Costruzioni elettromeccaniche srl

400 Hz
A.C. SYNCRONOUS CONVERTER
TYPE ATF 280 M16

OVERHAUL INSTRUCTIONS
WITH
ILLUSTRATED PARTS BREAKDOWN

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Macchine elettriche speciali

SECTION I
GENERAL INFORMATION

1-1. PURPOSE

The Frequency Converter (figure 1-1) has been designed to convert a 220/380 V, 50 Hz input current into a stabilized 200/115 V, 400 Hz output current.
The stabilized output voltage may be regulated within ±1 percent, while frequency, with a constant mains supply, may vary within +0 −1.5 percent, both at no-load and under load conditions.

1-2. LEADING PARTICULARS

See table 1-1.

1-3. DESCRIPTION

1-4. GENERAL DESCRIPTION

Frequency Converter is a built-up of four coaxial electrical machines which are assembled into a single, protected and self-ventilated housing. The frequency converter consist of the following:

— starting motor
— driving motor
— three-phase synchronous generator
— exciter and voltage regulator

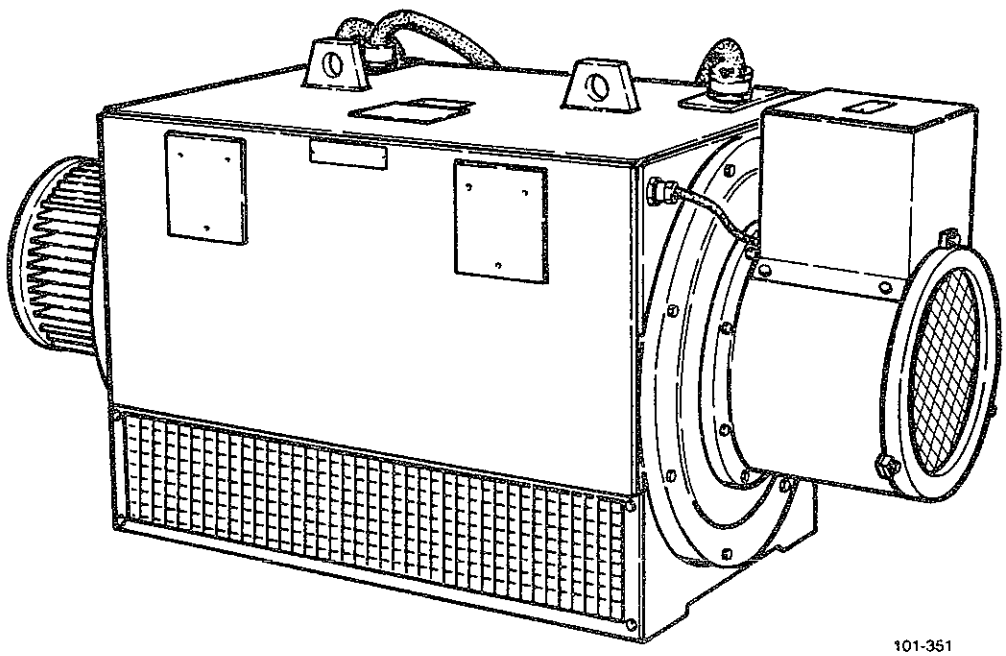


Figure 1-1. Frequency Converter Part No 280A1617

1-5. STARTING MOTOR

The asynchronous, three-phase starting motor (6, figure 1-2), with rotor of the cage winding type, necessitates 20 s only to drive the whole rotor assembly to a speed of 3000 rpm. The six-wire winding is IEC 85 class F insulation.

1-6. DRIVING MOTOR

The asynchronous, three-phase driving motor (5, fig. 1-2) is of a low slip design, with a cage winding type rotor. The six-wire winding is IEC 85 class F insulation.

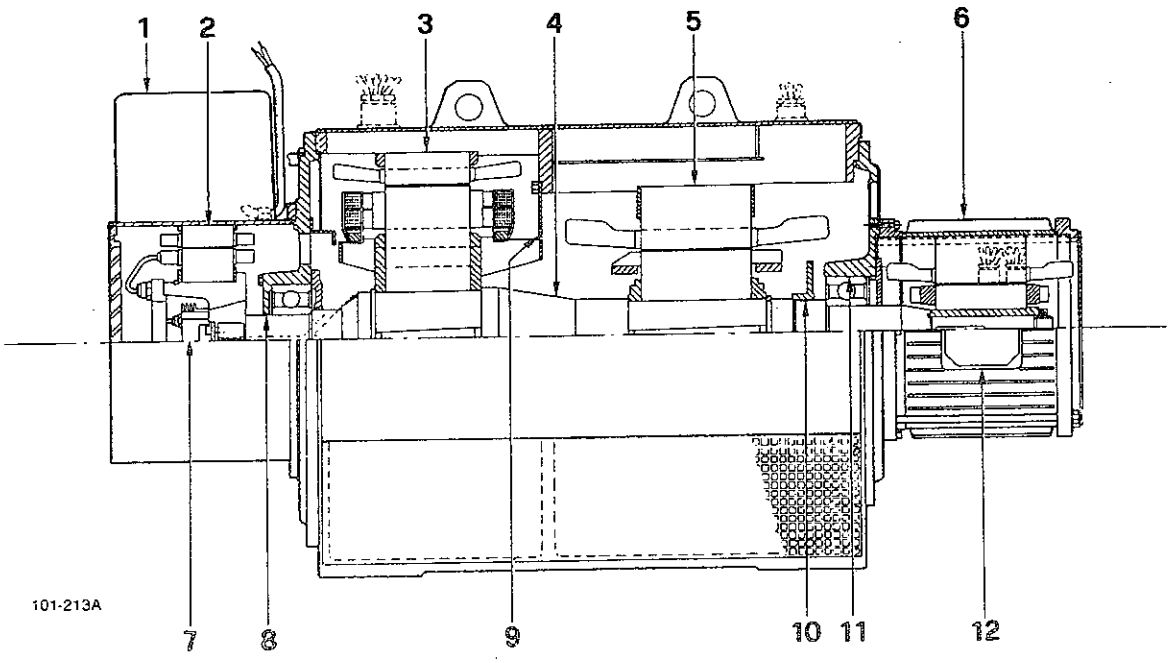
1-7. THREE-PHASE SYNCHRONOUS GENERATOR

The three-phase synchronous generator (3, figure 1-2) becomes complete with both a coaxial exciter of the rotating diodes type and a voltage regulator.
Four conductors (three lines and one neutral) supply power output; all windings are IEC 85 class F insulation.

1-8. OPERATION

1-9. FREQUENCY CONVERTER GENERAL OPERATION

The frequency converter (see figure 1-3 for schematic diagram) can be supplied with both 220 V (delta connection) and 380 V (star connection).
During start, both starting and driving motors are supplied in series. As the synchronous operating speed is reached (3000 rpm), the starting motor cuts out while driving motor maintains its operation, and exciter stator starts to be d.c. supplied by voltage regulator. Owing to this, the exciter, which is basically an alternator with a rotating armature, supplies excitation to the generator rotor by means of a Graetz bridge.



1. VOLTAGE REGULATOR
2. EXCITER
3. THREE-PHASE SYNCHRONOUS GENERATOR
4. ROTOR SHAFT
5. DRIVING MOTOR
6. STARTING MOTOR
7. DIODES SUPPORT PLATE
8. COVER
9. PROTECTION RING
10. BALANCING DISC
11. COVER
12. TERMINAL BLOCK

Figure 1-2. Frequency Converter - Main Components

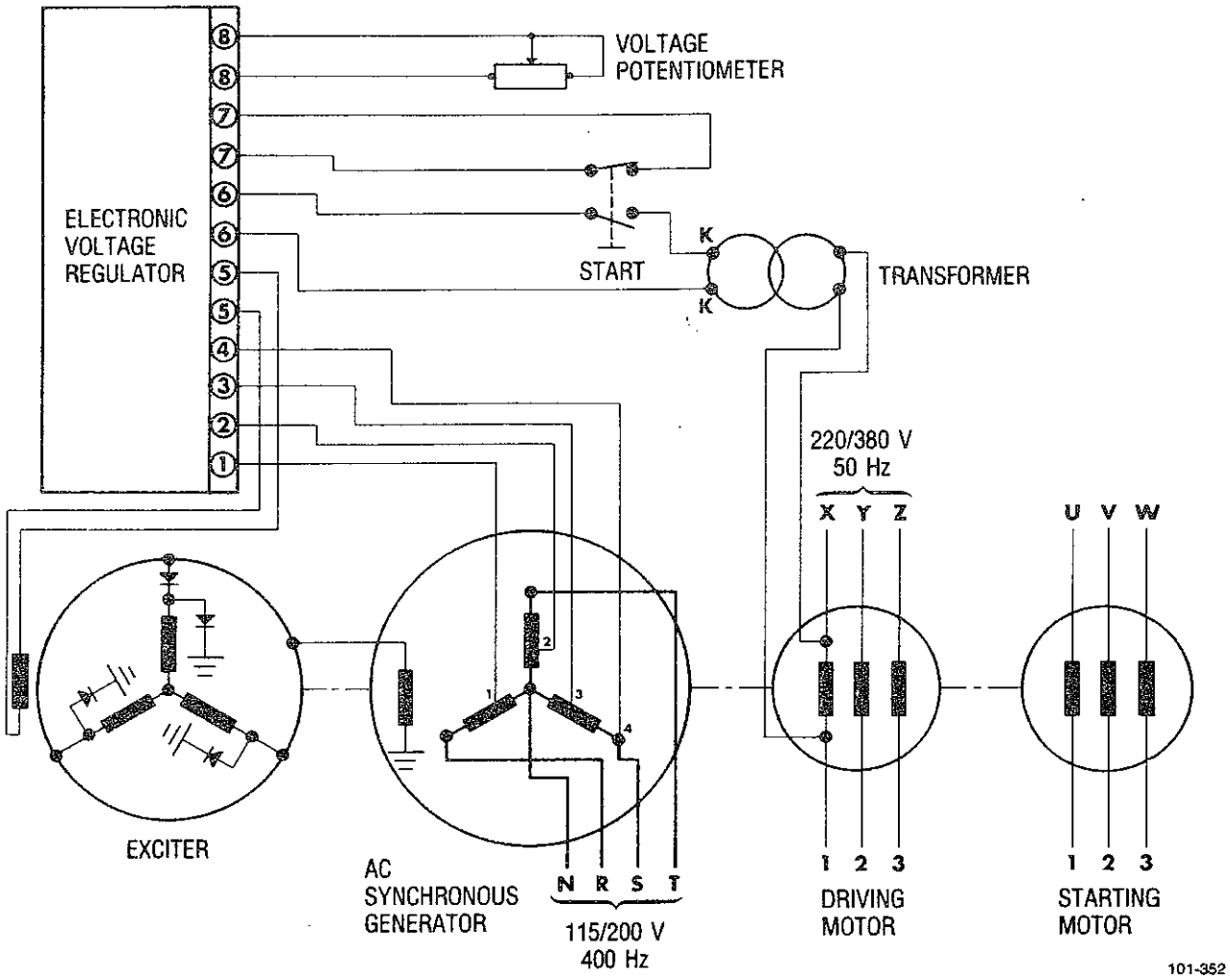


Figure 1-3. Frequency Converter Schematic Diagram

1-10. VOLTAGE REGULATOR OPERATION

The voltage regulator (see figure 1-4 for schematic diagram) supplies power to the exciter stator and, furthermore, provides stabilization of the generator output voltage. Voltage regulator is supplied by means of the three output phases of generator.

Filtering and rectifying of these three line voltages give an average value, which is compared with a high stability Zener circuit. The result is amplified and converted into a phase angle which controls the final transistor. To avoid generation of R.F. disturbs, the voltage regulator has been provided with specific filters. Finally, to avoid any interference between input and output supplies, transformers with both total galvanic and electrostatic screen separation have been installed.

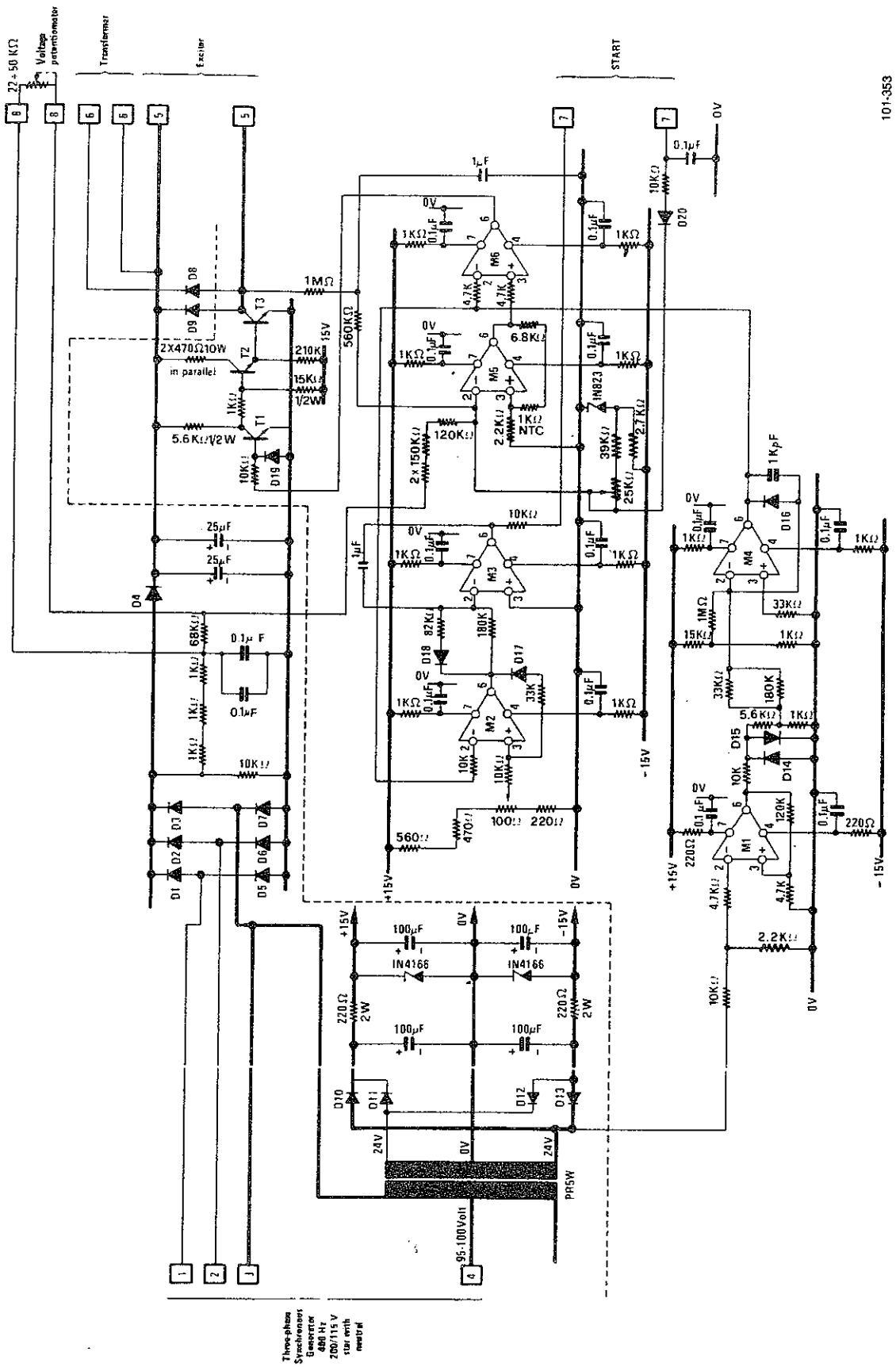


Figure 1-4. Electronic Voltage Regulator Schematic Diagram

Table 1-1. Leading Particulars

MASS	~550 kg (~ 1213 lb)
OVERALL DIMENSIONS:	
— Length	1250 mm
— Width	510 mm
— Height	592 mm

INPUT-POWER REQUIREMENTS

STARTING MOTOR	
— Voltage	220 V (delta connection)
	380 V (star connection)
— Frequency	50 Hz
— Max current consumption (during start)	155 A - 220 V
	90 A - 380 V
DRIVING MOTOR	
— Voltage	220 V (delta connection)
	380 V (star connection)
— Frequency	50 Hz
— Current	147 A - 220 V
	85 A - 380 V
— Power	60 CV (59 HP) at 2955 rpm

OUTPUT SPECIFICATIONS

POWER	45 kVA, cos φ=0.8
OVERLOAD CAPABILITY	80 kVA for 5 s
RATED SPEED	3000 rpm (+0% −1.5%)
RATED VOLTAGE	200/115 V (±1%)
RATED FREQUENCY	400 Hz (+0% −1.5%)

SECTION II
SPECIAL TOOLS, TEST EQUIPMENT AND CONSUMABLE MATERIALS

2-1. SPECIAL TOOLS

No special tools are required for the overhaul of the frequency converter.

2-2. TEST EQUIPMENT

The test equipment required for testing of the frequency converter is listed in table 2-1.

2-3. CONSUMABLE MATERIALS

Consumable materials required to carry-out overhaul of the frequency converter are listed in table 2-2.

Table 2-1. Test Equipment

PART NO	MFR OR SCM	NOMENCLATURE	USE
—	SIEMENS	Triple-pole switch, 200 A	To test frequency converter (S1, S3, fig 8-1)
—	ICE	Ammeter	To test frequency converter (M1-1 thru M1-6)
8060A	FLUKE	Frequency-meter 380÷420 Hz, 200 V	To test frequency converter
Mod. EXACTA	D.O. ORSENIGO	Milliohmmeter	To test winding and phase resistances

NOTE: Equivalent substitutes may be used for listed items.

Table 2-2. Consumable Materials

USA SPEC.	MATERIAL	USE
MIL-C-8514	Wash primer	External painting
MIL-L-19538	Dark grey, matt, nitrocellulose lacquer	External painting
MIL-P-8585	Zinc chromate primer	External painting
MIL-R-25134	Remover	To remove old external paint
MIL-T-27602	Trichloroethylene	For cleaning purposes
P-D-680 Type II	Cleaning solvent	For cleaning purposes
VV-K-211	Kerosene	For cleaning purposes
—	60/40 Rosin core solder	To carry out electrical connections
—	Epoxy resin	For balancing of rotor assembly
—	Isopropyl alcohol	To clean terminations and surfaces to be soldered
—	Thinner	To thin insulating varnish
—	Transparent insulating varnish	For electrical insulation

0-10. MAINTENANCE PARTS LIST

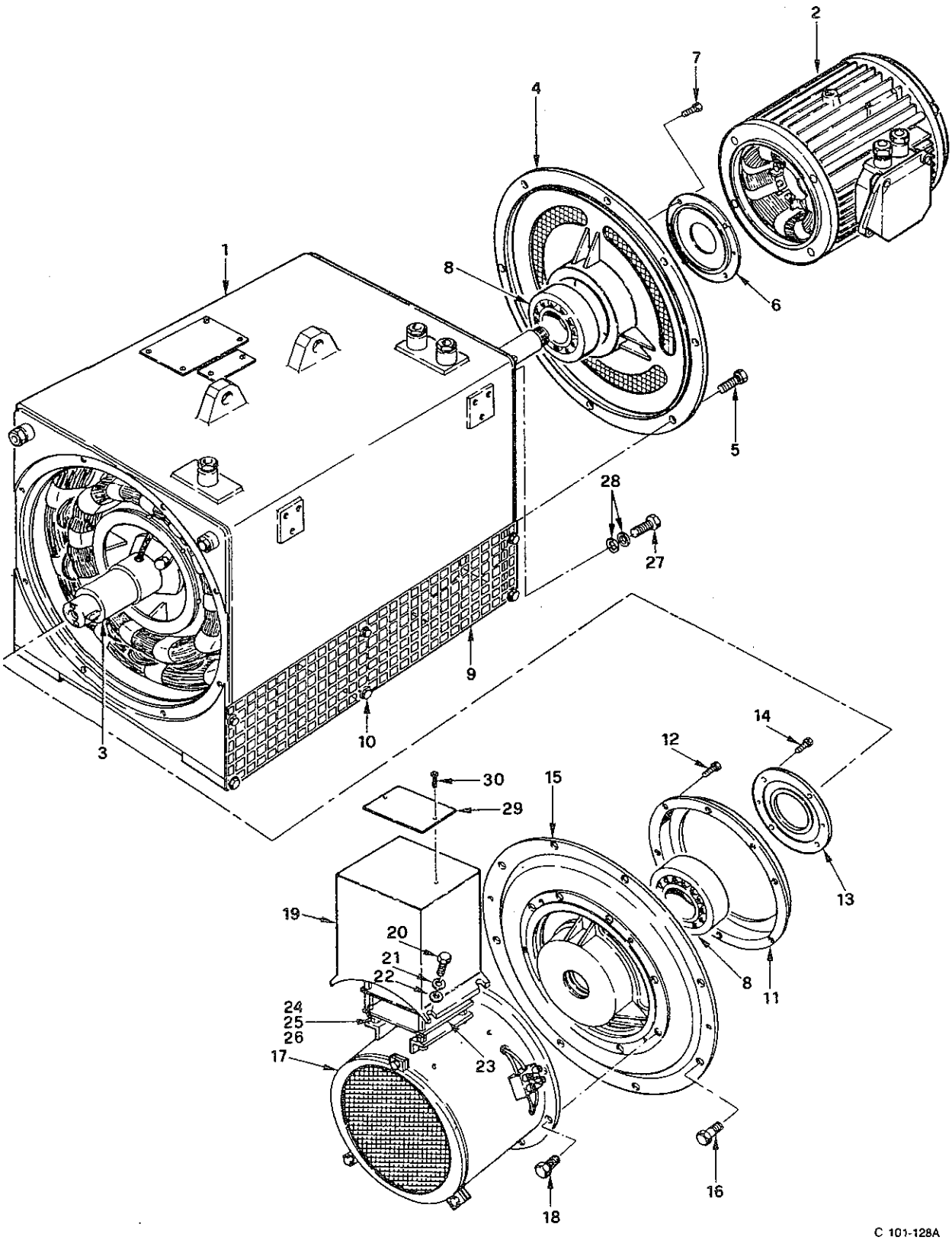


Figure 10-1. Frequency Converter Assembly

FIGURE & INDEX NO	PART NO	SCM	DESCRIPTION 1 2 3 4 5 6	UNITS PER ASSY	USE CODE
10-1- 0	280A1617		FREQUENCY CONVERTER ASSY, 45 kVA, 400 Hz, 3000 RPM	1	
- 1	HA2801618		. GENERATOR STATOR AND HOUSING ASSY (SEE FIG. 10-2 FOR DETAIL BKDN)	1	
- 2	HA132205		. MOTOR ASSY, STARTING (SEE FIG. 10-3 FOR DETAIL BKDN)	1	
- 3	HA2801620		. ROTOR ASSY (SEE FIG. 10-4 FOR DETAIL BKDN)	1	
- 4	280A1610		. COVER ASSY, DRIVING MOTOR END	1	
- 5	M10X40UNI191	A2666	. SCREW (AP)	8	
- 6	280A1615-2		. RETAINER, BEARING	1	
- 7	M10X25UNI256	A2666	. SCREW (AP)	4	
- 8	2RS1-62312C1		. BEARING	2	
- 9	280A1608-1		. GUARD	2	
-10	M6X10UNI5737	A2666	. SCREW (AP)	12	
-11	280A1612		. DIAPHRAGM, VENTILATION	1	
-12	M6X18UNI191	A2666	. SCREW (AP)	8	
-13	280A1615-1		. RETAINER, BEARING	1	
-14	M10X25UNI191	A2666	. SCREW (AP)	4	
-15	280A1609-1		. COVER, GENERATOR END	1	
-16	M10X40UNI191	A2666	. SCREW (AP)	8	
-17	HC2801613		. EXCITER ASSY (SEE FIG. 10-5 FOR DETAIL BKDN)	1	
-18	M8X25UNI191	A2666	. SCREW (AP)	8	
-19	HC2801616		. COVER, VOLTAGE REGULATOR	1	
-20	6MX20UNI5738-8G	A2666	. SCREW (AP)	4	
-21	A6E4UNI1751	A2666	. WASHER, SPRING (AP)	4	
-22	6E4UNI6592	A2666	. WASHER (AP)	4	
-23	HC2801617		. VOLTAGE REGULATOR ASSY (SEE FIG. 10-6 FOR DETAIL BKDN)	1	
-24	5MX20UNI5739-8G	A2666	. SCREW (AP)	4	
-25	A5E3UNI1751	A2666	. WASHER, SPRING (AP)	4	
-26	5MUNI5587	A2666	. NUT (AP)	4	
-27	M10X25UNI191	A2666	. SCREW, GROUND CONNECTION (AP)	1	
-28	A10E5UNI6593-69	A2666	. WASHER, BRASS (AP)	2	
-29	H2801626-2		. NAMEPLATE	1	
-30	H2801626-5		. SCREW (AP)	2	

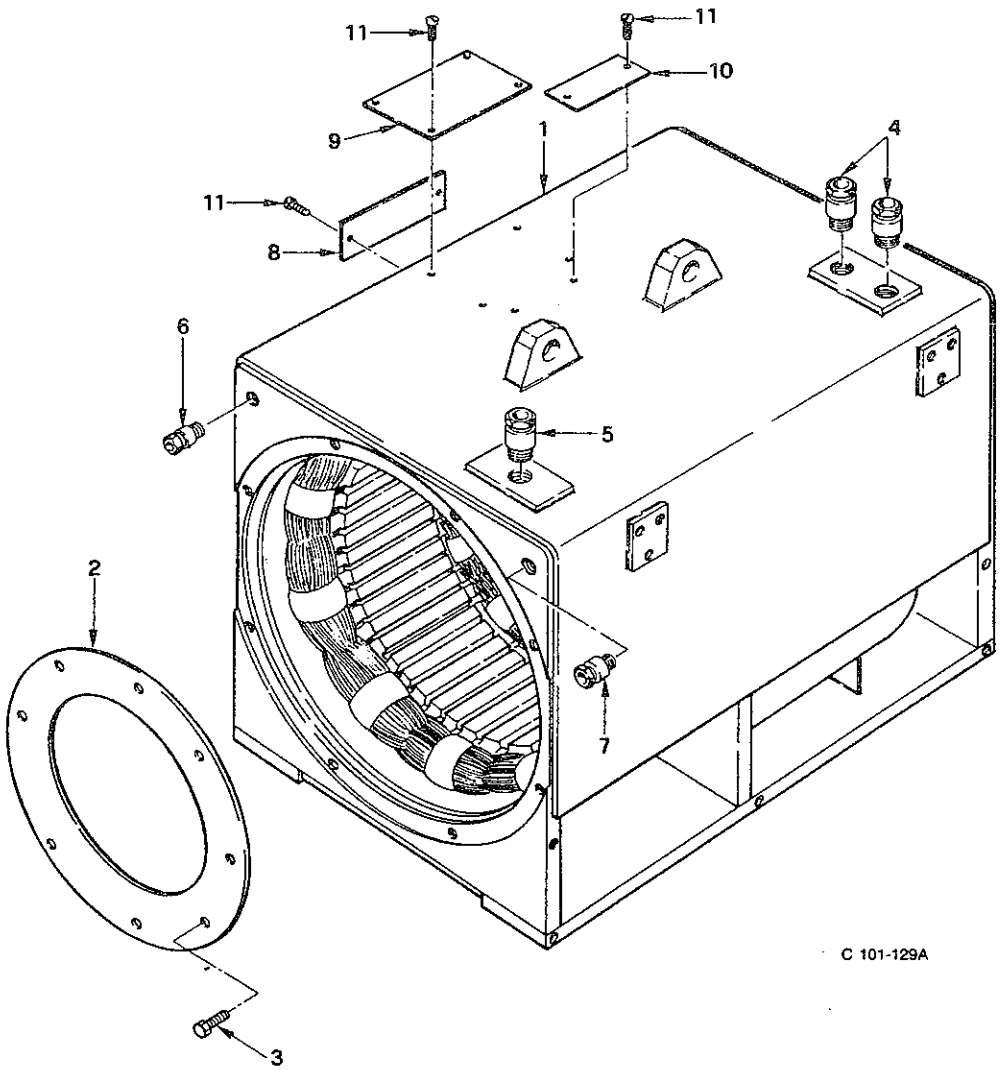


Figure 10-2. Generator Stator and Housing Assembly

FIGURE & INDEX NO	PART NO	SCM	DESCRIPTION 1 2 3 4 5 6	UNITS PER ASSY	USE CODE
10-2- 0	HA2801618		GENERATOR STATOR AND HOUSING ASSY (SEE FIG. 10-1 FOR NHA)	REF	
- 1	HA2801621		. STATOR AND HOUSING ASSY	1	
- 2	280A1607-2		. RING, PROTECTION	1	
- 3	M6X10UNI5737	A2666	. SCREW (AP)	8	
- 4	H221R-1-1/4GAS		. BUSHING	2	
- 5	H223R-1-1/2GAS		. BUSHING	1	
- 6	H209R-1/2GAS		. BUSHING	1	
- 7	H215R-3/4GAS		. BUSHING	1	
- 8	H2801626-4		. NAMEPLATE, MANUFACTURER	1	
- 9	H2801626-1		. NAMEPLATE, FEATURES	1	
-10	H2801626-3		. NAMEPLATE, CAUTION	1	
-11	H2801626-5		. SCREW (AP)	8	

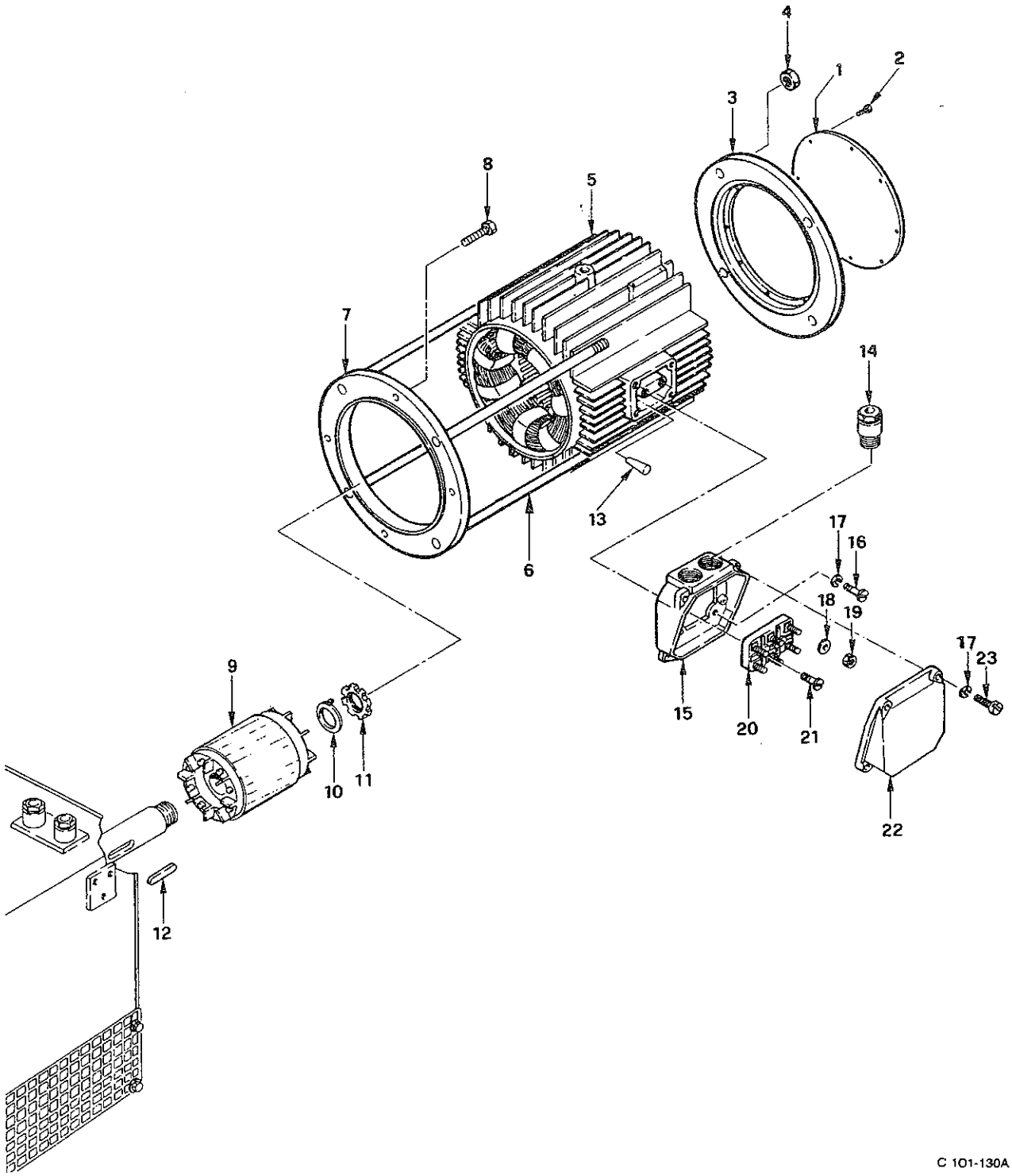


Figure 10-3. Starting Motor Assembly

FIGURE & INDEX NO	PART NO	SCM	DESCRIPTION 1 2 3 4 5 6	UNITS PER ASSY	USE CODE
10-3- 0	MT132M2		MOTOR ASSY, STARTING (SEE FIG. 10-1 FOR NHA)	REF	
- 1	132A200-3		. COVER	1	
- 2	M6X8UNI187	A2666	. SCREW (AP)	8	
- 3	132A200-2		. FLANGE, OUTER	1	
- 4	M10UNI207	A2666	. NUT (AP)	4	
- 5	HA132206		. STATOR ASSY, STARTING MOTOR	1	
- 6	132A200-4		. STUD (AP)	4	
- 7	132A200-1		. FLANGE, INNER, COUPLING	1	
- 8	M10X35UNI2383	A2666	. SCREW (AP)	4	
- 9	132A202		. ROTOR ASSY, STARTING MOTOR	1	
-10	280A1614-3		. RETAINING RING	1	
-11	280A1614-2		. AXLE NUT	1	
-12	10X8X36UNI6604-69	A2666	. KEY	1	
-13	4X6UNI6873	A2666	. PIN, SPRING	1	
-14	H200R-1/4GAS		. BUSHING	2	
-15	86864		. BOX, TERMINAL BLOCK	1	
-16	M6X25UNI6107	A2666	. SCREW (AP)	4	
-17	6E4UNI1751	A2666	. WASHER, SPRING (AP)	8	
-18	8E4UNI6592	A2666	. WASHER, BRASS	12	
-19	M8UNI5588	A2666	. NUT, BRASS	12	
-20	FC56-36		. TERMINAL BLOCK	1	
-21	M6X15UNI6107	A2666	. SCREW (AP)	2	
-22	HA132207		. COVER, TERMINAL BLOCK	1	
-23	M6X25UNI6107	A2666	. SCREW (AP)	4	

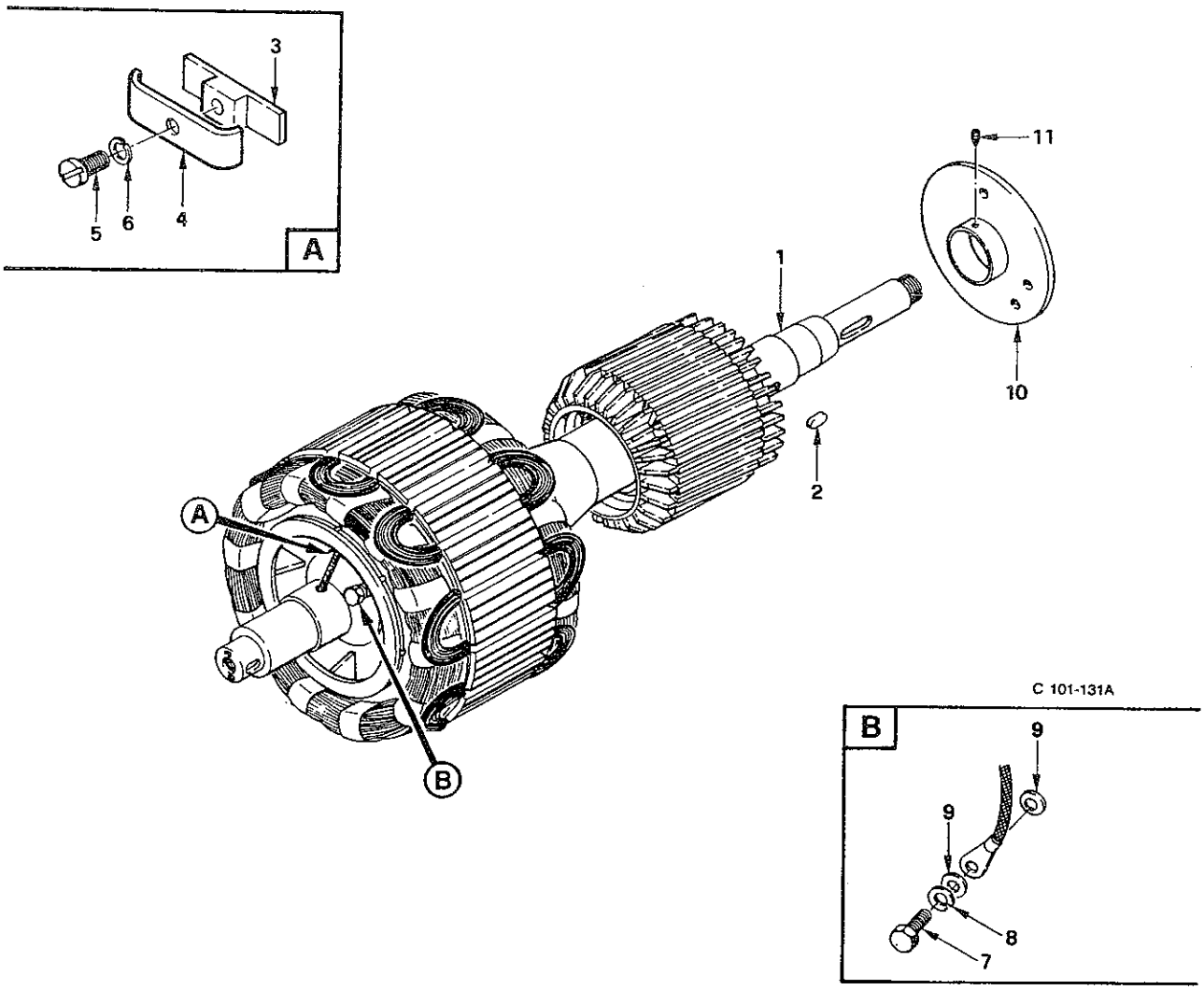


Figure 10-4. Rotor Assembly

FIGURE & INDEX NO	PART NO	SCM	DESCRIPTION 1 2 3 4 5 6	UNITS PER ASSY	USE CODE
10-4- 0	HA2801620		ROTOR ASSY (SEE FIG. 10-1 FOR NHA)	REF	
- 1	HA2801625		. ROTOR AND SHAFT ASSY	1	
- 2	8X7X18UNI6604-69	A2666	. KEY	1	
- 3	280A1606-6		. SPACER	1	
- 4	280A1606-8		. CLAMP	1	
- 5	M6X25UNI5739	A2666	. SCREW (AP)	1	
- 6	6E4UNI6596-69	A2666	. WASHER, SPRING (AP)	1	
- 7	M6X20UNI5739	A2666	. SCREW (AP)	1	
- 8	6E4UNI6596-69	A2666	. WASHER, SPRING (AP)	1	
- 9	6E4UNI6593-69	A2666	. WASHER, BRASS (AP)	2	
-10	HA2801622		. DISC, BALANCING	1	
-11	M6X16UNI2389	A2666	. SCREW (AP)	1	

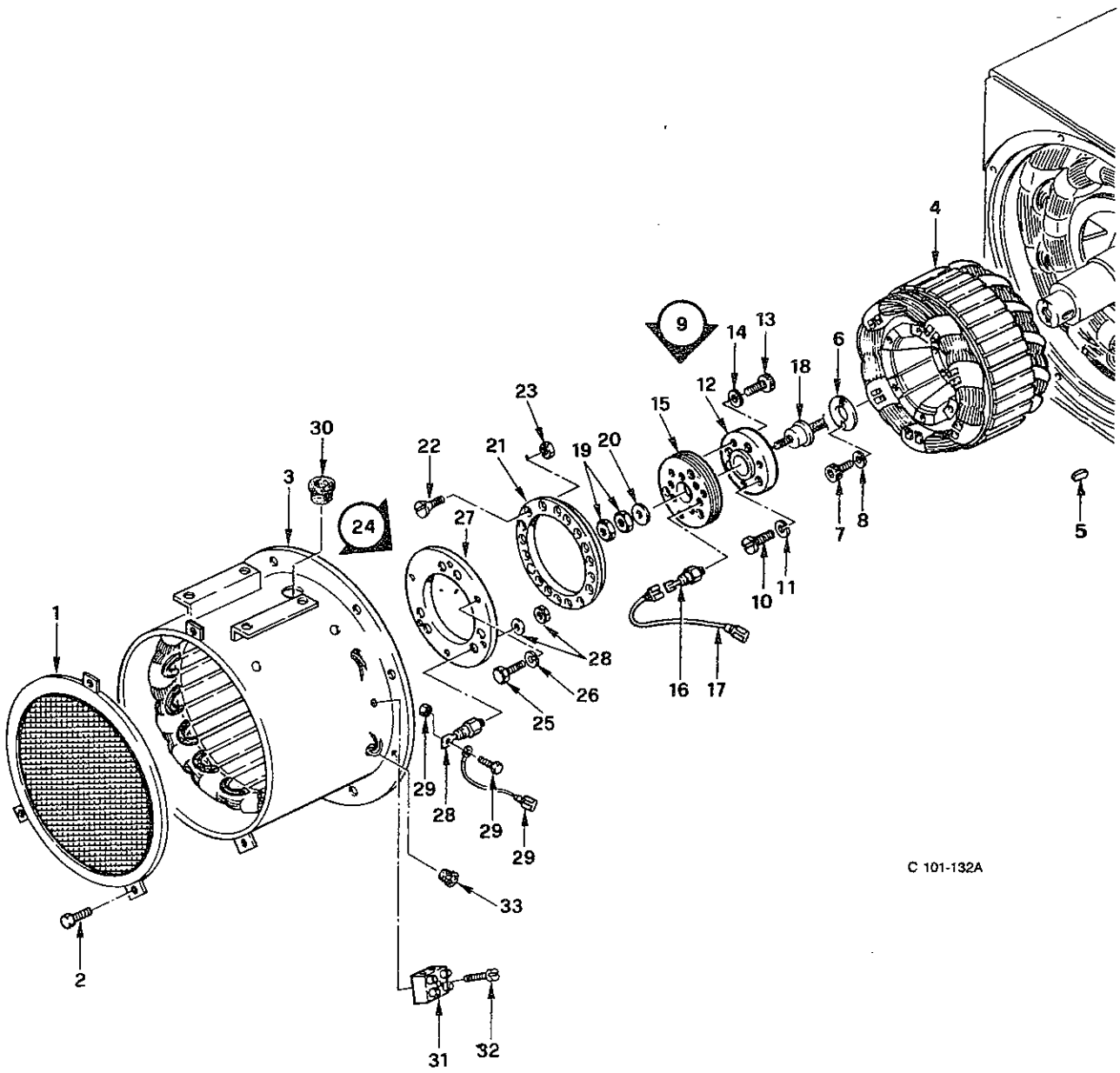


Figure 10-5. Exciter Assembly

FIGURE & INDEX NO	PART NO	SCM	DESCRIPTION 1 2 3 4 5 6	UNITS PER ASSY	USE CODE
10-5- 0	HC2801613		EXCITER ASSY (SEE FIG. 10-1 FOR NHA)	REF	
- 1	280C1602		. COVER	1	
- 2	M6X18UNI191	A2666	. SCREW (AP)	3	
- 3	HC2801620		. HOUSING AND STATOR ASSY, EXCITER	1	
- 4	HC2801619		. ROTOR ASSY, EXCITER	1	
- 5	10X8X28UNI6604-69	A2666	. KEY	1	
- 6	280A1613-7		. RING, BACK-UP	1	
- 7	M5X15UNI2383	A2666	. SCREW, SOCKET HEAD (AP)	2	
- 8	A5E3UNI1751	A2666	. WASHER, SPRING (AP)	2	
- 9	280C1607		. PLATE SUPPORT ASSY, DIODES, INNER	1	
-10	M5X18UNI2383	A2666	. SCREW, SOCKET HEAD (AP)	3	
-11	A5E3UNI1751	A2666	. WASHER, SPRING (AP)	3	
-12	280C1607-2		. . SPACER, INSULATING	1	
-13	M5X15UNI2383	A2666	. . SCREW, SOCKET HEAT (AP)	3	
-14	A5E3UNI1751	A2666	. . WASHER, SPRING (AP)	3	
-15	280C1607-1		. . PLATE, DIODES SUPPORT, INNER	1	
-16	IR41HFR60	A2849	. . DIODE	6	
-17	280C1607-10		. . LEAD	6	
-18	280C1607-3		. . TERMINAL, BRASS	1	
-19	8MAUNI207	A2666	. . NUT, BRASS (AP)	2	
-20	8E4UNI1733	A2666	. . WASHER, BRASS (AP)	1	
-21	280C1609-1		. DISC, BALANCING	1	
-22	M5X10UNI256	A2666	. SCREW, COUNTERSUNK HEAD, BALANCING	AR	
-23	5MAUNI207	A2666	. NUT, BALANCING	AR	
-24	280C1608		. PLATE SUPPORT ASSY, DIODES, OUTER	1	
-25	M6X30UNI2383	A2666	. SCREW (AP)	6	
-26	A7E4UNI1751	A2666	. WASHER, SPRING (AP)	6	
-27	280C1608-1		. . PLATE, DIODE SUPPORT, OUTER	1	
-28	280C1608-4		. . DIODE ASSY	6	
-29	280C1608-5		. . LEAD ASSY	6	
-30	HC2801618		. GROMMET	1	
-31	BK2		. TERMINAL	1	
-32	M3X20UNI6107-67	A2666	. SCREW (AP)	1	
-33	90-200-200		. GROMMET	2	