1.0 Objective

1.1 To define the metallurgical requirements of bloom cast steel used for deep case, induction hardened axle shafts.

2.0 Scope

2.1 This specification is for medium carbon steels used in axle shaft production.

3.0 Citing / Cited Documents

3.1 Cited

SAE J406, Methods of Determining Hardenability of Steels

4.0 Definitions

SAE - Society Automotive Engineering

5.0 General

5.1 The benefits of the steel making and casting process generate cleanliness and grain refinements that bring benefits to axle shaft fatigue strength. These benefits make possible the use of “as-forged” axle shafts. Use of this steel in the as-forged condition must be approved through endurance testing of axle shaft products under CBDC guidelines.

5.2 Steel making practice differing from that described within this specification may not produce the same level of cleanliness and grain structure refinement. Those practices must be controlled through cleanliness measures that limit inclusion content and form. Additionally, the degree of cast section reduction may not sufficiently eliminate the continuous cast structure. This would negate the potential for use of “as-forged” axles.

6.0 Description

6.1 SAE 1541 CHEMICAL COMPOSITION:

Element	Min.	Max.
Carbon	.38	.43
Manganese	1.45	1.60
Silicon	.20	.35
Phosphorous	.010	.025
Sulfur	.020	.025
Chromium		.20
Nickel		.20
Molybdenum		.15
Copper		.15
Aluminum	.02	.05

6.2 HARDENABILITY:
Hardenability will be defined by the SAE Hardenability Predictor, J406. A calculated D_I value of 2.5 to 3.1 inches is required. Carbon range must be maintained, but all other elements are secondary to D_I attainment.

6.3 STEEL MAKING PRACTICE:
Steel shall be produced by the basic oxygen furnace (BOF) process followed by desulfurization and resulfurization refining. The steel shall be bloom cast with a cross section of no less than 300 square inches.

6.4 MATERIAL QUALITY:
The steel bar should be “axle shaft quality” (ASQ) hot rolled bar. The controlling characteristics of this bar quality must be defined by the producer.

6.5 APPROVED STEEL SUPPLIERS:
- 6.5.1 Hamilton Steel (Division of Stelco)
- 6.5.2 Other suppliers may be approved upon successful metallurgical evaluation and endurance testing of axle products at the CBDC.

6.2 CERTIFICATION:
The forge shop will supply a copy of the steel mill certificate for all heats used to produce forgings.