DSE-F
ELECTRIC FURNACE
CONTROL
AND
PROTECTION

METAL-CLAD SWITCHGEAR WITH SOLENARC DSE BREAKERS **DATA SHEET -13** September, 1977

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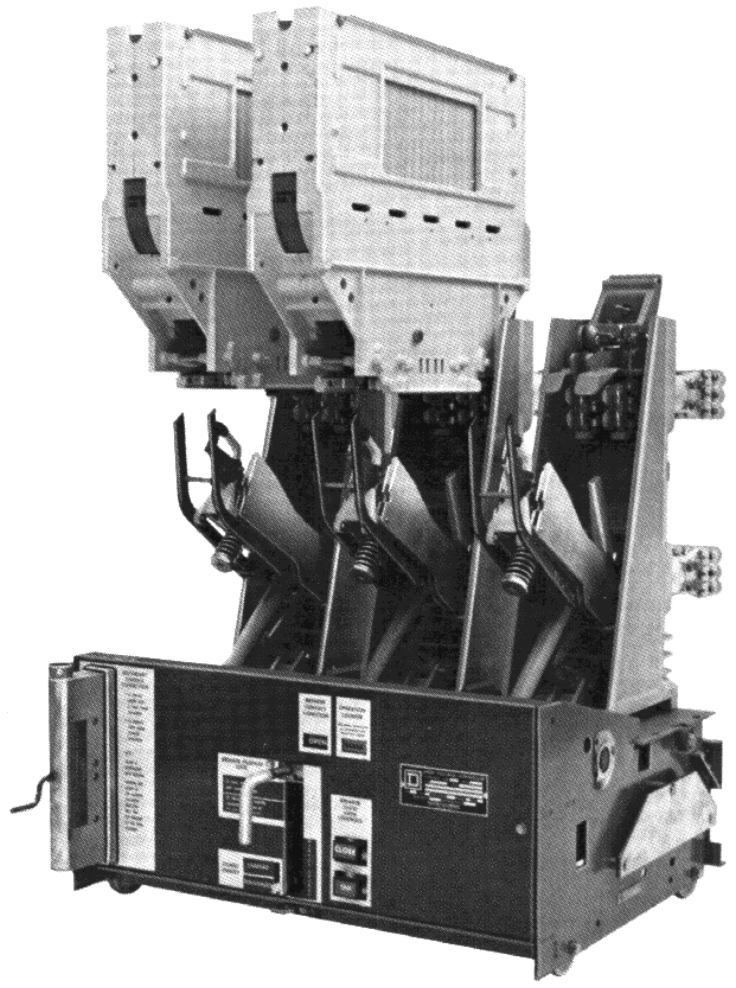
announcing new
SOLENARC® Electric Arc Furnace Circuit Breaker

The main requirements expected of these circuit breakers are:

- **Switching operations up to 100 a day.**
- **Protection against fault currents from inter-electrode short circuits.**
- **Protection against frequent overloads resulting from inter-electrode short circuits.**



To meet these conditions (in addition to the SOLENARC's inherent capabilities - breaking capacity, making capacity, withstand ability . . .), the circuit breaker must have other specific capabilities. With the same electrical operating mechanism (spring stored energy mechanism) as is used on the standard SOLENARC DSE circuit breakers, it has very high electrical and mechanical endurance, low switching surges, safety and reduced maintenance.

Since the operating conditions for a furnace circuit breaker are much more severe, many of the steel parts of the mechanism are reinforced and case hardened. The main shafts and hinges of the mechanical and electrical portions of the breaker are made of bronze or special steel alloys. Stressed screws and bolts are permanently secured, unless they must be removed for maintenance. On these the nuts contain nylon inserts to prevent loosening. The impact forces produced by opening and closing the circuit breaker are damped by additional shock absorbers to lessen the stress on mechanical linkages.

Preventative maintenance for breakers applied to furnace control and protection is a major problem. A preventative maintenance guide with specific maintenance procedures has been prepared to enable the circuit breaker to provide 100,000 operating cycles at rated current without any mechanical failure. Examples:

Every 10,000 operations all moving parts must be lubricated.
Every 20,000 operations the arcing contacts must be replaced.
Every 40,000 operations the arc chutes must be replaced.

With minimun maintenance a furnace breaker required to operate up to 100 operations per day, seven days a week, would give a minimum operating life of nearly 3 years.

continued ▶

MECHANICAL PERFORMANCE

Typical 15KV, 1200 amperes, 500 MVA, with 23KA Breaking Capacity Air Circuit Breaker

ANSI Standards require 10,000 close-open operations at no load for conventional breakers. We have tested our standard DSE circuit breaker for 20,000 no load operations, and the SOLENARC DSE-F circuit breaker far exceeds these performances. With preventative maintenance as specified, 100,000 load break operations can be performed by the SOLENARC furnace breaker.

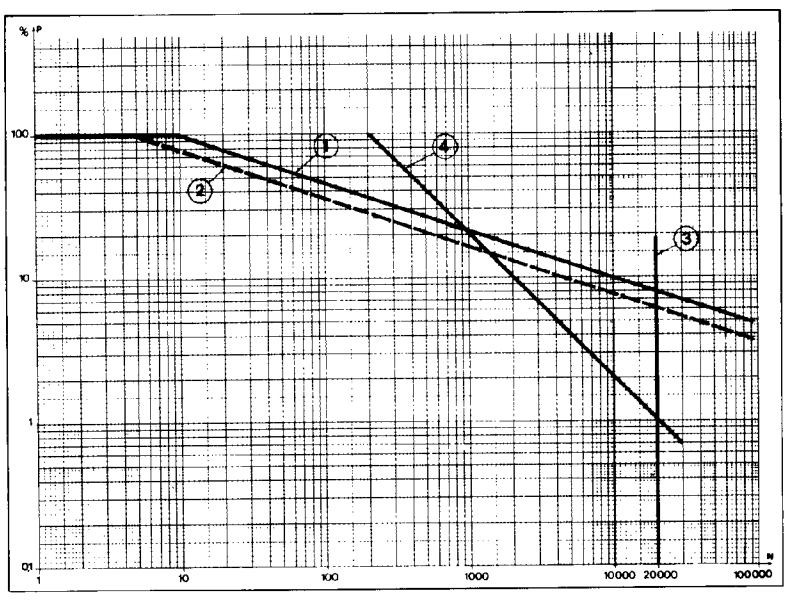
ELECTRICAL PERFORMANCE

Typical 15KV, 1200 amperes, 500 MVA, with 23KA Breaking Capacity Air Circuit Breaker

ANSI minimum performance data C37.09 and C37.06:

Short Circuit	**Load Current Switching**
5 interruptions at 100% breaking capacity	5000 CO at F.L.A.
5 interruptions at 75% breaking capacity	1000 CO at 3 x F.L.A. then
2 interruptions at 50% breaking capacity	1 CO at 100% breaking capacity

Interruption tests were performed on the DSE-F and curves were plotted as shown in the graph right.



Curve Nos.

1. Breakers with breaking capacity < 30KA RMS.
2. Breakers with breaking capacity ⩾ 30KA RMS.
3. Limit of mechanical endurance of arcing contacts.
4. Vacuum circuit breakers.

N = Number of operations
%P = Percent of maximum breaking capacity

The following table is based on DSE-F-65, 15KV, 1200 amperes, 500 MVA with 23KA interrupting capacity air circuit breaker - versus a vacuum breaker with comparable electrical ratings.

Curve #	INTERRUPTIONS KA	INTERRUPTIONS % of Rating	TOTAL INTERRUPTIONS SOLENARC	TOTAL INTERRUPTIONS Vacuum Breaker
1	30	100%	10	200
4	30	100%		
1	9	30%	300	650
4	9	30%		
1	6	20%	1,000	1,000
4	6	20%		
1	3	10%	10,000	2,000
4	3	10%		
1	2.4	8%	20,000	20,000
4	300 amps.	25% of F.L.A.		
1	1.2	F.L.A.	100,000	4,000
4	1.2	F.L.A.		

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