E-HOUSE · SMART POWER SOLUTION

Steel Industry E-House Solution

Scenario-based MV drive E-House configuration for steel manufact processes — from raw material handling to finished product.

Process Coverage
7 production stages, all MV drive loads

Packaged Delivery
Switchgear + VFD + PLC + HVAC in one unit

Energy Saving
15–50% reduction on fan & pump loads

Fast Deployment
40–60% site time reduction vs. traditional

INTEGRATED STEEL PLANT · FULL PROCESS COVERAGE

Steel Production Flow & E-House Deployment Map

3D Aerial View — Multiple E-House Units Across Integrated Steel Plant

7 PRODUCTION STAGES × E-HOUSE DEPLOYMENT

01	Sintering & Raw Material	Main exhaust fan, cooler fan, mixing drum drives	2,000–4,000 kW
02	Blast Furnace & Ironmaking	BF blower, gas cleaning fan, cooling water pumps	3,000–8,000 kW
03	Steelmaking (BOF / EAF)	Primary dedusting fan, gas recovery, LF fan	2,000–4,000 kW
04	Continuous Casting	Withdrawal rolls, mold oscillation, spray pumps	100–500 kW
05	Hot Rolling Mill	Main roll drives, roughing/finishing, coiler	3,000–10,000 kW
06	Cold Rolling Mill	Tandem mill, temper mill, pickling, annealing	2,000–5,000 kW
07	Water & Utilities	Circulating pumps, cooling towers, compressors	500–2,000 kW

7
Production stages covered

5–15
E-House units per plant

10–15%
Total plant energy saving

100–50,000
kW motor range per unit

MPA-200 Steel Industry E-House Solution

Sintering · Blast Furnace · BOF/EAF · Casting · Rolling · Utilities

MARKET ANALYSIS · ENERGY TRANSITION · CARBON REDUCTION

Why Steel Plants Need E-House VFD Solutions

7%

of Global CO_2 Emissions

Steel industry is one of the hardest-to-abate sectors. Energy efficiency is the fastest path to decarbonization.

20–40%

Energy Cost Share

Energy represents 20–40% of total steel production cost. VFD on motors directly reduces the largest controllable expense.

60–70%

Motor Electricity Consumption

MV motors (fans, pumps, compressors, drives) consume 60–70% of total plant electricity — the primary VFD target.

KEY MARKET DRIVERS FOR E-HOUSE ADOPTION

01 **Government Carbon Mandates**

EU CBAM, China dual-carbon policy, and national energy efficiency standards require steel plants to reduce specific energy consumption by 15–20% by 2030.

02 **Aging Infrastructure Replacement**

Many steel plants built in the 1980s–2000s are upgrading from DOL/soft-starter to VFD. E-House enables brownfield retrofit without new buildings.

03 **Skilled Labor Shortage**

Factory-prefabricated E-House reduces on-site electrical installation by 60–70%, minimizing dependence on scarce skilled electricians.

04 **Digital Transformation**

Steel 4.0 requires integrated SCADA, predictive maintenance, and energy management. E-House provides a pre-wired digital-ready platform.

Market Opportunity:
$1.72B → $3.05B by 2033

The global E-House market is projected to grow from USD 1.72 billion (2024) to USD 3.05 billion (2033) at a CAGR of 6.6%. Steel and metals represent the largest industrial segment, driven by energy efficiency mandates and brownfield modernization programs worldwide.

Source: Global E-House Market Report 2024 · IEA Steel Roadmap · World Steel Association

STAGE 01 · RAW MATERIAL PREPARATION · SINTERING

Raw Material Handling & Sintering Plant

Biggest energy consumer in raw material area — main exhaust fan alone accounts for 40–50% of sintering electricity

SINTERING PROCESS

From Raw Material to Sinter Feed

Iron ore fines, coke breeze, and limestone are blended, moistened, and ignited on a traveling grate. The sintered product feeds the blast furnace.

Main Exhaust Fan

Draws air through the sinter bed. Variable flow control via VFD replaces damper throttling, saving 25–40% energy.

Cooler Exhaust Fan

Extracts heat from hot sinter on the cooling strand. Speed varies with sinter temperature and throughput.

Mixing Drum Drive

Blends raw materials with water. Torque-controlled drive ensures uniform mixture quality.

Electrostatic Precipitator Fan

Handles flue gas from sinter strand. VFD adjusts flow to match emission control requirements.

MOTOR LOAD SUMMARY

Key MV Drive Loads in Sintering

EQUIPMENT	POWER	LOAD TYPE
Main Exhaust Fan Sinter strand suction	2,000–4,000 kW	Variable torque
Cooler Exhaust Fan Sinter cooling strand	500–1,500 kW	Variable torque
EP Fan Electrostatic precipitator	300–800 kW	Variable torque
Mixing Drum Raw material blending	200–500 kW	Constant torque
Coke Oven Gas Blower Gas distribution	800–2,000 kW	Variable torque
Pelletizing Fan Indurating machine	1,500–3,000 kW	Variable torque

E-HOUSE CONFIGURATION

Typical Sintering E-House

VFD Units	2–3 MV VFDs per E-House
Power Range	500 kW – 4,000 kW per VFD
MV Voltage	6 kV / 10 kV / 11 kV
Switchgear	MV VCB + LV MCCB
Control	PLC + HMI + SCADA link
HVAC	N+1 cooling, dust filtration
Fire Protection	Novec 1230, 2 zones
Enclosure	IP55 for dusty environment

25–40%

Energy Saving on Fan Loads

Variable-torque fan loads follow the affinity law: power ∝ speed³. Reducing speed by 20% saves ~50% energy. ROI typically 1.5–2.5 years.

2–3
MV VFDs per E-House unit

4,000 kW
Max single motor power

1.5–2.5 yr
Typical payback period

40–50%
Share of sintering electricity

Blast Furnace & Ironmaking Applications

3D Rendering — E-House Deployed Adjacent to Blast Furnace Complex

15–25%

Energy Saving on BF Blower Alone

The BF blower is the single largest energy consumer in ironmaking. VFD control replaces throttle/damper regulation, saving 15–25% of blower electricity — typically 3,000–6,000 MWh/year per furnace.

KEY MOTOR LOADS IN BLAST FURNACE AREA

6 Critical VFD Applications per Blast Furnace

EQUIPMENT	POWER RANGE	LOAD TYPE	VFD BENEFIT
BF Blower (Hot Blast)	3,000–8,000 kW	Variable torque	Largest energy consumer. VFD replaces inlet vane control. 15–25% saving.
Gas Cleaning Fan	1,000–2,500 kW	Variable torque	BF gas cleaning system. Flow varies with furnace load. 20–30% saving.
Cooling Water Pump	500–1,500 kW	Variable torque	Multiple units. Closed-loop pressure control. 25–40% saving.
Slag Granulation Pump	300–800 kW	Variable torque	High-pressure water jet for slag processing. Intermittent duty.
Dust Collection Fan	500–1,500 kW	Variable torque	Casthouse dedusting. Flow varies with tapping schedule.
Hot Stove Combustion Fan	200–600 kW	Variable torque	Combustion air supply. Cyclic operation with stove changeover.

TYPICAL E-HOUSE CONFIGURATION FOR BF AREA

2–4 MV VFDs + MV Switchgear + PLC/SCADA

VFD Cabinets

MV Switchgear

BF AREA ENVIRONMENTAL CHALLENGES

Extreme Heat, Dust & Corrosive Atmosphere

Ambient Temperature

Dust & Particles

EXTREME ENVIRONMENT · HEAVY DUST · HIGH TEMPERATURE

Steelmaking (BOF/EAF) Dedusting & Gas Recovery

Most demanding E-House environment in the entire steel plant

BOF (BASIC OXYGEN FURNACE) VFD APPLICATIONS

Primary Dedusting + Gas Recovery + LF/RH

Primary Dedusting Fan	Largest single load — captures fumes during oxygen blowing, tapping, and charging	2,000–4,000 kW Save 25–35%
BOF Gas Recovery Fan	Recovers CO-rich gas for fuel reuse, variable flow during blowing cycle	1,000–2,000 kW Save 20–30%
Secondary Dedusting Fan	Captures fugitive emissions from charging, tapping, deslagging	500–1,500 kW Save 20–30%
Ladle Furnace (LF) Fan	Fume extraction during secondary refining	300–800 kW Save 15–25%
RH Vacuum Pump	Degassing — precise vacuum control for steel quality	500–1,500 kW Save 15–20%
Cooling Water Pump	Converter cooling, hood cooling, lance cooling	300–1,000 kW Save 30–40%

EAF (ELECTRIC ARC FURNACE) VFD APPLICATIONS

Fume Extraction + Baghouse + Cooling

Fume Extraction Fan	Primary off-gas system — massive volume during melting, variable during refining	2,000–5,000 kW Save 25–35%
Baghouse ID Fan	Induced draft through bag filter — pressure control critical for filter life	500–1,500 kW Save 20–30%
Cooling Water Pump	Furnace shell, roof, electrode arms, off-gas duct cooling	300–800 kW Save 30–40%
Hydraulic Power Unit	Electrode regulation, furnace tilting, roof swing	200–500 kW —
Material Handling	Scrap bucket crane, alloy conveyor, DRI feed	100–400 kW —

EXTREME ENVIRONMENTAL CHALLENGES

Harshest Conditions in Steel Plant

Ambient Temperature

50–65°C

Near converter mouth and EAF roof during operation

Dust Loading

Heavy Iron Oxide

FeO, Fe_2O_3 particles, slag dust, carbon black from electrodes

Corrosive Gases

CO · SO_2 · NOx

Off-gas contains CO (toxic), SO_2, NOx, and trace HF

EMI / Harmonics

EAF Arc Interference

EAF generates severe electromagnetic interference and power quality disturbances

E-HOUSE PROTECTION MEASURES

IP55 sealed enclosure, all penetrations gasketed

N+1 HVAC with enhanced cooling capacity for 55°C+ ambient

G4 + F7 + Carbon multi-stage filtration for iron dust and SO_2

25–50 Pa positive pressure prevents any dust ingress

EMC shielding and line reactors for EAF proximity

PROCESS STAGE 04 · PRECISION SPEED CONTROL · MULTI-STRAND SYNCHRONIZATION

Continuous Casting Drive Systems

CC PROCESS OVERVIEW

Multi-Strand Coordinated Drive Control

Continuous casting transforms liquid steel into solid slabs, billets, or blooms through a precisely controlled solidification process. Each caster typically has 2–8 strands, with 8–12 VFDs operating in tight coordination. Speed accuracy directly determines product surface quality, internal structure, and dimensional tolerance.

PRECISION REQUIREMENTS

Critical Tolerances for Product Quality

±0.1%
Speed accuracy — withdrawal rolls

< 5 ms
Torque response time

±0.05%
Multi-strand synchronization

0.5–6.0
Casting speed range (m/min)

DRIVE APPLICATIONS — 6 KEY MOTOR GROUPS PER CASTER

DRIVE 01

Mold Oscillation Drive

50–200 kW

Sinusoidal oscillation pattern, ±0.1% frequency accuracy. Prevents sticking and controls surface quality of solidifying shell.

DRIVE 02

Withdrawal Roll Drive

100–500 kW / strand

Master speed reference for entire caster. Torque-controlled to prevent strand breakout. Multi-strand synchronization critical.

DRIVE 03

Cooling Water Pump

200–800 kW

Primary mold cooling circuit. Constant flow required for uniform solidification. VFD maintains precise flow setpoint.

DRIVE 04

Spray Water Pump

100–400 kW

Secondary cooling zones (6–10 zones per strand). VFD adjusts flow per zone based on casting speed and steel grade.

DRIVE 05

Hydraulic Power Unit

100–300 kW

Mold level control via stopper rod or SEN. Rapid response hydraulic servo. VFD on HPU pump reduces energy waste.

DRIVE 06

Fume Extraction Fan

200–600 kW

Tundish and ladle area fume collection. Variable speed based on casting phase (ladle change, steady state, tail-out).

E-HOUSE CONFIGURATION FOR CC

Compact Multi-Drive Package

Size: 20ft or custom compact

VFDs: 8–12 units per caster

PLC: Coordinated master control

Comm: Fiber optic speed sync

QUALITY IMPACT — VFD VS. FIXED SPEED

Measurable Product Improvement

Surface defects: reduced 30–50%

Breakout rate: reduced 60–80%

Dimensional tolerance: improved ±1mm

Yield increase: 1–2% more prime product

ROLLING MILL · MAIN DRIVES · MOST DEMANDING VFD APPLICATION

Hot & Cold Rolling Mill Main Drives

HOT ROLLING MILL — DRIVE SPECIFICATIONS

Roughing Mill	5,000–8,000 kW	Reversing operation, high torque at low speed, heavy slab reduction. Single or twin stand with edger.
Finishing Mill (per stand)	3,000–6,000 kW	6–7 stands in cascade, ±0.1% speed accuracy required. Coordinated speed control for strip thickness.
Coiler / Downcoiler	2,000–4,000 kW	Tension control critical for coil quality. Regenerative braking recovers energy during deceleration.
Descaling Pump	1,500–3,000 kW	High pressure water (150–250 bar) removes oxide scale before rolling. Constant pressure VFD control.
Roller Table Drives	50–200 kW each	Hundreds of individual drives for slab/strip transport. Low voltage, grouped in MCC cabinets.

COLD ROLLING MILL — DRIVE SPECIFICATIONS

Tandem Mill
2,000–5,000 kW
4–6 stands, high precision thickness control, ±0.5% gauge accuracy

Temper / Skin Pass
1,000–3,000 kW
Surface finish and flatness control, low reduction ratio

Pickling / Annealing
300–800 kW
Line speed control, acid circulation pumps, furnace fans

3D View — E-House Installation Adjacent to Hot Strip Mill Building

TECHNICAL CHALLENGES — ROLLING MILL VFD

Dynamic Torque Control
Rapid load cycling during bite-in/bite-out. Torque response < 5ms required.

Regenerative Braking
Active front end (AFE) recovers energy during deceleration, feeding back to grid.

Multi-Stand Coordination
Speed cascade across 6–7 finishing stands. Master-slave control with real-time sync.

Power Quality / Harmonics
36-pulse transformer + active filter to meet IEEE 519 limits at PCC.

HOT STRIP MILL — E-HOUSE DRIVE CONFIGURATION (TYPICAL)

Reheat Furnace — Slab heating → Descaling 2,500 kW HP pump VFD → Roughing Mill 7,000 kW Reversing VFD → F1 5,500 kW Stand 1 → F2 5,000 kW Stand 2 → F3 4,500 kW Stand 3 → F4 4,000 kW Stand 4 → F5 3,800 kW Stand 5 → F6 3,500 kW Stand 6 → Laminar Cooling 800 kW Pump VFD → Coiler 3,000 kW Tension VFD

PLANT UTILITIES · WATER · COOLING · COMPRESSED AIR · GAS PLANT

Water Treatment & Plant Utilities

30–50%

Energy saving on pump & fan loads

via VFD speed control (affinity law)

SYSTEM 01 — CIRCULATING WATER

Main Cooling Water Circuits

30–50%

Energy saving

Main Circulating Pump Closed-loop pressure control	500–2,000 kW	4–8 units
Booster Pump Secondary circuit pressure	200–500 kW	2–4 units
Backwash / Filter Pump Water treatment filtration	100–300 kW	2–3 units
Make-up Water Pump Replenish evaporation loss	100–200 kW	1–2 units

E-House config: 4–6 MV VFDs in one E-House, PLC with flow/pressure cascade control. Affinity law: 20% speed reduction = ~50% power saving.

SYSTEM 02 — COOLING TOWERS

Forced / Induced Draft Cooling

25–40%

Energy saving

CT Fan (Induced Draft) Temperature-based speed control	200–500 kW	6–12 units
CT Circulation Pump Basin to distribution header	300–800 kW	4–6 units
Spray Nozzle Pump Evaporative cooling spray	50–150 kW	2–4 units

E-House config: Multiple LV/MV VFDs grouped per cooling tower bank. Ambient temperature + return water temp as control inputs. Seasonal load variation 40–100%.

SYSTEM 03 — COMPRESSED AIR

Process & Instrument Air Supply

15–30%

Energy saving

Main Air Compressor Centrifugal, pressure-based VFD	500–1,500 kW	3–5 units
Instrument Air Dryer Desiccant regeneration blower	50–200 kW	2–3 units
Booster Compressor High-pressure process air	200–500 kW	1–2 units

E-House config: VFD on lead compressor, fixed-speed base load units. Pressure-band optimization eliminates blow-off waste. Anti-surge protection integrated.

SYSTEM 04 — OXYGEN & GAS PLANT

ASU, O_2, N_2 & Ar Production

15–25%

Energy saving

Main Air Compressor (ASU) Air separation unit feed	1,000–3,000 kW	2–3 units
Oxygen Compressor BOF/EAF oxygen supply	500–1,500 kW	2–3 units
Nitrogen Compressor Purging, blanketing, cooling	300–800 kW	1–2 units

E-House config: Dedicated E-House near ASU. VFD on main compressor matches O_2 demand to BOF/EAF schedule. Reduces venting and energy waste during low-demand periods.

UTILITY E-HOUSE — TOTAL PLANT ROI SUMMARY

10–30 MW

15,000–40,000

1–2 Years

3–5 Units

10,000–25,000

PRODUCT CONFIGURATION · INTERNAL LAYOUT · TECHNICAL SPECIFICATIONS

MPA-200 Steel Configuration & Internal Layout

25,800 × 7,800 × 4,000 mm
Overall Dimensions (L × W × H)

3D Cutaway View — MPA-200 Internal Layout for Steel Industry Configuration

4 × 1,800 kW	3 × 180 kW	2 Zones
MV VFD Cabinets	HVAC Units (N+1)	Novec 1230 Fire Suppression

MAIN SPECIFICATIONS (PER E-HOUSE)

Electrical, Mechanical & Environmental

Input Voltage	6.6 kV / 50 Hz / 3 Ph
Output Voltage	0 – 6.6 kV (variable)
Motor Power (each)	1,800 kW
Converter Type	Medium Voltage VFD
Configuration	4 × 1,800 kW VFD per unit
Enclosure	IP54 / IP55
Fire Rating	120 min (R120)
Insulation	Rockwool, 100 mm (A1)
HVAC System	3 × 180 kW (N+1)
Air Flow (each)	28,600 m³/h
Fire Fighting	Novec 1230 / 2 Zones
Ambient Temp.	-5 ~ 40 °C (standard) / 55 °C (enhanced)
Relative Humidity	5 ~ 95% (Non-condensing)
Dimensions (L×W×H)	25,800 × 7,800 × 4,000 mm
Weight (Approx.)	~40 Tons

DESIGN STANDARDS & CERTIFICATIONS

IEC 61439 — LV switchgear assemblies

IEC 62271 — HV switchgear & controlgear

IEC 61800 — Adjustable speed drives

IEEE 519 — Harmonic control

MAIN EQUIPMENT LIST (PER E-HOUSE)

STRUCTURAL ENGINEERING · INSULATION · FIRE PROTECTION · CORROSION RESISTANCE

Wall & Roof Structure — Multi-Layer Protection

WALL PANEL CROSS-SECTION

Outside → Inside (5 Layers)

Steel frame + insulated sandwich panel construction

Outer Sheet	Galvanized steel, color-coated (RAL 9002/7035), t = 1.5 mm
Insulation	Rockwool, A1 non-combustible, density 100–120 kg/m³, t = 100 mm
Vapour Barrier	Polyethylene film, prevents moisture migration into insulation core
Inner Sheet	Galvanized steel, fire proof, t = 1.0 mm, powder-coated light grey
Joint Sealing	Tongue-and-groove interlocking panels, IP55 rated seals
Total Thickness	~105 mm (wall panel assembly)

ROOF PANEL CROSS-SECTION

Top → Bottom (5 Layers)

Standing seam or trapezoidal profile roof system

Roof Sheet	Galvanized steel, standing seam, t = 1.2 mm, 2% min slope
Waterproofing	TPO/PVC membrane, UV-resistant, welded seams, 20-year warranty
Insulation	Rockwool, A1 non-combustible, density 100–120 kg/m³, t = 100 mm
Ceiling Panel	Fire proof mineral fiber or steel, accessible for cable tray zone above
Cable Tray Zone	800 mm clear space above ceiling for MV/LV cable routing
Drainage	Internal gutters + downpipes, ≥ 1% slope for positive drainage

PERFORMANCE SPECIFICATIONS

Fire · Thermal · Structural

FIRE RATING

R120

120 min structural integrity under fire. All doors fire-rated steel. Rockwool A1 non-combustible (EN 13501-1).

THERMAL PERFORMANCE

U ≤ 0.40 W/m²K

100mm rockwool provides excellent thermal insulation. Reduces HVAC energy consumption by 20–30%.

ACOUSTIC INSULATION

Rw 35–45 dB

Rockwool core absorbs VFD switching noise. Meets industrial noise regulations at 1m boundary.

CORROSION CLASS

C3–C5

Optional C5-M marine/offshore coating for coastal or high-corrosion steel plant environments.

WIND / SEISMIC

150 km/h · Zone 3

Structural steel frame designed for 150 km/h wind load and seismic zone 2–3 compliance.

DESIGN LIFE

≥ 25 Years

Hot-dip galvanized steel frame. All components rated for outdoor industrial environment. Minimal maintenance.

CLIMATE CONTROL · N+1 REDUNDANCY · DUST-FREE ENVIRONMENT

HVAC System & Airflow Simulation

N+1 redundancy ensures continuous cooling even during unit maintenance or failure in extreme steel plant conditions

N+1 HVAC CONFIGURATION

3 × 180 kW Cooling Units

HVAC-1	HVAC-2	HVAC-3
180 kW	180 kW	180 kW
ACTIVE	ACTIVE	STANDBY (N+1)

Air Flow (each)	28,600 m³/h
Cooling Capacity	180 kW per unit, 360 kW active total
Ambient Design	-5°C to +55°C outdoor range
Internal Target	≤ 35°C at VFD cabinet air inlet
Refrigerant	R410A, environmentally compliant
Control	PLC-integrated, auto switchover
Monitoring	Temperature sensors per zone, SCADA link

Automatic Failover Logic

If any active unit fails or exceeds temperature threshold, standby unit activates within 30 seconds. Rotating duty cycle equalizes wear across all 3 units. Alarm triggers at 40°C internal; emergency shutdown at 50°C.

AIRFLOW PATH SIMULATION

Bottom-Up Cooling Through Equipment

HOT AIR EXHAUST (Top)	4 × exhaust outlets at roof level	34–38°C ↑ ↑ ↑ ↑
VFD CABINET ZONE	Heat generated by power electronics	28–34°C ↑ ↑ ↑ ↑
SWITCHGEAR ZONE	MV switchgear, transformer area	22–28°C ↑ ↑ ↑ ↑
COLD AIR INLET (Bottom)	Filtered fresh air from HVAC units	18–22°C → → → →

AIR TEMPERATURE DISTRIBUTION (°C)

28,600 m³/h air flow per unit	4 Exhaust outlets at roof
Bottom-Up Airflow direction pattern	20°C ΔT Inlet-to-exhaust gradient

MULTI-STAGE AIR FILTRATION

3-Stage Protection for Steel Plant Dust

S1 — G4 Pre-Filter

Captures particles > 10 µm

Coarse filtration removes iron ore dust, coke fines, and large airborne particles. Washable and reusable. Replacement every 3 months in heavy dust areas.

S2 — F7 Fine Filter

Captures particles > 1 µm (85% efficiency)

Fine particulate filtration protects sensitive VFD electronics from sub-10µm iron oxide and carbon particles. Bag or pocket type. Replace every 6 months.

S3 — Activated Carbon Filter

Absorbs SO_2, H_2S, corrosive gases

Chemical filtration removes corrosive gases from BF/BOF off-gas that can damage copper busbars and PCB components. Replace every 6–12 months.

POSITIVE PRESSURE DESIGN

25–50 Pa

Internal Overpressure vs. Ambient

Continuous positive pressure prevents unfiltered dust-laden air from entering through any gap, door opening, or cable penetration. Pressure monitored by differential sensor with SCADA alarm.

G4 Filter Life

F7 Filter Life

SAFETY CRITICAL · CLEAN AGENT SUPPRESSION · VESDA DETECTION

Fire Protection & Safety Systems

Novec 1230
Clean agent — zero residue, safe for electronics

SUPPRESSION AGENT

Novec 1230 (FK-5-1-12)

Fluoroketone-based clean agent that extinguishes fire by heat absorption. Electrically non-conductive, leaves zero residue, and is safe for occupied spaces — ideal for protecting high-value VFD and switchgear equipment.

ODP	0 — zero ozone depletion
GWP	1 — lowest of all clean agents
ALT	5 days — atmospheric lifetime
NOAEL	10% — safe for occupied spaces
Design Conc.	4.2–5.8% by volume
Discharge Time	≤ 10 seconds full discharge
Residue	None — evaporates completely
Conductivity	Non-conductive — safe for live equipment

STANDARDS COMPLIANCE

- **NFPA 2001** Clean Agent Systems
- **EN 15004** Fixed Firefighting
- **ISO 14520** Gaseous Extinguishing
- **UL 2166** Halocarbon Agent

SYSTEM COMPONENTS

6 Integrated Safety Elements

01 — VESDA Aspirating Smoke Detection
Very Early Smoke Detection Apparatus — continuously samples air through pipe network. Detects smoke at pre-alarm level (0.005% obs/m), far earlier than point-type detectors.
Alert → Action → Fire 1 → Fire 2 (4-stage alarm)

02 — Gas Bottle Rack
Novec 1230 stored in steel cylinders, nitrogen-pressurized at 25 bar. Rack-mounted with manifold for simultaneous discharge to all nozzles in the zone.
Cylinder capacity: 68L / 80L per unit

03 — Discharge Nozzles
Ceiling-mounted 360° spray nozzles ensure uniform agent distribution. Engineered flow calculation for each protected volume.
Coverage: 12–16 m² per nozzle

04 — Fire Alarm Control Panel (FACP)
Zone-selectable release panel with auto/manual mode switch. Interfaces with SCADA for remote monitoring and alarm forwarding.
Addressable loop, RS-485 + Modbus TCP

05 — Manual Release Station
Break-glass stations at each exit door. Allows manual triggering of suppression in the event of visible fire before automatic detection.

06 — Warning Light & Horn
Visual strobe (red) and audible horn (95 dB) provide 30-second pre-discharge warning for personnel evacuation.

INDEPENDENT FIRE ZONES

Dual-Zone Protection Design

Zone 1 — VFD Room
PRIMARY ZONE

Covers: VFD cabinets, transformers, MCC panels

- Independent VESDA sampling network
- Dedicated Novec 1230 cylinder bank
- 6–8 ceiling nozzles, 360° coverage
- Automatic HVAC shutdown on alarm

Zone 2 — Control / MV S/G
SECONDARY ZONE

Covers: MV switchgear, PLC/HMI, control room

- Separate VESDA loop from Zone 1
- Independent suppression discharge
- 4–6 ceiling nozzles
- Cross-zone alarm notification

CROSS-ZONE SAFETY FEATURES

Both zones share a common fire alarm control panel with zone-selective release. If one zone discharges, the other zone receives an alarm notification for evacuation. **Pressure relief vents** prevent overpressure during agent discharge. **Door interlocks** ensure all access doors are closed before release.

FIRE RESPONSE SEQUENCE — FROM DETECTION TO POST-DISCHARGE

ELECTRICAL DESIGN · POWER DISTRIBUTION · CONTROL HIERARCHY · COMMUNICATION

System Single Line Diagram & Control Architecture

4-Layer architecture from field instruments to cloud-based remote monitoring with industrial-grade protocols

ELECTRICAL SINGLE LINE DIAGRAM — POWER PATH

4-LAYER CONTROL ARCHITECTURE

L4 — Remote Monitoring
Cloud / Enterprise Level

Cloud-based platform for 24/7 fleet monitoring, predictive analytics, KPI dashboards, and mobile app access. Multi-site E-House management from central engineering office.

OPC-UA · MQTT · HTTPS REST API

L3 — Plant SCADA / DCS
Supervisory Level

Integration with plant-wide DCS (ABB 800xA / Siemens PCS7). Historian data logging, alarm management, trending, and operator interface for E-House subsystem.

OPC-UA · Modbus TCP · IEC 61850

L2 — PLC / HMI Control
E-House Local Level

Siemens S7-1500 or ABB AC500 PLC with 15" HMI touchscreen. Executes VFD start/stop sequences, speed setpoints, cascade control, interlock logic, and HVAC/fire system coordination.

Profinet · Modbus TCP · EtherNet/IP

L1 — Field Instruments
Device / Sensor Level

VFD status feedback, motor current/speed, bearing temperature (Pt100), vibration sensors, flow transmitters, pressure transmitters, power meters, and HVAC/fire panel I/O.

Profinet · HART 4–20mA · Modbus RTU

COMMUNICATION PROTOCOLS

Industrial-Grade Connectivity

Profinet
PLC · VFD Real-Time Control

Deterministic Ethernet for VFD speed commands, status feedback, and diagnostic data. Cycle time ≤ 1 ms. IRT mode for synchronized multi-drive control.

Modbus TCP/RTU
PLC · Instruments & Meters

Standard protocol for power meters, temperature transmitters, HVAC controllers, and auxiliary I/O. TCP for Ethernet, RTU for RS-485 legacy devices.

OPC-UA
SCADA · PLC Secure Exchange

Platform-independent, encrypted data exchange between E-House PLC and plant SCADA/DCS. Built-in security with X.509 certificates.

HART (4–20 mA)
Analog + Digital Overlay

Superimposed digital signal on 4–20 mA analog loop. Enables remote configuration and diagnostics of field instruments without additional wiring.

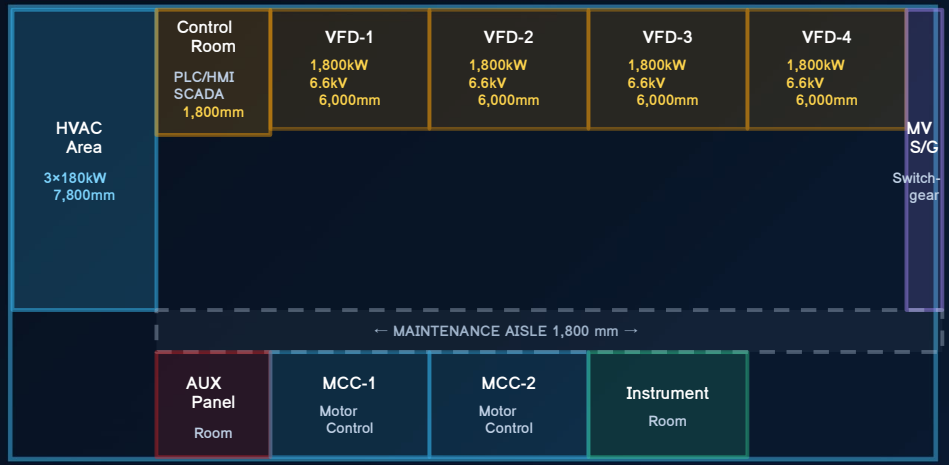
ENGINEERING DRAWINGS · LAYOUT · DIMENSIONS · FOUNDATION

Floor Plan, Cross Section & Foundation

25,800 × 7,800 × 4,000 mm
Overall Dimensions (L × W × H)

FLOOR PLAN (TOP VIEW) — 25,800 × 7,800 MM OVERALL

Maintenance Aisle: 1,800 mm center · Service Door: 2,000 (W) × 2,400 (H) mm · Equipment Access Doors: front panel



Overall Length: 25,800 mm Overall Width: 7,800 mm Module Pitch: 6,000 mm Aisle Width: 1,800 mm

HVAC / Control · VFD / MV / MCC · Auxiliary · Maintenance Aisle · Instrument · MV Switchgear

3D CUTAWAY VIEW (INTERNAL LAYOUT)

3D Cutaway — MPA-200 Internal Layout for Steel Industry Configuration

4 × 1,800 kW	6 Zones	1,800 mm
MV VFD Cabinets	Functional Areas	Maintenance Aisle

CROSS SECTION PL-A

Internal Height & Clearance

Overall Height	4,000 mm (external)
Internal Clear	3,200 mm (floor to ceiling)
Cable Tray Zone	800 mm above ceiling panel
Floor Loading	> 10 kN/m² (equipment area)

FOUNDATION PLAN

Concrete Foundation & Cable Trench

Foundation Type	Reinforced concrete pad
Min. Strength	200 kPa soil bearing capacity
Cable Trench	Below E-House, 600 × 600 mm
Drainage	Slope > 1%, drainage channel

CABLE ENTRY DETAIL (BOTTOM)

Bottom Entry via Cable Trench

Entry Method	Bottom entry through floor
Cable Gland	Cable gland plate, IP55 sealed
MV Cables	XLPE, 6/10kV, single core
Control Cables	Screened, fire retardant

COMMERCIAL VALUE · PROJECT DELIVERY · TOTAL COST OF OWNERSHIP

Customer Value: Traditional vs. E-House

40–60%

Reduction in on-site construction time vs. traditional approach

	TRADITIONAL SITE-BUILT	MPA-200 E-HOUSE SOLUTION
Project Timeline Design to handover	**12–18 Months** Sequential: design → civil → install → commission. Weather-dependent site work causes frequent delays.	**5–7 Months** Parallel: factory build + site prep simultaneously. Factory-controlled schedule eliminates weather risk. 50–60% FASTER
On-Site Duration Construction + install	**8–12 Months** Building construction, cable trenching, equipment installation, wiring, and testing — all performed on-site.	**2–4 Weeks** Crane placement on prepared foundation, MV/LV cable connection, and final site acceptance test only. 90% SITE TIME REDUCTION
Quality Control Testing & validation	**Site-Dependent** Quality varies with local labor skill, weather conditions, and site supervision. Defects found during commissioning.	**Factory FAT Completed** 100% factory acceptance test before shipment. Controlled environment ensures consistent quality. ISO 9001 certified. ZERO REWORK ON SITE
Vendor Management Coordination effort	**5–8 Vendors** Civil, electrical, HVAC, fire, controls — each with separate contracts, schedules, and interface risks.	**Single Vendor** One contract, one schedule, one point of responsibility. All interfaces resolved in factory integration. SINGLE RESPONSIBILITY
Commissioning Testing duration	**3–6 Months** Sequential system-by-system commissioning. Interface issues between vendors cause delays and finger-pointing.	**2–4 Weeks** Pre-commissioned in factory. Site commissioning is verification only — power on, load test, SCADA integration. 80% FASTER COMMISSIONING
Expansion Future capacity growth	**Major Civil Works** Building extension or new building required. Disrupts existing operations during construction phase.	**Add Another Module** Place additional E-House unit adjacent to existing. Modular design allows capacity doubling with minimal disruption. PLUG & EXPAND
Relocation Asset redeployment	**Not Possible**	**Crane-Relocatable**

Ready to Transform Your Steel Plant Drive Infrastructure?

Share your motor list and site conditions — we will deliver a tailored E-House proposal with full engineering design, energy saving analysis, and ROI projection within 2 weeks.

3-STEP ENGAGEMENT PROCESS

01

Share Motor List & Site Data

Provide motor ratings, quantities, operating profiles, site layout, ambient conditions, and power supply details.

02

Engineering Review & Site Assessment

Our team conducts technical review, site survey, thermal analysis, and preliminary E-House sizing and configuration.

03

Tailored Proposal & ROI Report

Receive detailed proposal with GA drawings, SLD, equipment list, energy saving projection, and investment payback analysis.

CONTACT US

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info@electrical-house.com

WEBSITE
www.electrical-house.com

PHONE

RESPONSE TIME
Within 48 hours

WHY CHOOSE MPA-200 E-HOUSE

4 Key Differentiators for Steel Industry

D1 — All-in-One Packaged Solution

Single Vendor · Factory Tested · Plug & Play

MV switchgear, VFD, MCC, PLC, HVAC, and fire protection integrated in one factory-tested enclosure. Eliminates multi-vendor coordination risk.

D2 — 40–60% Faster Deployment

5–7 Months vs. Traditional 12–18 Months

Factory prefabrication runs parallel to civil works. FAT completed before shipment. Site work reduced to foundation, cable, and commissioning only.

D3 — 15–50% Energy Saving

VFD on All Motor Loads · 1–2 Year Payback

Affinity law: 20% speed reduction = ~50% power saving on fans and pumps. Covers BF blowers, ID/FD fans, rolling mills, water pumps, and utilities.

D4 — 24/7 Smart O&M Platform

Remote Monitoring · Predictive Maintenance · SCADA

PLC + HMI + SCADA integrated control with OPC-UA connectivity. Vibration, temperature, and power quality monitoring enables predictive maintenance and reduces unplanned downtime.