# ALTERNATOR TECHNICAL DESCRIPTION
# WHA 52.3 L9 / 4p

Date: 02-26-2024 V6.10 - 12/2023

197 A,Fushou East Street,High-Tech Development Zone, Weifang,China

| Main data | | | | | C |
|---|---|---|---|---|---|
| Generator type: | **WHA 52.3 L9 / 4p** | | | | |
| Power: | 2 000 | kVA | 1 600 kWe | 1 660 kWm | |
| Voltage: | 400 | V | Star serial | | |
| Rated voltage range: | +5/-5% | | | | |
| Power factor - Lagging: | 0,8 | | | | |
| Frequency: | 50 | Hz | | | |
| Speed: | 1 500 | rpm | | | |
| Nominal current: | 2 887 | A | | | |
| Winding type: | p2/3 | | | | |
| Classes (Insulation / Temperature Rise): | H / H | | | | |
| Ambient temperature: | 40 | °C | | | |
| Altitude: | 1 000 | m | | | |

| Installation | IEC | Quantity | 1 |
|---|---|---|---|
| Prime mover: | Reciprocating engine | | |
| Manufacturer: | - | | |
| Type: | - | | |
| Duty: | Base Rating | | |

| Mechanical construction | IM1201 |
|---|---|
| Type of construction: | Single bearing |
| Mounting arrangement: | Horizontal Axis |
| Direction of rotation: | Clockwise (seen when facing the drive end - DE) |
| Bearing type: | Anti-friction |
| Bearing Lubrication: | Regreasable |
| Bearing insulation: | Not insulated |
| Flector type: | Cylindrical with keyway |
| Balancing - Class (ISO 21940-11): | Half key - G2,5 (std) |
| Flange: | SAE 0 |
| Shaft height: | 500 mm |
| Width: | 750 mm |

**Comments: SAE0-18**

| Additional specificities | |
|---|---|
| Stabilized Runaway speed: | 1 800 rpm - 2 min. |

| Cooling Method | IC01 |
|---|---|
| Degree of protection: | IP23 |
| Coolant: | Air / Temperature: 40 °C |
| Air quality: | Salt laden |
| Ventilation (internal): | Self-ventilated |
| Filters: | Without |
| Ducting for air inlet: | No |
| Ducting for air outlet: | No |

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## Connection, Excitation & Regulation

| | |
|---|---|
| Parallel operation: | Island mode (0F) - no droop CT |
| Excitation: | Self-excited - Brushless - Type: PMG |
| Sustained 3-phase Isc: | > 3 x FLC for 10s. |
| AVR type: | Leroy Somer - D550 - Digital |
| AVR location: | In terminal box |
| Alternator Voltage sensing: | In terminal box |

## Terminal box

| | |
|---|---|
| Power connection: | 4 connectors (brought out neutral) |
| Main terminal box location: | 1 terminal box on the top |
| Line side outlet: | Left hand side (seen when facing the drive end - D) |
| Gland plate: | Non magnetic, Undrilled |
| Auxiliaries | In main terminal box |
| | - |

## Protection and measurement accessories

### Temperature detection

| | |
|---|---|
| Stator windings: | 6 x PT100 (3 wires) |
| Guide bearing - NDE: | 1 x PT100 per bearing (3 wires) |

### Anti-condensation heating

Voltage: 230 V - 1Ph / Power: 500 W

### Transformers (Client use)

LS Supply

| **Set of 3 x CTs (measuring and/or protection):** | | | I Primary / I Secondary / Power / Class |
|---|---|---|---|
| *Preliminary* | Neutral side | S1 | 4000 / 5A / 10VA / Cl. 0,5 |

## Various items

| | |
|---|---|
| Paint: | PE - Primary - RAL 7032 |
| Documentation: | PDF manual |
| Documentation Language: | English |
| Nameplate | Sticker |

## Controls

| | |
|---|---|
| Standards: | IEC |
| QUAL/INES/006 001 => 101 | Measurement of winding resistance |
| QUAL/INES/006 021 => 128 | Insulation check on sensors (when fitted) |
| QUAL/INES/006 002 => 102&103 | Voltage balance and phase order check |
| QUAL/INES/006 007 => 109 | Overspeed test (according to test bench limitation) |
| QUAL/INES/006 009 => 111 | High potential test |
| QUAL/INES/006 010 => 112 | Insulation resistance measurement |

# ALTERNATOR ELECTRICAL DATA
# WHA 52.3 L9 / 4P

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## Main data: C

| | | | | | | |
|---|---|---|---|---|---|---|
| Power: | **2 000** | kVA | **1 600** | kWe | **1 660** | kWm |
| Voltage: | **400** | V | Frequency: | | **50** | Hz |
| Rated voltage range: | +5% / -5% | | Speed: | | 1500 | rpm |
| Power factor - Lagging: | 0,8 | | | | | |
| Nominal current: | 2 887 | A | Phases | | 3 | |
| Insulation / Temperature rise: | H / H | | Connexion | | Star serial | |
| Cooling: | **IC01** | | Winding type: | | p2/3 | |
| | | | Winding: | | - 6 Wires | |
| Ambient temperature: | 40 | °C | | | | |
| Altitude: | 1000 | m | Overspeed (rpm) | | 2250 | |
| Duty: Base Rating | | | Total Harmonic Distortion (THD) < 3,5% | | | |

## Efficiency ( Base 1600 kWe ) IEC

| | 25% | 50% | 75% | **100%** | 110% |
|---|---|---|---|---|---|
| **Power factor - Lagging: 0,8** | 94,75 | 96,43 | 96,60 | **96,41** | 96,30 |
| **Power factor - Lagging: 1** | 95,31 | 97,13 | 97,46 | **97,45** | 97,41 |

## Reactances (%) - ( Base 2000 kVA )

Unitary impedance ( 1 per unit ) = 0,08 ohms

| | | Direct axis *Unsaturated* | Direct axis *Saturated* | | Quadrature axis *Unsaturated* | Quadrature axis *Saturated* |
|---|---|---|---|---|---|---|
| Synchronous reactance | Xd | 292 | 217 | Xq | 149 | 111 |
| Transient reactance | X'd | 26,0 | 22,1 | X'q | 149 | 111 |
| Subtransient reactance | X"d | 13,1 | 11,2 | X"q | 13,6 | 11,6 |
| Negative sequence reactance | X2 | 13,4 | 11,4 | | | |

| | | |
|---|---|---|
| X0 | 2,1 | Zero sequence reactance |
| Xl | 6,6 | Stator leakage reactance |
| Xr | 20,9 | Rotor leakage reactance |
| **Kc** | **0,46** | Short-circuit ratio |

## Time constants (s)

| | Direct axis | | Quadrature axis | |
|---|---|---|---|---|
| Open circuit transient time constant | T'do | 2,99 | T'qo | NA |
| Short-circuit transient time constant | T'd | 0,267 | T'q | NA |
| Open circuit subtransient time constant | T"do | 0,044 | T"qo | 0,216 |
| Subtransient time constant | T"d | 0,022 | T"q | 0,020 |

| | | |
|---|---|---|
| Ta | 0,028 | Armature winding short circuit time constant |

## Resistances (%)

| | | | | | |
|---|---|---|---|---|---|
| Ra | 1,5 | Armature resistance | R0 | 0,7 | Zero sequence resistance |
| X/R | 7,3 | X/R ratio (without unit) | R2 | 2,7 | Negative sequence resistance |

Voltage accuracy: 0,25%
Maximum inrush current for a voltage dip of 15%: 1507 kVA
when starting an AC motor having a starting power factor between 0 and 0.4

Rating is provided for the specified temperature rise, by resistance measurement according to IEC60034-1

According to: I.E.C. 60034.1 - 60034.2 - NEMA MG 1-32

Products and materials shown in this catalogue may, at any time, be modified in order to follow the latest technological developments,

# ALTERNATOR MAIN CURVES
# WHA 52.3 L9 / 4P

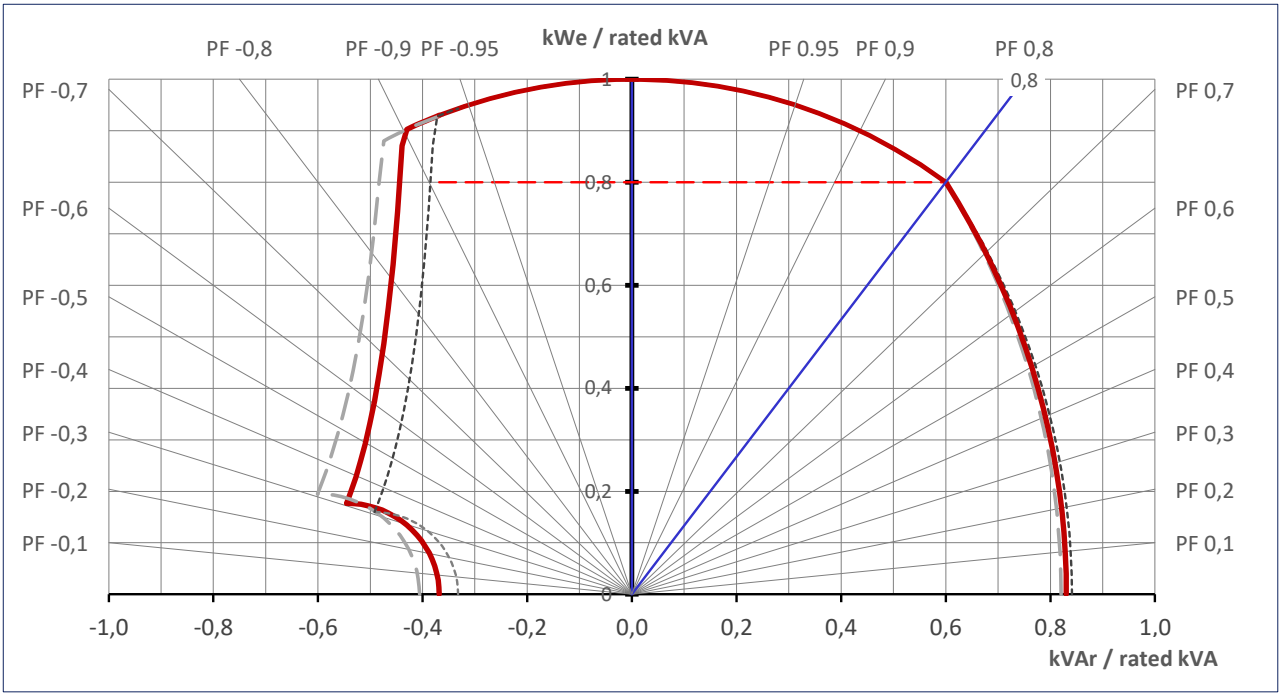
Date: 02-26-2024

**2000kVA - 400V - 50 Hz**

V6.10 - 12/2023

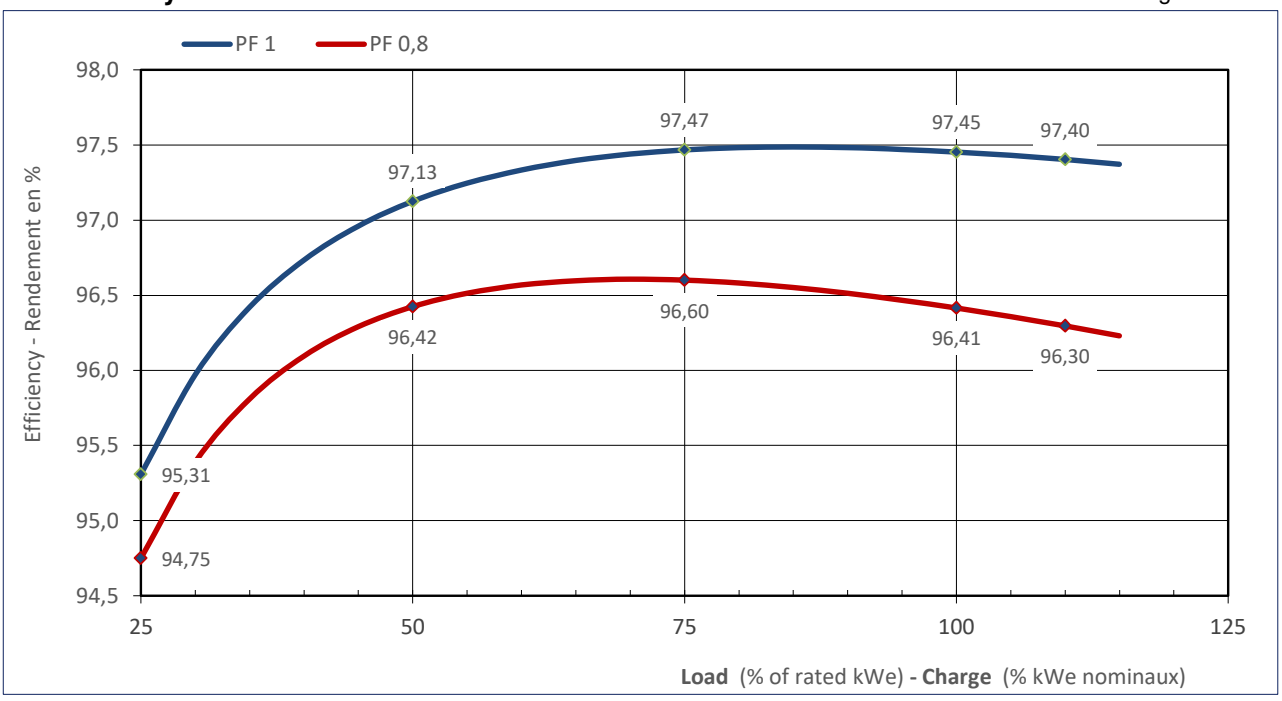
## Capability Curve

| | | | |
|---|---|---|---|
| Umax | + 5% | 420 | V |
| Un | | **400** | V |
| Umin | - 5% | 380 | V |




## Efficiency Curves

According to: IEC



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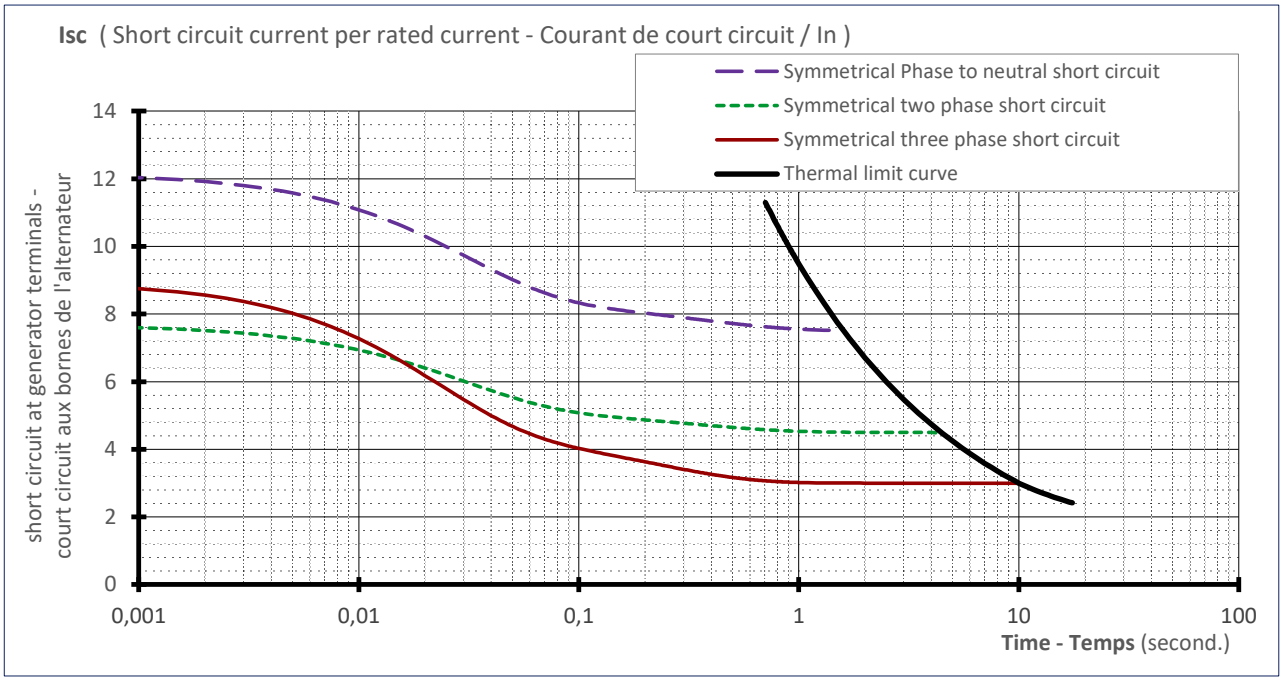
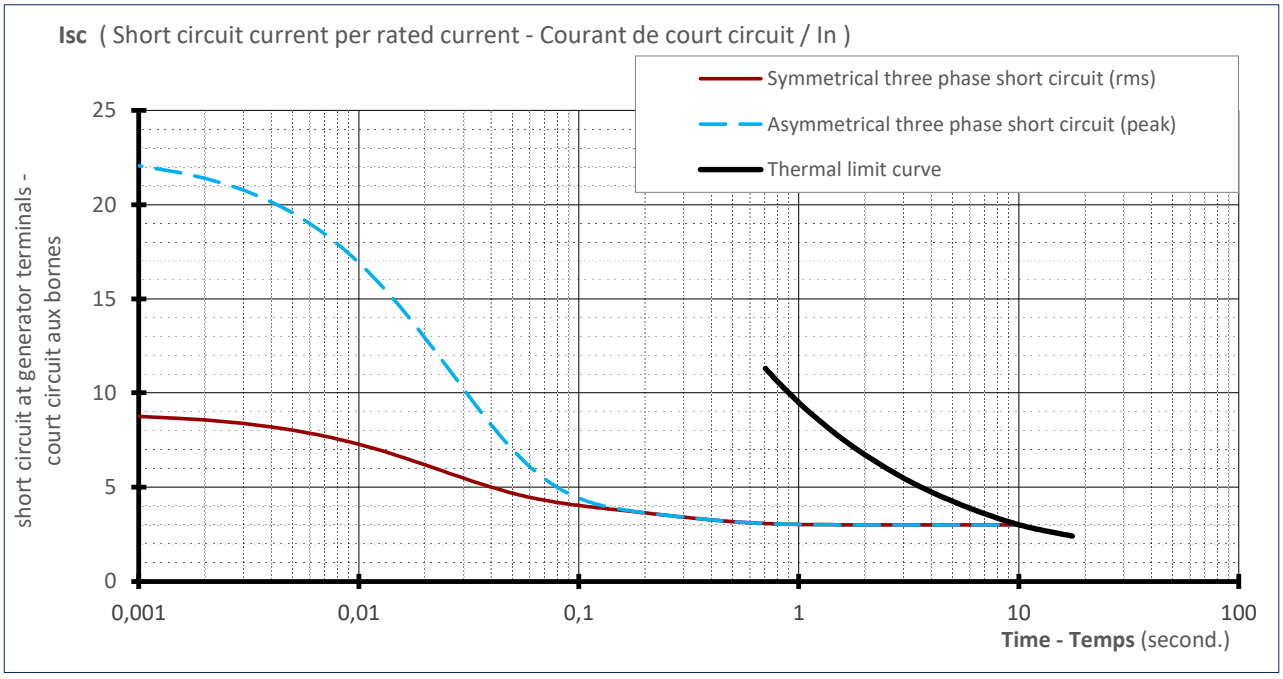
## Stator Current decrement curves

| | | | | | | |
|---|---|---|---|---|---|---|
| Symmetrical phase to neutral short-circu | initial | 34 755 | A | 12 x In | In = | **2887** A |
| Symmetrical two phase short-circuit | max | 21 929 | A | 7,6 x In | | |
| Symmetrical three phase short-circuit | value | 25 269 | A | 8,8 x In | | |
| Thermal Limit | | | | | | |




| | | | | | |
|---|---|---|---|---|---|
| Asymmetrical three phase short-circuit | IP | 63 133 | A | 21,9 x In | |



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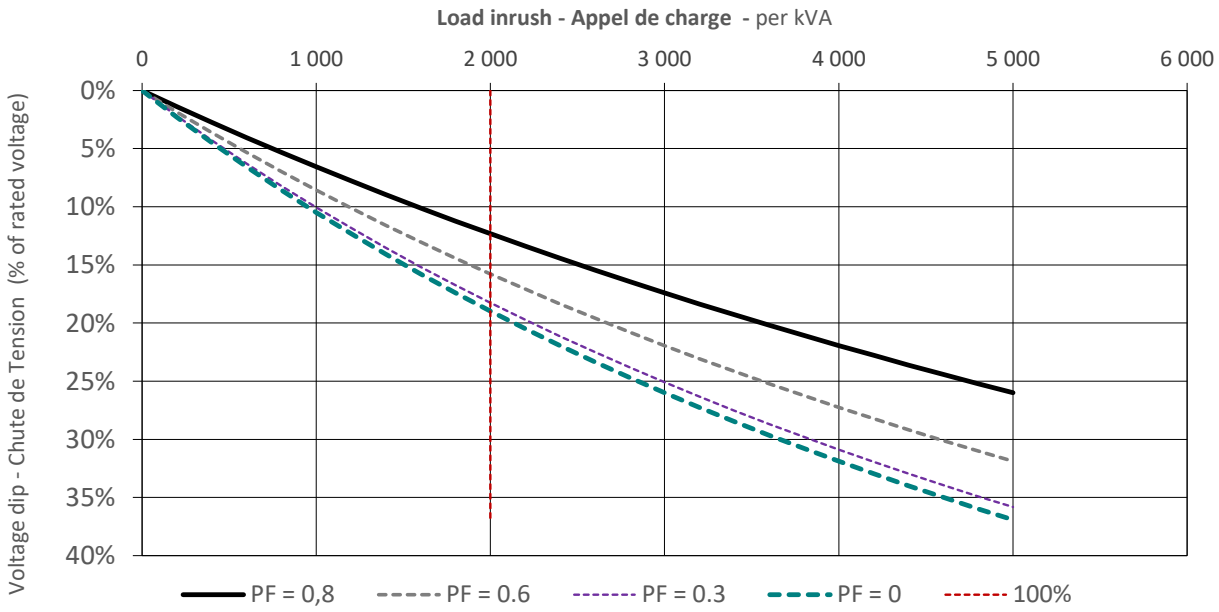
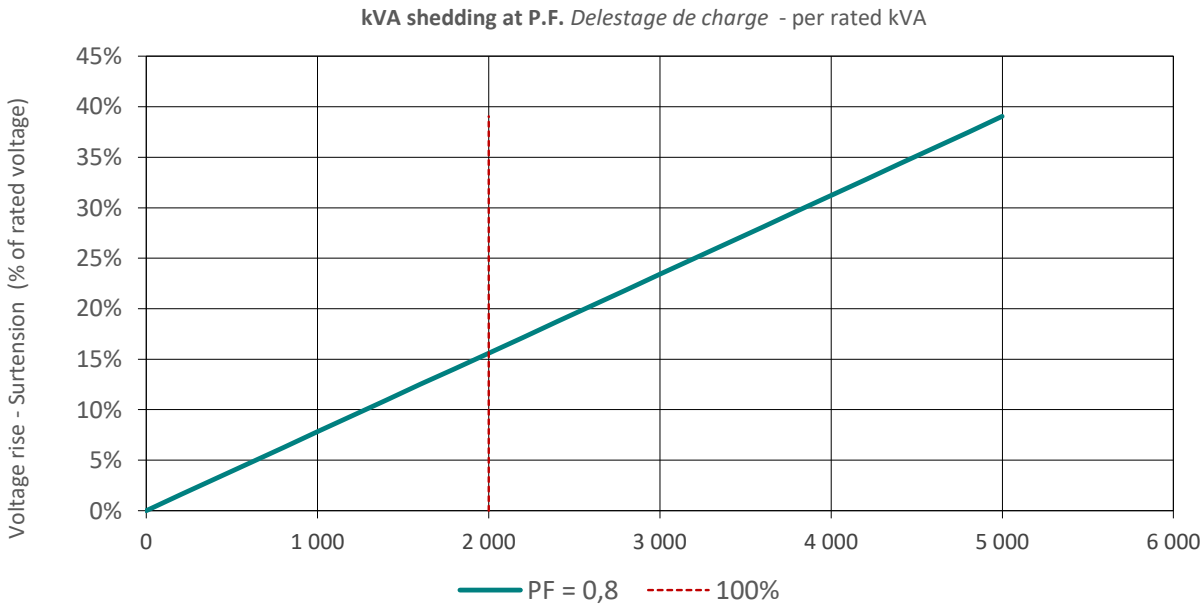
## Transient Voltage Variation

### Transient voltage dip curve versus load impact




### Transient voltage rise curve versus load rejection



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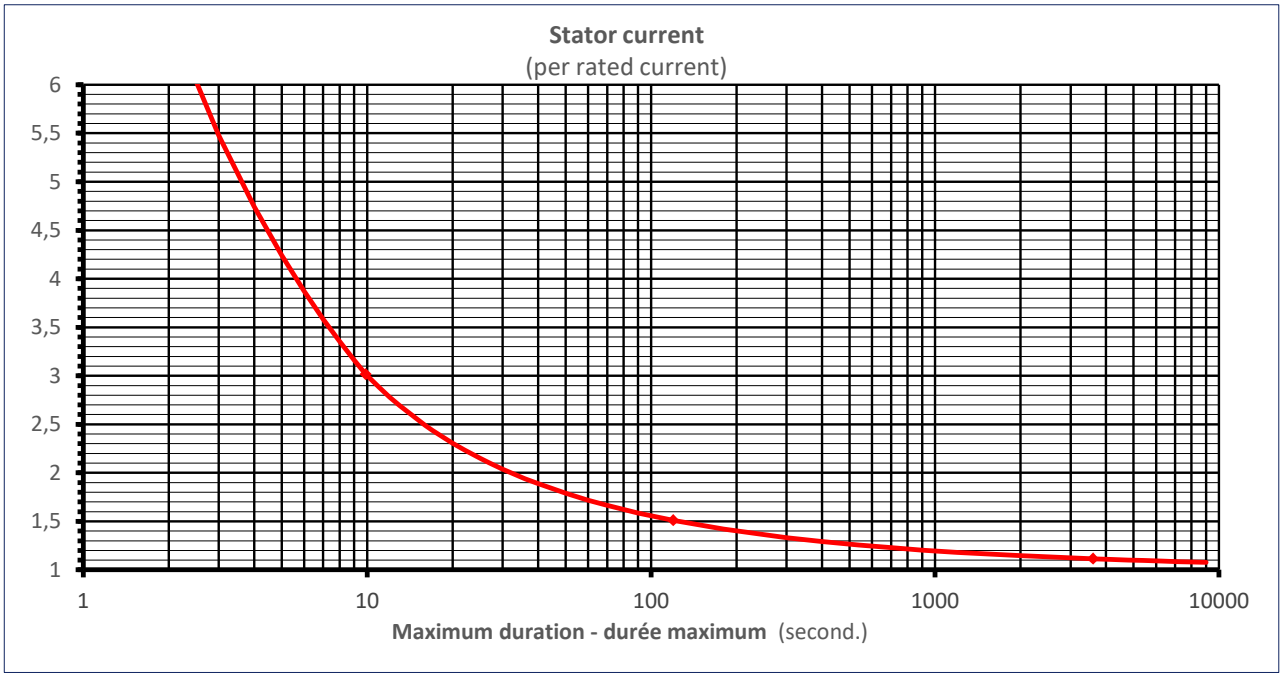
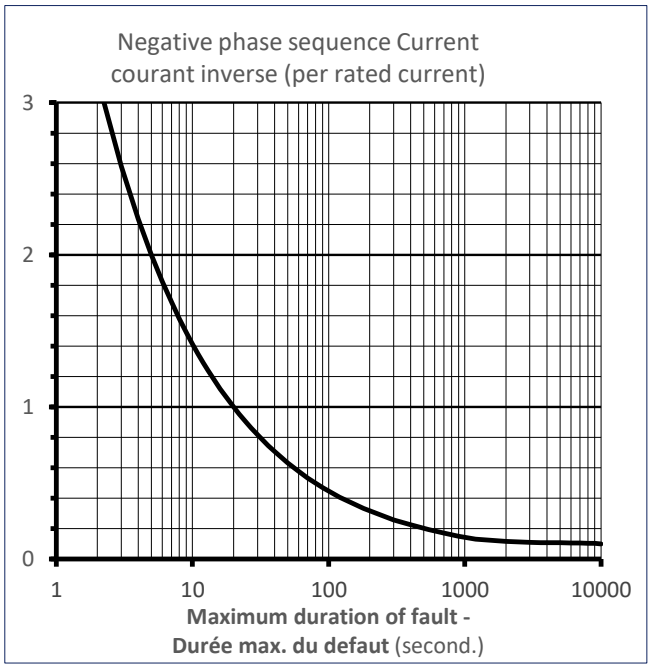
## Thermal Damage Curve




## Unbalance Load Curve




## Stator Earth Fault Current