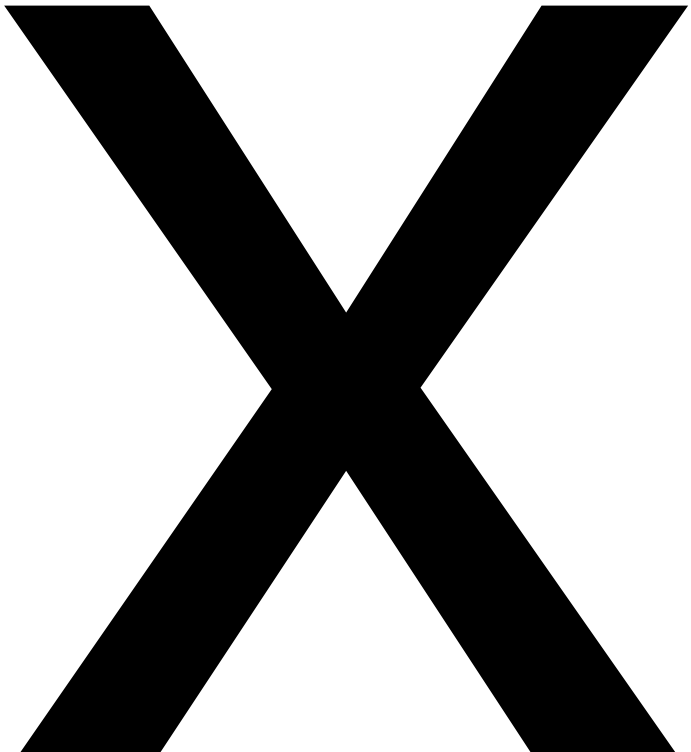
g

GE Motors &
Industrial Systems

AL-Tight™
Fabricated Aluminum Rotor Features

An Extra Level of Performance
for
Induction Motors



History

The first squirrel-cage induction motor rotors were constructed using bars of copper or copper alloy fastened to copper shorting rings by brazing in the early 1920's. In the 1930's through the 1950's the production process for casting aluminum rotors were developed and improved. In the 1960's, fabricated aluminum technology was developed by GE
for the Custom 8000 motor line.

The major features of the aluminum rotor construction can be summarized as follows:

- Bar tension maintains punching tightness.
- Cage migration eliminated with end-rings tight against the punchings.
- Longer stall time than copper, for equivalent I^2R loss (Torque vs slip characteristics) design.
- Shaped rotor bars for optimum torque vs slip designs.
- Lower rotor inertia.
- Lower weight bars and end rings reduce the centifugal force - retaining rings are not required on the end rings.
- Bar to end-ring joints are 15 to 20 times stronger than brazed joints.
- Closed rotor slots, reduced windage noise.
- Welded construction fatigue strength increases at 200^{o}C over room temperature, brazed joint strength decreases at this temperature.
- Fabricated aluminum rotor windings are repairable.

Now

The Custom 8000 motor line of aluminum rotor construction has been successful in supplying motors to industrial customers for 30 years, with over 15000 units in service.

Now, in the 1990's, GE Motors offers the AL-Tight design of fabricated Aluminum rotors, boosting the reliability for demanding applications.

Pre-Stressed Rotor Assembly

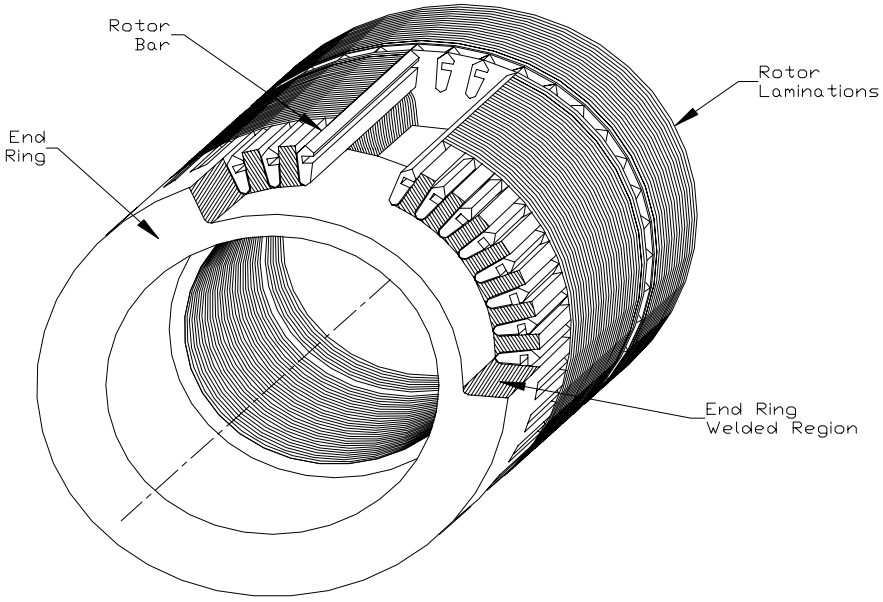
As illustrated below, the rotor body (core) is assembled by stacking the punchings, inserting the aluminum bars, and then by welding the bars to the end-rings. In the **AL-Tight** construction, the welding is done at an elevated temperature to improve the welding process itself and to control the final tightness of the assembly.

During welding (at 150 deg C or higher), the steel laminations and the aluminum bars expand axially. For a typical 40 inch stack length, the differential expansion will be .0612 inches, with a greater aluminum bar expansion than for the steel lamination. When the assembly cools, the aluminum will have a greater reduction in length, producing a compressive force on the steel stack.

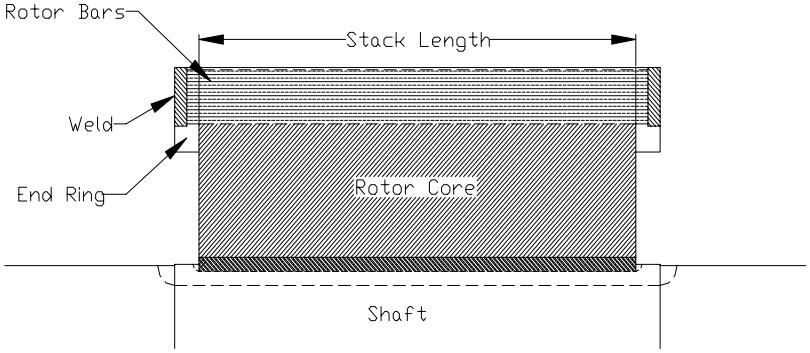
This force can be calculated from the definition of the modulus of elasticity, where
$E = P \times L/(A \times d)$ where

E = Modulus of elasticity (10.6 E+06)
P = Axial load in pounds
A = Rotor bar cross section
L = Total length (stack)
d = Axial displacement in inches (.0612")

For a 5000 Hp, 4 pole, design, the (Rotor bar cross section) A = 60 square inches.
The axial load will be 973,000 pounds. This is 16218 psi on the aluminum conductors.



The **AL-Tight** design is configured so that, during normal operation, the rotor assembly temperature remains below the processing temperature. The additional features provided by the **AL-Tight** design and process are:



o Maintains stack pressure

o Extends the cyclic fatigue capability of the assembly.

o Provides longer life.

Why Should Users Specify AL-Tight ?

- For demanding applications, the **AL-Tight** performance can extend the operating life of your motor. Most rotor failures result when fatigue cracks become large enough for some rapid terminal mode of failure to take over. In induction motor rotors, this terminal mode is produced by the large rotor currents which continue and span the gap caused by the crack. These currents are particularly high during motor starting.

- **AL-Tight** designs provide the only rotor construction which maintains stack tightness during all operating conditions.

Give us a call! Ask for AL-Tight

Marketing Specialists:	(219) 439-3915 (fax)
Bernardo Anzae	(219) 439-3864
Eduardo Reis	(219) 439-3806
Roberto Maciel	(219) 439-3434
Travis Hayman	(219) 439-3097
Application Engineers:	(219) 439-3122 (fax)
Ken Polcyn	(219) 439-3804
Carlos Yamada	(219) 439-3805
For Warranty Service:	(518) 372-4910 (fax)
Glen Walkup	(518) 377-6731

g

GE Motors & Industrial Systems

GEK-100935B (2/99)

Fort Wayne, IN 46802