SELECTION GUIDE 13 min read Updated January 2024

IFB Grade Selection: JM-23 vs JM-26 vs JM-28 vs JM-30 — When to Use Which

A complete decision framework for selecting insulating firebrick grades based on ASTM C155 — balancing temperature capability, thermal conductivity, mechanical strength, and cost.

Insulating firebrick (IFB) grade selection per ASTM C155 requires matching four interrelated properties to crushing strength (mechanical load capacity), and material cost. IFB is classified by JM number — JM-23, correlates with temperature capability and insulation performance. JM-23 (bulk density ~370 kg/m³, 1260 structural strength. JM-30 (bulk density ~880 kg/m³, 1650°C max) provides highest temperature capabili increases 40–60% compared to JM-23. The most common specification error is over-specifying grade to 50% material cost premium with no operational benefit.

Proper IFB grade selection follows a priority hierarchy: (1) match maximum use temperature to hot-face s insulation applications have zero structural load and do not require high-density grades), (3) optimize the while meeting performance criteria. This guide provides performance comparison matrices, application d

ASTM C155 Classification System Explained

ASTM C155 categorizes insulating firebrick by maximum use temperature and bulk density, designated by

ASTM GRADE	MAX USE TEMP (°C)	BULK DENSITY (KG/M³)
JM-23	1260	360–400
JM-26	1425	600–670
JM-28	1540	750–850
JM-30	1650	850–900

> **Important:** Maximum use temperature is the continuous operating limit. Short-term temperature excursions
> 30–50%. Always add 50–100°C safety margin when specifying grade.

Comprehensive Performance Comparison Matrix

PROPERTY	JM-23	JM-26
Max Use Temp (°C)	1260	1425
Bulk Density (kg/m³)	370	640
Cold Crushing Strength (MPa)	2.5–3.5	5.0–7.0
Thermal Conductivity @ 600°C (W/m·K)	0.26	0.35
Thermal Conductivity @ 1000°C (W/m·K)	0.40	0.52
Porosity (%)	75–80	68–72
Linear Shrinkage @ Max Temp (% after 24h)	1.5–2.5	1.0–2.0
Relative Material Cost	1.0×	1.3×

Key Performance Trade-Offs

Density vs Insulation: As bulk density increases (JM-23 → JM-30), thermal conductivity increases by ~9 shell temperatures and greater energy loss.

Strength vs Temperature: Higher density grades provide 4–5× greater crushing strength (JM-30: 14 MP load-bearing, this strength is unnecessary and wastes insulation performance.

Cost vs Capability: Material cost per cubic meter increases 60% from JM-23 to JM-30. Installation labor furnace wall application.

Grade Selection Decision Rules

RULE 1 Temperature Matching with Safety Margin

Match IFB maximum use temperature to your hot-face service temperature using this formula:

> **Selection Rule:** IFB Max Use Temp ≥ Hot Face Service Temp + Safety Margin
> **Safety Margin:** 50–80°C for stable process | 80–120°C for process with upsets

HOT FACE SERVICE TEMP	RECOMMENDED IFB GRADE
<1100°C	JM-23 (1260°C max)
1100–1180°C	JM-23 (1260°C max)
1180–1300°C	JM-26 (1425°C max)
1300–1420°C	JM-28 (1540°C max)
1420–1550°C	JM-30 (1650°C max)
>1550°C	Not suitable (use dense brick or castable)

RULE 2 Mechanical Load Assessment

Determine if the IFB layer must support mechanical loads:

- **Non-load-bearing (95% of backup insulation applications):** IFB sits behind working lining or dense b (optimizes insulation)
- **Light load-bearing:** IFB supports lightweight ceramic fiber or light equipment (e.g., burner tiles, therm
- **Moderate load-bearing:** IFB forms structural arch or supports kiln furniture → JM-28 or JM-30 require
- **Heavy load-bearing:** Not suitable for IFB — use dense firebrick or high-alumina brick

> **Common Error:** Specifying JM-28 or JM-30 for backup insulation "because it's stronger" when the layer ca to JM-23 at same temperature rating.

RULE 3

Thermal Conductivity & Energy Loss Optimization

For backup insulation applications where temperature requirement allows multiple grade options, select t

Energy Loss Comparison Example

Scenario: Industrial furnace wall, 1150°C hot face, 100mm IFB backup layer, 1000 m² surface area, 8000

IFB GRADE	TEMP RATING	K @ 1000°C (W/M·K)
JM-23	1260°C (110°C margin)	0.40
JM-26	1425°C (275°C margin — excessive)	0.52
JM-28	1540°C (390°C margin — wasteful)	0.62

Energy Verdict

In this scenario, specifying JM-28 instead of JM-23 increases annual energy cost by **$95,040** (55% furnace campaign, the JM-28 over-specification wastes **$475,000** in energy costs, far exceeding ar

Application-Specific Selection Guide

Industrial Heating Furnaces

FURNACE TYPE	TYPICAL HOT FACE TEMP
Aluminum melting (reverberatory)	1000–1100°C
Heat treating (batch)	900–1050°C
Reheating furnace (steel)	1200–1350°C
Forging furnace	1150–1280°C

Ceramic & Glass Industries

APPLICATION	HOT FACE TEMP	RECOMMEND
Pottery kiln (shuttle)	1100–1250°C	JM-23 or JM-
Ceramic tile kiln (roller hearth)	1150–1220°C	JM-26
Glass annealing lehr	550–750°C	JM-23
Glass tank regenerator backup	1350–1450°C	JM-28

Material Cost vs Total Cost of Ownership

IFB material cost increases with grade, but **total cost of ownership** (material + installation + energy over

5-Year TCO Model: 100 m² Furnace Wall Backup Layer

Assumptions:

- Hot face temperature: 1150°C
- IFB layer thickness: 100mm
- Furnace operation: 7500 hours/year
- Energy cost: $15/GJ
- IFB service life: 8–12 years (exceeds 5-year analysis period)

COST COMPONENT	JM-23	JM-26
Material Cost (100 m²)	$8,500	$11,000
Installation Labor	$4,200	$4,200
5-Year Energy Loss	$161,600	$210,600
Total 5-Year Cost	**$174,300**	**$225,800**
Cost Premium vs JM-23	—	+$51,500 (30%)

TCO Verdict

For this 1150°C application, **JM-23 is the optimal choice** — lowest total cost, excellent temperature
Specifying JM-28 wastes $93,900 — the higher material cost ($4,300) is dwarfed by the energy per

Common IFB Grade Selection Errors

ERROR 01

Over-Specifying for "Safety" Without Energy Cost Analysis

Mistake: Using JM-28 (1540°C rating) for 1100°C hot face temperature "to be safe." **Impact:** 55% hi
rating) provides 160°C safety margin and optimal insulation.

ERROR 02

Specifying High-Density Grade for Non-Load-Bearing Application

Mistake: Using JM-30 for backup insulation layer that carries zero mechanical load because "it's str
Use JM-23 or JM-26 based on temperature only; reserve JM-28/JM-30 for actual load-bearing appl

ERROR 03

Using Maximum Spec Temp Without Safety Margin

Mistake: Specifying JM-23 (1260°C max) for 1250°C hot face with only 10°C margin. **Impact:** Any pr
margin for stable processes, 80–120°C for processes with temperature variability. Use JM-26 for this

ERROR 04

Ignoring Thermal Conductivity Differences Between Grades

Mistake: Comparing only material cost per m³ without calculating heat loss. **Example:** JM-23 costs $
rated and will fail. **Correct approach:** Match temp first, then optimize cost within suitable grades.

IFB Grade Selection Checklist

01 **Measure hot-face service temperature** — Use pyrometer or thermocouples; add 30–50°C for process va

02 **Determine IFB layer function** — Backup insulation (non-load-bearing) vs structural element (load-bearing

03 **Match temperature with margin** — IFB max use temp ≥ hot face temp + 50–120°C safety margin

04 **Select lowest density grade meeting temp requirement** — Unless mechanical load requires higher stren

05 **Calculate 5-year energy loss** — Compare thermal conductivity × surface area × operating hours × energy

06 **Verify supplier classification compliance** — Request ASTM C155 test data: bulk density, thermal conduc

07 **Consider installation practicalities** — JM-23 is more fragile (handle carefully); JM-28/JM-30 more durab

08 **Document decision rationale** — Record temp requirement, safety margin, load assessment, energy calc -

Vuulcan Insulating Firebrick: Full range of JM-23, JM-26, JM-28 grades per ASTM C155. Manufactured i
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IFB Grade Selection FAQ

What does the JM number in IFB grades mean? +

Can I use JM-30 everywhere to be safe?

How do I match IFB grade to my furnace hot-face temperature?

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