

Table 2 — Customer Data Requirements for CSR - TDE-EAF™

What information is required from the customer?

The implementation level depends on the quality, depth and availability of plant data. The matrix below shows what is typically needed for each TDE-EAF™ deployment level.

Legend:

● Required ◐ Recommended ○ Optional — Not required

| Required input from customer | Offline Simulator | DSS / Advisory Mode | Online Digital Twin |
|--|-------------------|---------------------|---------------------|
| Basic EAF plant data (furnace size, transformer power, nominal heat size, shell type, main equipment) | ● | ● | ● |
| General EAF process description (melting practice, charging sequence, oxygen practice, carbon injection, slag foaming logic) | ● | ● | ● |
| Typical operating values (scrap mix, DRI/HBI if used, hot heel practice, power-on time, tap temperature targets) | ● | ● | ● |
| Standard recipes / operating practice | ● | ● | ● |
| Electrical operating data (power profiles, voltage/current levels, transformer settings, electrode consumption if available) | ◐ | ● | ● |
| Historical heat results (tap temperature, tap chemistry, power consumption, oxygen used, electrode consumption, yield data) | ◐ | ● | ● |
| Heat-by-heat production data | ○ | ● | ● |
| Time-stamped process sequence (charge events, bucket sequence, power-on/off, oxygen blowing, carbon injection, tapping events) | ○ | ◐ | ● |
| Actual process measurements during operation | ○ | ● | ● |
| Off-gas data (if available) | ○ | ◐ | ● |
| Furnace electrical signals (active/reactive power, current, voltage, arc stability indicators, if available) | ○ | ● | ● |
| Oxygen, natural gas and carbon injection data | ○ | ● | ● |
| Electrode regulation / arc control related data (if available) | ○ | ◐ | ● |

| Required input from customer | Offline Simulator | DSS / Advisory Mode | Online Digital Twin |
|---|----------------------------------|----------------------------------|----------------------------------|
| Refractory lining description (roof, sidewall, hearth zoning, material grades, nominal thickness) | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Refractory campaign history and consumption records (kg/heat, kg/t steel, campaign length if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Shell temperature / hot spot monitoring data (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Refractory repair and gunning records (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Slag composition history relevant to refractory attack (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| List of available data sources (Excel, CSV, historian, database, Level 2, etc.) | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Live signal availability | — | <input type="radio"/> | <input checked="" type="radio"/> |
| PLC / Level 1 / Level 2 tag list | — | <input type="radio"/> | <input checked="" type="radio"/> |
| Tag description and engineering units | — | <input type="radio"/> | <input checked="" type="radio"/> |
| Data communication architecture (OPC-UA, database, API, historian, network constraints) | — | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Automation sequence and phase logic | — | <input type="radio"/> | <input checked="" type="radio"/> |
| IT / OT environment and deployment constraints | — | <input type="radio"/> | <input checked="" type="radio"/> |
| Customer expectations and project objectives | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |

TDE-EAF™ can start as an Offline Simulator and progressively evolve into DSS / Advisory Mode and a fully integrated Online Digital Twin as plant data availability increases.

Note on data quality and consistency

The quality of TDE™ outputs depends on the accuracy, completeness, time alignment and engineering consistency of the data provided by the customer. Whenever available, data should be supplied with clear units, time stamps, signal descriptions, process phase references and indication of measurement source. Inaccurate, incomplete or non-synchronized data may still allow a preliminary implementation, but with reduced predictive strength and advisory precision.

Note on refractory-related analyses

Refractory optimization, lining wear interpretation, campaign life support and slag/refractory interaction assessment can be significantly improved when the customer provides refractory design data, lining zoning, material grades, campaign history, repair records, shell temperature information, hot spot history and refractory consumption records.