.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM E45

ASTM E112

ISO 6506

2.2 GM Standards/Specifications.

GMW3059

3 Requirements

3.1 Chemical Requirements. Chemical Composition: Material supplied to this specification shall conform to the following chemical composition (percent (%) by mass, product analysis). See Table 1.

Table 1: Chemical Composition

Carbon	0.48% to 0.53%
Manganese	0.80% to 0.90%
Silicon	0.15% to 0.30%
Chromium	0.70%to 0.80%
Phosphorus	0.030% maximum
Sulfur	0.035% to 0.050%
Aluminum	0.007% maximum
Vanadium	0.035% to 0.050%

3.2 Mechanical Requirements. Hardness: Normalized barstock shall exhibit hardness of 275 Brinell Hardness Number (BHN) maximum when tested per ISO 6506.

3.3 Physical Requirements. Indigenous Inclusions (microscopic inclusions resulting from deoxidation and/or limited solubility in solid steel).

Steel shall meet the following inclusion rating maximum limits in 100% of specimens examined per ASTM E45 Method A. Critical regions for evaluation include the finish-machined bearing journal surfaces, and finish-machined lobes at ramps and nose locations to a depth of 0.5 mm.

- Type A (Sulfides) Thin = 4 Heavy = 2.5
- Type B (Alumina) Thin = 2 Heavy = 1
- Type C (Silicate) Thin = 1.5 Heavy = 1
- Type D (Globular) Thin = 1.5 Heavy = 1

3.3.1 Exogenous Inclusions. (Macroscopic inclusions from entrapped slag and/or refractories) step-down testing per ASTM E45 Section 5.1.3 shall be used to evaluate cleanliness of rolled steel bars supplied by the mill. Five (5) 25 mm (1 in) long steps with diameters incremented equally between the base circle diameter (minimum) and nose circle diameter (maximum) of a particular camshaft shall be turned on each specimen. Magnetic particle inspection technique shall be used to inspect steps for globular and linear indications. Each specimen may contain up to 15 indications (no more than three (3) per step). Any such indications with a major dimension greater than 4 mm are unacceptable. This test shall be conducted once per heat run or other agreed upon frequency and documented in the supplier control plan.

3.4 Additional Requirements. Microstructure: Material must be normalized to produce a lamellar pearlitic structure. Grain size to be 5 to 10 when tested per ASTM E112.

3.5 Processing Requirements. Straightness must be maintained throughout the processing sequence. Bars should be stress relieved at approximately 620 °C to eliminate residual stresses.

The surface condition of processed barstock (camshaft blanks) must be free of seams and decarburization.

Additional ultrasonic testing will be conducted if the following two conditions are met:

- If total oxygen content values are over 30 ppm on the final product
- If degas time is less than 10 minutes

3.5.1 Requirements on Other Stages During Life Cycle. Components manufactured to this standard shall not have any negative effect on recyclability of the parts/vehicle.

3.6 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

4 Manufacturing Process

Not applicable.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.

It is the responsibility of the supplier to inform the customer in a timely manner, without solicitation, and to include documentation of all modifications of materials and/or processes and to apply for a new release.

5.4 Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS). For new product submissions, or when a change in chemical composition of an existing product has occurred, a complete copy of the Material Safety Data Sheet/Safety Data Sheet must be submitted in compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) requirements or other country-specific MSDS/SDS requirements.