

HINDUSTAN ELECTRIC MOTORS



ABOUT US

Hindustan Electric Motors is one of India’s leading electric motor manufacturers, with over five decades of experience in delivering reliable, high-quality and innovative motor solutions.

With a strong focus on quality, reliability, timely delivery and customer satisfaction, the company has built a trusted presence across India and international markets, backed by offices, authorized distributors, dealers and service centers that support OEMs, end users and major industries.

Delivering reliable motor solutions, driven by quality and customer trust.

PRODUCT RANGE

1. Flameproof Motors
2. Crane Duty Motors
3. Cooling Tower Motors
4. Textile Motors
5. Inverter Duty Motors
6. Brake Motors
7. Customized motors for diverse industrial applications

QUALITY & FACILITIES

An **ISO 9001:2015** certified company operating state-of-the-art manufacturing facilities in **Daman and Vapi**, supported by advanced technology and experienced professionals.

- Reliable, high-quality motors
- Timely delivery
- Technical support for OEMs & end users

7.5 kW · 4P
MOTOR

132S/M
FRAME

6208-2Z
BEARINGS, BOTH ENDS

478 mm
OVERALL LENGTH

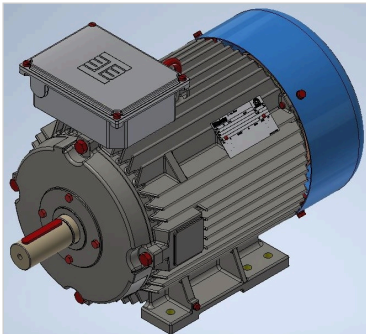
SOLID vs HOLLOW SHAFT

7.5 kW 4-Pole Motor
Frame 132S/M
Shaft Material: EN8

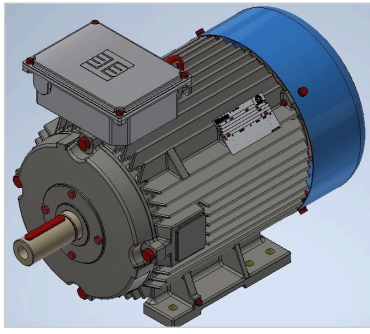
DESIGN OVERVIEW

Management has reviewed a mechanical design brief comparing a **solid** and a **hollow** shaft for the 7.5 kW, 4-pole, Frame 132S/M motor, made of EN8 steel. Both variants share the same outer profile, length and bearing interfaces — **the only change is a Ø18 mm through-bore**.

Externally the two motors are identical: the hollow-shaft variant fits the same motor without any change to endshields, bearings or fan-side design. The drive-end bearing uses a lock arrangement, and the non-drive end a wavy washer.



Solid shaft variant — 7.5kW-4P, Frame 132S/M



Hollow shaft variant — Ø18 mm bore visible at shaft end

SOLID SHAFT

Drg. No. 33-13-029-0103
No bore — fully solid cross-section
Shaft OD Ø38 (DE) stepped to Ø49 (max) at core mount
Est. mass ≈ 5.69 kg

HOLLOW SHAFT

Drg. No. 33-13-029-0104
Identical profile, Ø18 mm bore full length (478 mm)
Same EN8 grade
Est. mass ≈ 4.74 kg

DESIGN COMPARISON

Parameter	Solid	Hollow
Drawing No.	33-13-029-0103	33-13-029-0104
Material	EN8	EN8 (same grade)
Shaft OD	Ø38 (DE) to Ø49 (max)	Identical profile
Through-bore	None	Ø18 mm, 478 mm
Overall length	478 mm	478 mm
Bearings (DE & NDE)	6208-2Z, Ø40×Ø80×18	6208-2Z (unchanged)
Est. mass / shaft	≈ 5.69 kg	≈ 4.74 kg

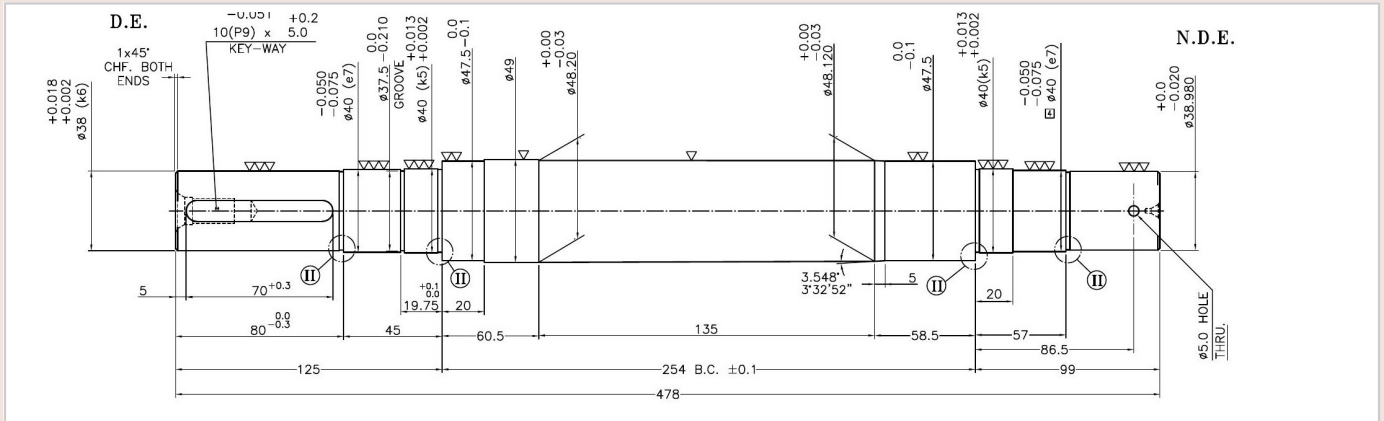
16.8%

material saved per shaft — about 0.95 kg of EN8 steel removed (Ø18 mm bore × 478 mm).

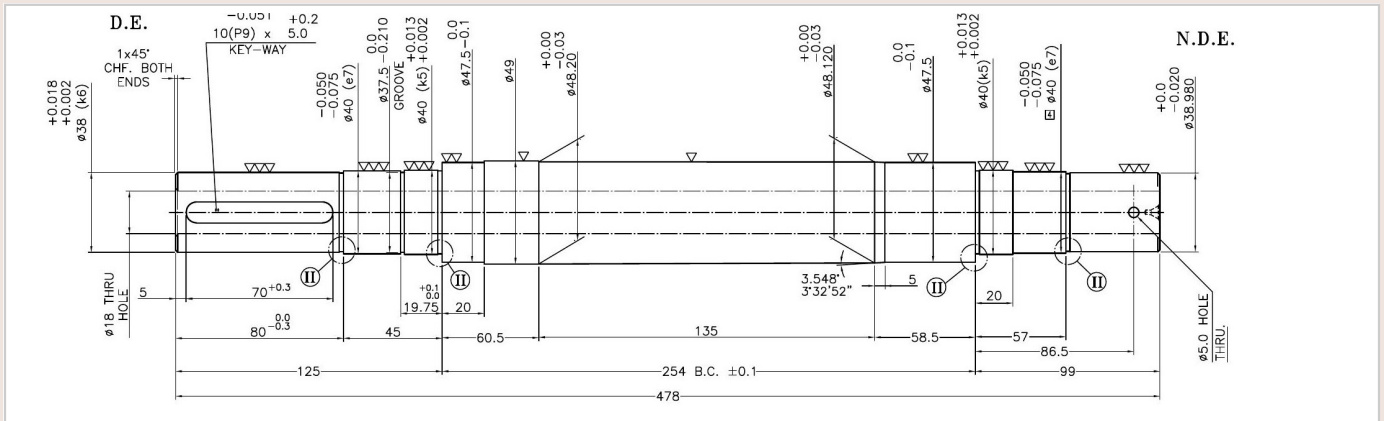
SOLID vs HOLLOW SHAFT

ENGINEERING ANALYSIS · 7.5 kW 4-Pole · Frame 132S/M · EN8 · DE Bearing Lock / Wavy Washer NDE

REFERENCE DRAWINGS (D.E. → N.D.E.)



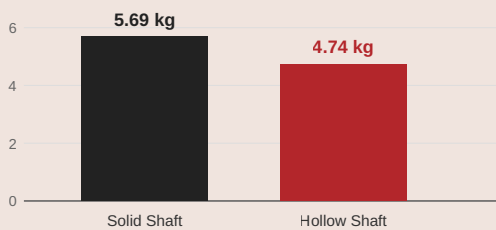
Solid shaft — Drg. 33-13-029-0103, frame 132S/M, overall length 478 mm.



Hollow shaft — Drg. 33-13-029-0104, same profile with Ø18 mm through-bore ("Ø18 thru hole").

MATERIAL SAVING — ~17% LIGHTER

Estimated shaft mass comparison (kg)



≈ **0.95 kg** EN8 steel removed per shaft (Ø18 mm bore × 478 mm). At roughly ₹70/kg (EN8 alloy round bar) the saving is worth ≈ **₹65–70** of raw material per shaft — an indicative metal-content value only.

STRENGTH VERIFICATION

Checked at the critical section — **Ø38 (DE, keyway zone)** — with the bore present. Applied torque (same for both shafts):

$$T = 9550 \times P / N = 9550 \times 7.5 / 1440 = 49.740 \text{ N}\cdot\text{m}$$

	Solid (Ø38, EN8)	Hollow (Ø38 / Ø18)
Shear stress formula	$\tau = 16T / (\pi d^3)$	$\tau = 16T \cdot Do / [\pi (Do^4 - Di^4)]$
Cross-section area	1134.115 mm ²	879.646 mm ²
Polar modulus Zp	10,774.09 mm ³	10,231.67 mm ³
Induced shear stress	4.617 MPa	4.861 MPa
Allowable shear	84 MPa	84 MPa
FOS in torsion	18.20	17.28

The bore trims only a small fraction of torsional margin — the hollow shaft still carries a factor of safety above 17.

16.8%

LESS SHAFT MASS

≈ 0.95 kg

EN8 STEEL SAVED PER MOTOR
OF SHAFT WEIGHT

17.28

FOS IN TORSION (HOLLOW)

0.010 mm

T.I.R. CONCENTRICITY

MANUFACTURING IMPACT

COST · PROCESS · PRACTICAL RISKS · 7.5 kW 4-Pole · Frame 132S/M · EN8

IMPACT ANALYSIS — MANUFACTURING, COST & PRACTICAL RISKS

- M Extra machining operation**
Ø18 mm through-bore over 478 mm (L/D ≈ 26:1) needs deep-hole / gun-drilling.
- ₹ Cost trade-off is process-dependent**
Drilling a solid bar yields ~0.95 kg as swarf, which is scrap-recoverable.
- ! Concentricity & tool-wander**
The drawing calls for 0.010 mm T.I.R. concentricity on all ground diameters. Deep-hole drilling at this L/D ratio carries bore-wander risk — it may need in-process gauging / boring-bar support to hold tolerance.
- + Lower rotating mass & inertia**
A lighter shaft reduces rotor moment of inertia — beneficial for acceleration/deceleration response, especially if the motor sees VFD or frequent start-stop duty.

FROM THE SHOP FLOOR — REAL-WORLD IMPACTS OF HOLLOWING

1	Handling & assembly ~1 kg lighter shaft-rotor sub-assembly eases repeated manual handling at the assembly station.	
2	Balancing Less material to correct during dynamic balancing of the rotor-shaft assembly — generally favorable.	
3	Tooling & coolant Gun-drilling needs coolant-through tooling and adds a wear item to track — plan tooling budget & maintenance.	
4	Scrap recovery Swarf from the bore is clean EN8 turnings, recoverable as scrap, partially offsetting material cost.	
5	Freight & inventory Marginal freight saving on weight-based shipping; existing solid-bar stock needs a transition plan.	

THE BOTTOM LINE

Hollowing the 132S/M shaft saves **16.8% (≈ 0.95 kg)** of EN8 steel per shaft without change in endshields, bearings or fan-side arrangement design, and the torsional factor of safety stays at **17.28** against 18.20 for the solid shaft. The trade-off is process-side: a deep-hole drilling operation, and tight control of 0.010 mm concentricity.