maranello alternator

# M400

CONT 375 kVA

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# THREE-PHASE SYNCHRONOUS GENERATOR

Datasheet for 4 poles -50Hz @ 1500rpm/ 60Hz @ 1800rpm

| | | | |
|---|---|---|---|
| Ambient Temperature | 40°C | Method of Cooling | Air cooling |
| Temperature Rise | 125°C | Direction of Rotation | Clockwise |
| Insulation Class | H | Maximum Over-speed | 2250r/min |
| Power Factor | 0.8 | Degree of Protection / Enclosure | IP23 |
| Excitation | Brushless | Altitude | 1000m |
| Winding Pitch | 2/3 | Stator winding | DLL |
| Pole | 4 | Number of Terminal | 12 |
| Duty | S1- Continuous | Rotor | With damping cage |
| Waveform | TIF<50 | THF<2% | |
| Waveform distortion | BS EN 61000-6-2&BS EN 61000-6-4,VDE 0875G,VDE0874N | | |
| Radio interference | Noload<1.5%,Non-distorting balanced linear load<5% | | |

| AVR MODEL AVR | Standard | Selection | | PMG | | |
|---|---|---|---|---|---|---|
| | AS440 | KRS440 | | MX341B | MX321 | |
| Voltage Regulation - in steady state condition | ±1.0 | ±1.0 | | ±0.5 | ±0.5 | |
| Short Circuit Current Capacity | Control does not sustain a short circuit current | | | 1650A | | |

## Electrical Characteristic

| Frequency | Hz | 50 | | | | 60 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Voltage ( series star ) Y | V | 380/220 | 400/231 | 415/240 | 440/254 | 416/240 | 440/254 | 460/266 | 480/277 |
| Voltage ( parallel star ) YY | V | 190/110 | 200/115 | 208/120 | 220/127 | 208/120 | 220/127 | 230/133 | 240/138 |
| Voltage ( series delta ) Δ | V | 220 | 230 | 240 | 254 | 240 | 254 | 266 | 277 |
| Rated power at Class H (125° C) temperature rise | kVA | 375 | 375 | 375 | 375 | 420 | 435 | 460 | 460 |
| | kW | 300.0 | 300.0 | 300.0 | 300.0 | 336.0 | 348.0 | 368.0 | 368.0 |
| Efficiency at Class H (P.F.=0.8) | 4/4% | 93.2 | 93.3 | 93.6 | 93.8 | 93.3 | 93.4 | 93.4 | 93.7 |
| | 3/4% | 94.2 | 94.3 | 94.3 | 94.3 | 94.3 | 94.3 | 94.4 | 94.4 |
| | 2/4% | 94.5 | 94.4 | 94.3 | 94.2 | 94.4 | 94.4 | 94.4 | 0.3 |
| Efficiency at Class H (P.F.=1.0) | 4/4% | 94.6 | 94.8 | 95 | 95.1 | 94.8 | 94.8 | 94.9 | 95 |
| | 3/4% | 95.5 | 95.6 | 95.6 | 95.7 | 95.5 | 95.6 | 95.6 | 95.7 |
| | 2/4% | 95.7 | 95.7 | 95.7 | 95.6 | 95.7 | 95.7 | 95.7 | 95.7 |
| Reactances (%) at Class H | | | | | | | | | |
| Direct axis synchronous reactance unsaturated | Xd | 2.74 | 2.46 | 2.29 | 2.05 | 3.29 | 3.1 | 2.98 | 2.76 |
| Direct axis transient reactance saturated | X'd | 0.18 | 0.16 | 0.15 | 0.13 | 0.18 | 0.17 | 0.16 | 0.15 |
| Direct axis subtransient reactance saturated | X"d | 0.13 | 0.12 | 0.11 | 0.1 | 0.13 | 0.12 | 0.12 | 0.11 |
| Quadrature axis synchronous reactance unsaturated | Xq | 2.37 | 2.15 | 1.98 | 1.77 | 2.95 | 2.76 | 2.64 | 2.41 |
| Quadrature axis subtransient reactance saturated | X"q | 0.31 | 0.28 | 0.26 | 0.23 | 0.43 | 0.41 | 0.39 | 0.35 |
| Leakage reactance | X1 | 0.06 | 0.05 | 0.05 | 0.04 | 0.07 | 0.07 | 0.06 | 0.06 |
| Negative sequence reactance saturated | X2 | 0.23 | 0.2 | 0.19 | 0.17 | 0.29 | 0.27 | 0.26 | 0.24 |
| Zero sequence reactance unsaturated | X0 | 0.08 | 0.08 | 0.07 | 0.06 | 0.1 | 0.09 | 0.09 | 0.08 |
| Short-circuit ratio | Kcc | 0.3650 | 0.4065 | 0.4367 | 0.4878 | 0.3040 | 0.3226 | 0.3356 | 0.3623 |

| | | |
|---|---|---|
| Short-circuit transient time constant (sec.) | T'd | 0.08 |
| Subtransient time constant (sec.) | T"d | 0.018 |
| Open circuit time constant (sec.) | T'do | 1.65 |
| Armature time constant (sec.) | Tα | 0.018 |
| Stator Winding Resistance (20℃) | ohm | 0.00766 |
| Rotor Winding Resistance (20℃) | ohm | 1.26 |
| Exciter Stator Resistance (20℃) | ohm | 18 |
| Exciter Rotor Phase resistance | ohm | 0.068 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No load excitation current | io (A) | 0.5 | 0.52 | 0.6 | 0.6 | 0.5 | 0.51 | 0.6 | 0.6 |
| Full load excitation current | ic(A) | 2.2 | 2.2 | 2.3 | 2.3 | 2.2 | 2.2 | 2.3 | 2.3 |
| Cooling air requirement | $m^3$/sec | 0.8m3/s 1700cfm | | | | 0.99m3/s 2100cfm | | | |

## Mechanical Characteristic

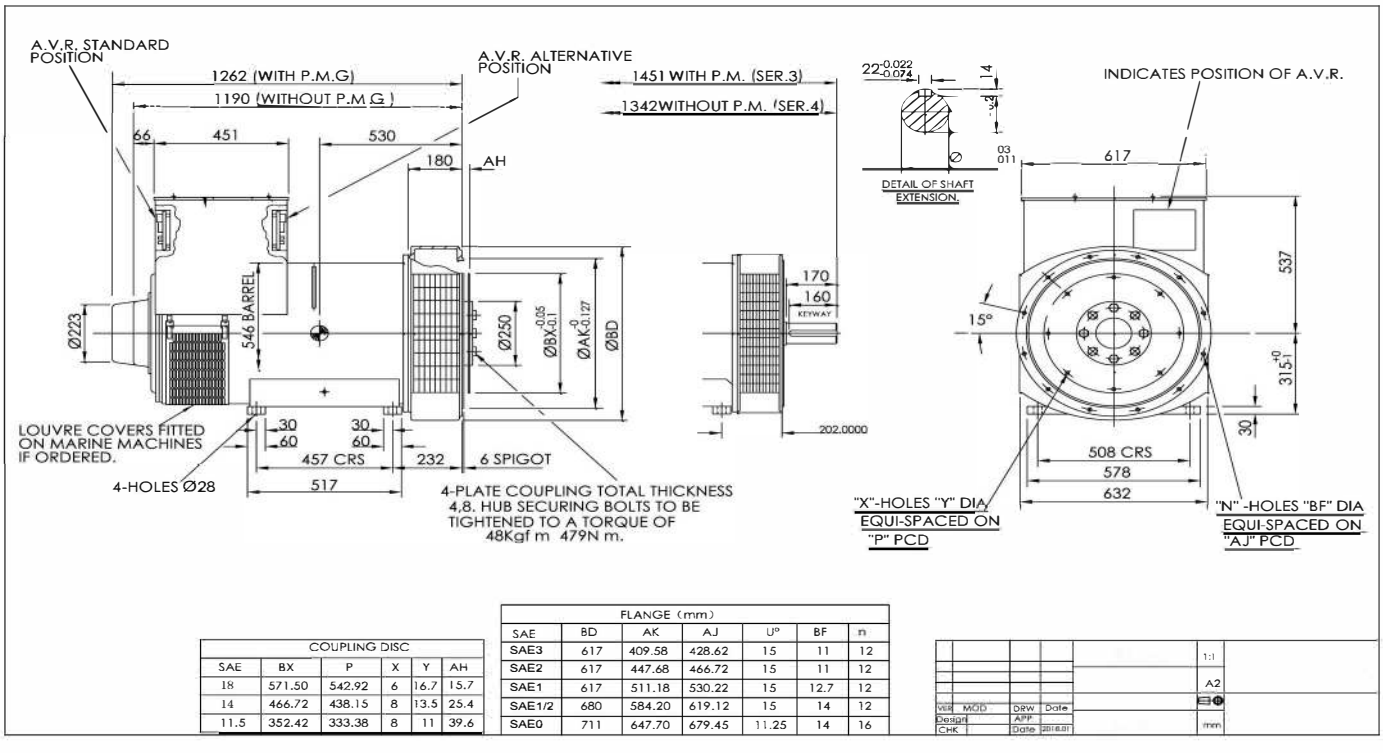
| | | |
|---|---|---|
| Configuration | Single Bearing | Double Bearing |
| Type of Construction | B2-SAE | IM B34 |
| Total Weight - kgs | 1088 | 1068 |
| Weight wound stator - kgs | 502 | 502 |
| Weight wound rotor - kgs | 432.4 | 410 |
| Inertia (J) [kgm2] | 4.998kgm2 | 4.799kgm2 |
| Drive end bearing / Lubrication | | BALL.6317-2RS(ISO) |
| Non-drive end bearing / Lubrication | BALL.6314-2RS(ISO) | BALL.6314-2RS(ISO) |
| Packing crate size（cm） | 133X70X104 | 145X70X104 |

## Winding 311 / 0.8 Power Factor

## RATINGS

| Class - Temp Rise | | Cont. F - 105/40° C | | | | Cont. H - 125/40° C | | | | Standby - 150/40° C | | | | Standby - 163/27° C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 Hz | Series Star (V) | 380 | 400 | 415 | 440 | 380 | 400 | 415 | 440 | 380 | 400 | 415 | 440 | 380 | 400 | 415 | 440 |
| | Parallel Star(V) | 190 | 200 | 208 | 220 | 190 | 200 | 208 | 220 | 190 | 200 | 208 | 220 | 190 | 200 | 208 | 220 |
| | Series Delta (V) | 220 | 230 | 240 | 254 | 220 | 230 | 240 | 254 | 220 | 230 | 240 | 254 | 220 | 230 | 240 | 254 |
| | kVA | 345 | 345 | 345 | 345 | 375 | 375 | 375 | 375 | 401.3 | 401.3 | 401.3 | 401.3 | 412.5 | 412.5 | 412.5 | 412.5 |
| | kW | 276 | 276 | 276 | 276 | 300 | 300 | 300 | 300 | 321 | 321 | 321 | 321 | 330 | 330 | 330 | 330 |
| | Efficiency (%) | 93.5 | 93.8 | 93.9 | 94 | 93.2 | 93.4 | 93.6 | 93.8 | 92.9 | 93 | 93.2 | 93.5 | 92.8 | 92.8 | 93.1 | 93.4 |
| | kW Input | 295 | 294 | 294 | 294 | 322 | 321 | 321 | 320 | 346 | 345 | 344 | 343 | 356 | 356 | 354 | 353 |
| | | | | | | | | | | | | | | | | | |
| 60 Hz | Series Star (V) | 416 | 440 | 460 | 480 | 416 | 440 | 460 | 480 | 416 | 440 | 460 | 480 | 416 | 440 | 460 | 480 |
| | Parallel Star(V) | 208 | 220 | 230 | 240 | 208 | 220 | 230 | 240 | 208 | 220 | 230 | 240 | 208 | 220 | 230 | 240 |
| | Series Delta (V) | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 |
| | kVA | 386.4 | 400.2 | 423.2 | 423.2 | 420 | 435 | 460 | 460 | 453.6 | 469.8 | 496.8 | 496.8 | 462 | 478.5 | 506 | 506 |
| | kW | 309.1 | 320.2 | 338.6 | 338.6 | 336 | 348 | 368 | 368 | 362.9 | 375.8 | 397.4 | 397.4 | 369.6 | 382.8 | 404.8 | 404.8 |
| | Efficiency (%) | 93.7 | 93.8 | 93.8 | 94 | 93.4 | 93.4 | 93.5 | 93.7 | 93.1 | 93.1 | 93.1 | 93.4 | 92.9 | 92.9 | 93 | 93.2 |
| | kW Input | 330 | 341 | 361 | 360 | 360 | 373 | 394 | 393 | 390 | 404 | 427 | 426 | 398 | 412 | 435 | 434 |

## DIMENSIONS




| COUPLING DISC | | | | | |
|---|---|---|---|---|---|
| SAE | BX | P | X | Y | AH |
| 18 | 571.50 | 542.92 | 6 | 16.7 | 15.7 |
| 14 | 466.72 | 438.15 | 8 | 13.5 | 25.4 |
| 11.5 | 352.42 | 333.38 | 8 | 11 | 39.6 |

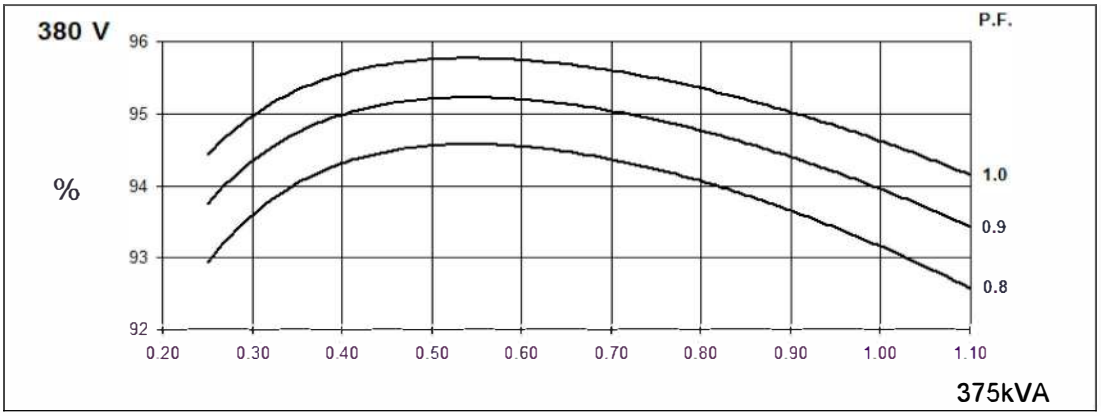
| FLANGE (mm) | | | | | | |
|---|---|---|---|---|---|---|
| SAE | BD | AK | AJ | U° | BF | n |
| SAE3 | 617 | 409.58 | 428.62 | 15 | 11 | 12 |
| SAE2 | 617 | 447.68 | 466.72 | 15 | 11 | 12 |
| SAE1 | 617 | 511.18 | 530.22 | 15 | 12.7 | 12 |
| SAE1/2 | 680 | 584.20 | 619.12 | 15 | 14 | 12 |
| SAE0 | 711 | 647.70 | 679.45 | 11.25 | 14 | 16 |

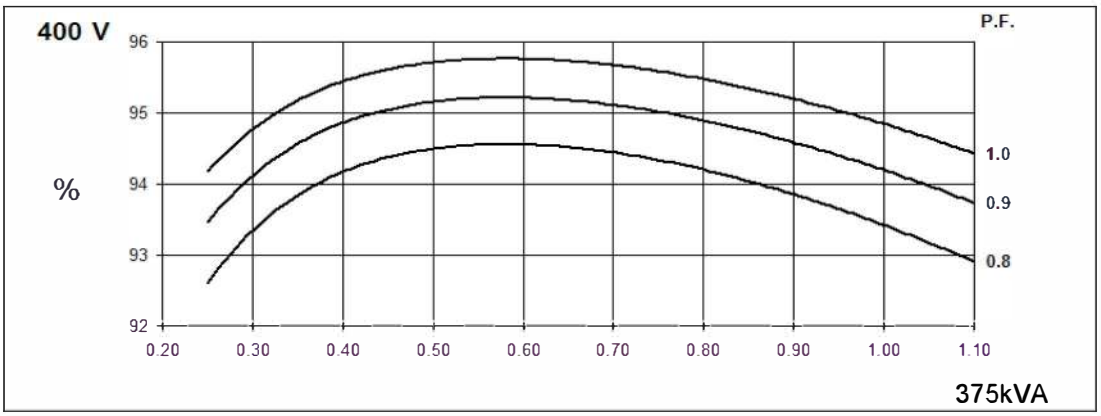
1:1
A2
mm

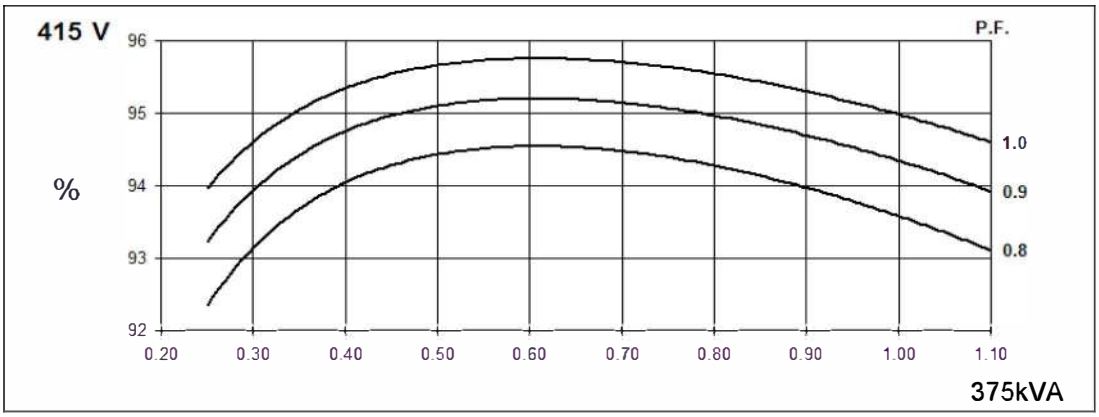
**50 Hz**

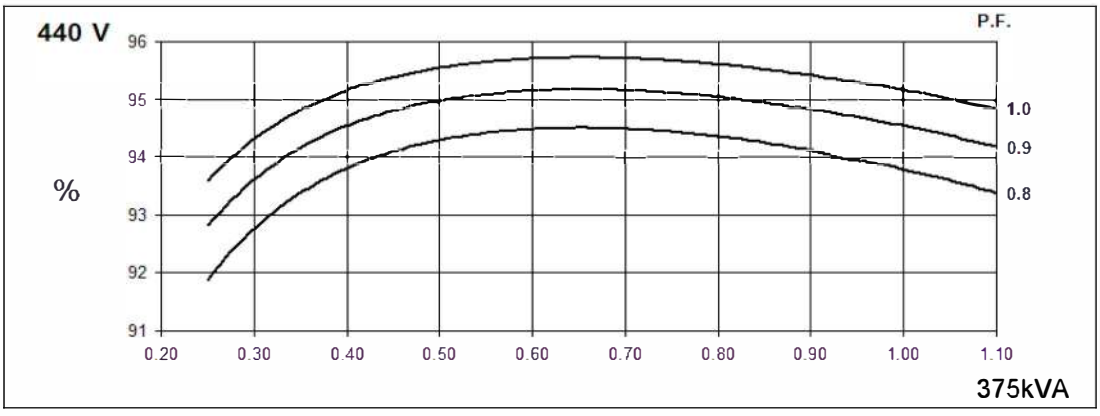
## Winding 311

## THREE PHASE EFFICIENCY CURVES



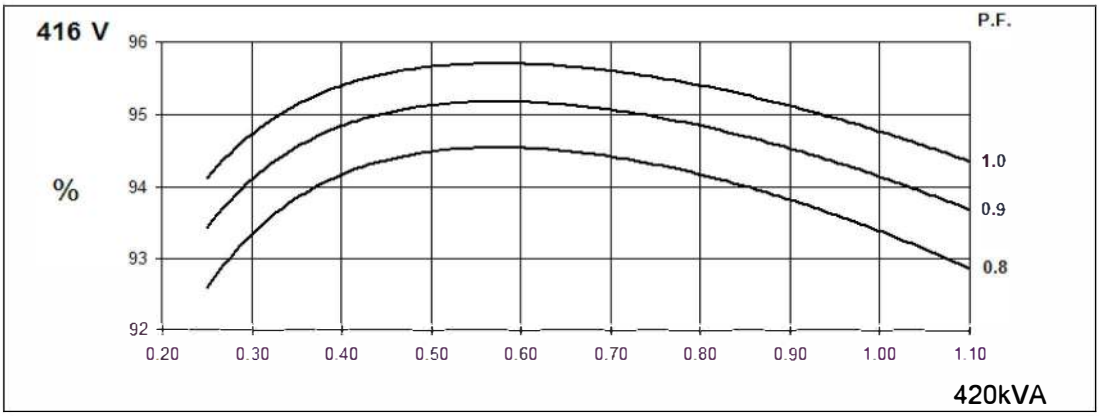



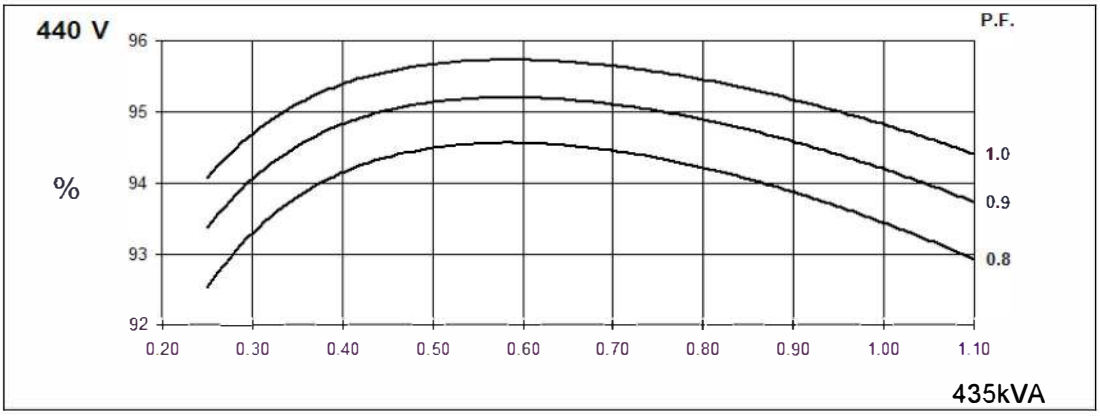



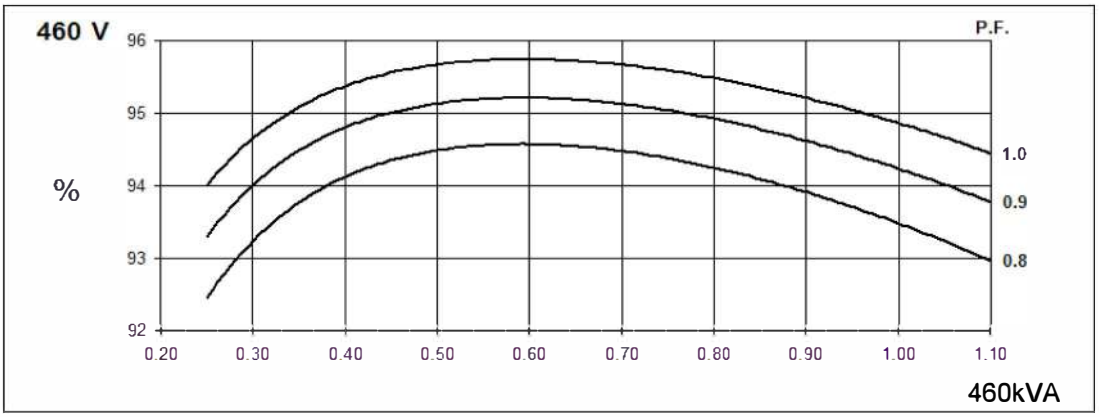
**60 Hz**

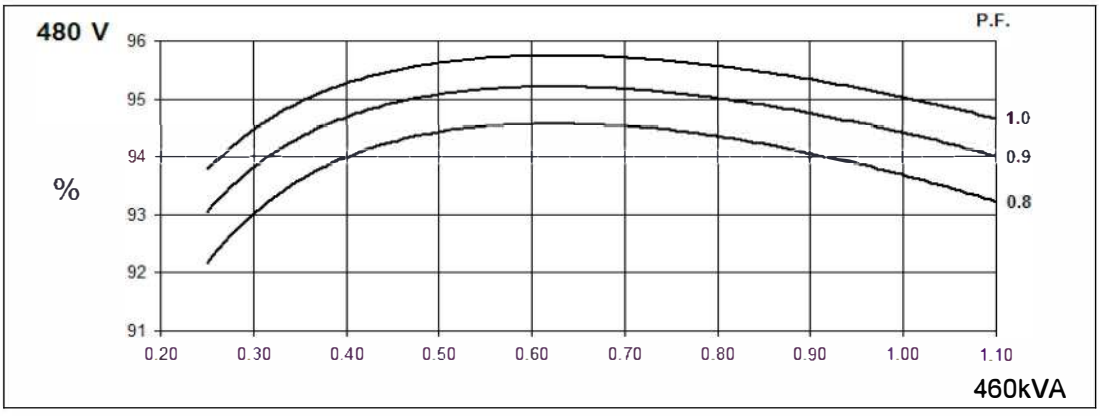
## Winding 311

## THREE PHASE EFFICIENCY CURVES



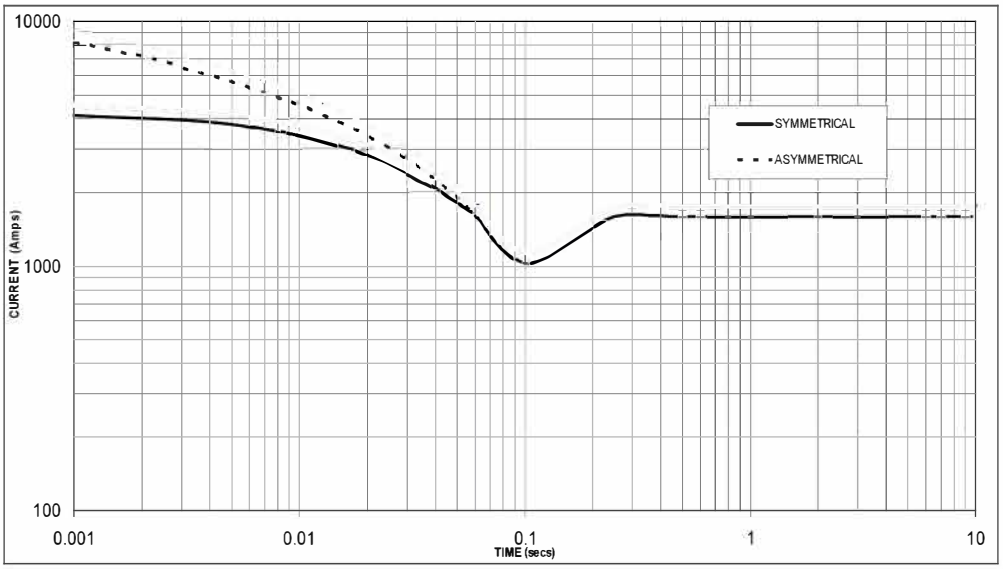



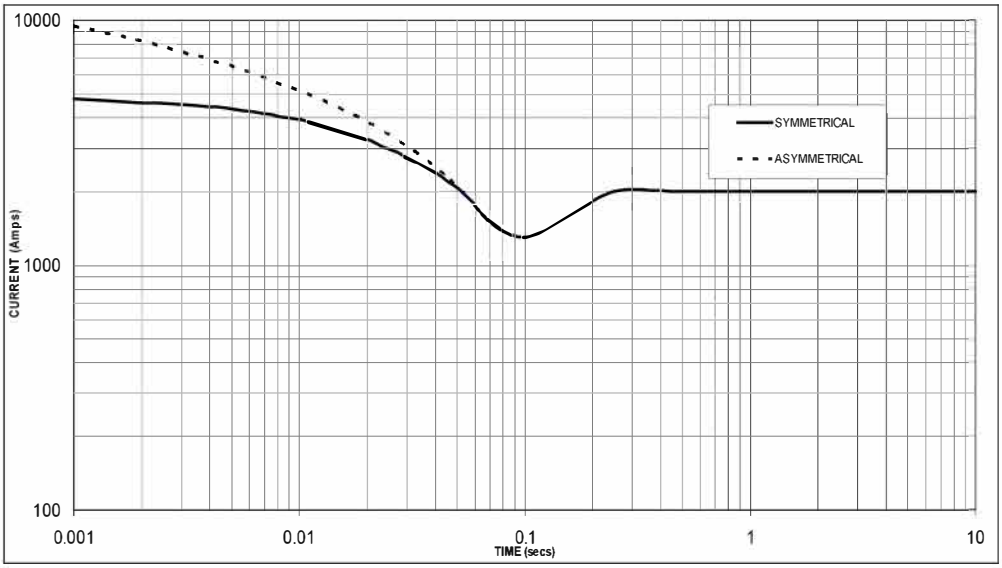
## Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed
## Based on star (wye) connection.

**50 Hz**




Sustained Short Circuit = 1,650 Amps

**60 Hz**




Sustained Short Circuit = 2,000 Amps

**Note 1**

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

| 50Hz | | 60Hz | |
|---|---|---|---|
| Voltage | Factor | Voltage | Factor |
| 380v | X 1.00 | 416v | X 1.00 |
| 400v | X 1.05 | 440v | X 1.06 |
| 415v | X 1.09 | 460v | X 1.10 |
| 440v | X 1.16 | 480v | X 1.15 |

The sustained current value is constant irrespective of voltage level

**Note 2**

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

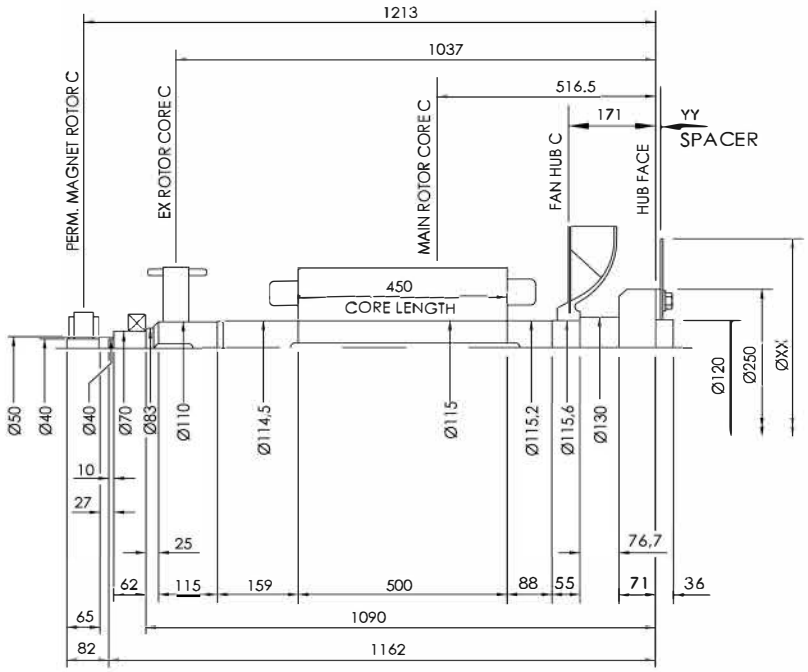
| | 3-phase | 2-phase L-L | 1-phase L-N |
|---|---|---|---|
| Instantaneous | x 1.00 | x 0.87 | x 1.30 |
| Minimum | x 1.00 | x 1.80 | x 3.20 |
| Sustained | x 1.00 | x 1.50 | x 2.50 |
| Max. sustained duration | 10 sec. | 5 sec. | 2 sec. |

All other times are unchanged

**Note 3**

Curves are drawn for Star (Wye) connected machines. For other connection the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2




| COMPONENT | Wt kg | J kgm$^2$ |
|---|---|---|
| EX. ROTOR | 31,290 | 0,5100 |
| MAIN ROTOR | 273 | 3.878 |
| FAN | 9,910 | 0,2630 |
| SHAFT | 94.53 | 0,1571 |
| HUB | 18,507 | 0,1779 |
| TOTAL | 427.237 | 4.986 |
| PERM. MAG. | 5.215 | 0,0122 |
| TOTAL | 432.452 | 4.998 |

| COUPLING SAE No | COUPLING DIMEN's XX | COUPLING DIMEN's YY | COUPLING ASSEMBLY WEIGHT kg | COUPLING DISC J kgm$^2$ |
|---|---|---|---|---|
| 11,5 | 352 | 23,8 | 12,08 | 0,055 |
| 14 | 467 | 9,5 | 11,66 | 0,172 |
| 18 | 572 | 0,0 | 12,07 | 0,386 |
| | | | | |

| | | | |
|---|---|---|---|
| VER | MOD | DRW | Date |
| Design | | APP | |
| CHK | | Date | 2018.01 |

mm




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