1.0 Objective

1.1 To define the metallurgical requirements of continuous cast steel to be 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

EN 10083-1, Quenched and Tempered Steels - Part 1 : Technical Delivery Conditions for Special Steels

UNI 3244 – Microscopic Examination of Ferrous Materials. Rating of Non-Metallic Inclusions in Steels with Reference Pictures

UNI 8449 (1-3), Microscopic Examination of Ferrous Materials. Classification of Banded Structure in Case Hardening Steels

4.0 Definitions

SAE - Society Automotive Engineering
EN – European Standard
UNI – Italian Standard

5.0 General

5.1 This specification defines the requirements to generate cleanliness and grain refinement that bring benefits to axle shaft fatigue strength. Use of this steel in the quenched and tempered condition must be approved through endurance testing of axle shaft products under CBDC guidelines.

6.0 Description

6.1 EN 10083-1: 41Cr4 CHEMICAL COMPOSITION:

Element	**Min.**	**Max.**
Carbon	.38	.45
Manganese	.60	.90
Silicon		.40
Phosphorous		.035
Sulfur	.020	.045
Chromium	.90	1.20

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 INCLUSION RATIO:
Inclusion rating per NORM UNI 3244 Method K: K4<30(0)

6.4 BANDING:
Banding rating per UNI 8449: 1-3 (narrow band)

6.5 STEEL MAKING PRACTICE:
If continuous cast steel is used, a minimum reduction ratio of 7:1 must be used.

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

6.7 FORGING HEAT TREATMENT:
Forgings produced under this specification will be quenched and tempered to a hardness of 266-311 BHN.

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