Elements of Basic SSS® Clutch

A. Pawl
B. Clutch Teeth
C. Sliding Component
D. Helical Splines
E. Input Shaft
F. Output Clutch Ring
G. Ratchet Teeth

SSS® Clutch Principle of Operation

1.  
2.  
3.  

Power Applications

Single-Shaft, Combined-Cycle Plant
Cogeneration Plant
Synchronous Condensing using the Generator of Peak Load Turbines
Combined Heat and Power Plant (CHP)
Rotating Uninterruptible Power System (UPS)
Pumped Hydro
AUXILIARIES: Gas and Steam Turbine Turning Gears, Gas Turbine Starting

Petrochemical/Process/Refinery/Pipeline Applications

Compressors: Air, Gas, Refrigeration, Process, Pipeline, etc.
Fans: ID, FD, Gas Recirculation, etc.
Pumps: Amine, Water, etc.
Hydraulic Power Recovery Turbines
PTA Mixers
Expander Turbines: FCC, Gas, etc.
Steam Turbines: HP, LP, Back Pressure, Condensing, etc.
Gas Turbines

SSS® Clutch

Dual Driven Equipment Applications for SSS® Clutches

SSS® Clutch Principle of Operation:

1. Pawl
2. Clutch Teeth
3. Sliding Component
4. Helical Splines
5. Input Shaft
6. Output Clutch Ring
7. Ratchet Teeth

400 MW Highest Power SSS® Clutch
17,000 rpm Highest Speed SSS® Clutch
1,100+ SSS® Clutches for Power Plants (Synchronous Condensing and Combined Cycle)
100+ SSS® Clutches for Combined Heat and Power (CHP) in 14 Countries
25,000+ SSS® Clutches for Starting and Turning Gear Systems
1,500+ SSS® Clutches for Uninterruptible Power Supplies
4,800+ SSS® Clutches for Naval and Marine Applications
700+ SSS® Clutches for Pumps
275+ SSS® Clutches for Fans
300+ SSS® Clutches for Compressors

SSS® Clutch

Synchronous Condensing
Spinning Reserve
Grid Inertia

SSS Clutch Company, Inc.
Application Engineering
Sales and Aftermarket Service in North and South America
610 West Basin Road, New Castle, Delaware 19720, USA
(302) 322-8080 engineering@ssschutch.com www.ssschutch.com

SSS Gears Limited
All clutches are designed, built and tested in the UK Factory.
Park Road, Sunbury-on-Thames Middx TW16 5BL, England
+44 1932 780644 engineering@sssgears.co.uk www.sssgears.co.uk

Seventy Plus Years of Designing and Building High Power Clutches
36,000+ SSS® Clutches Supplied Worldwide
**Gas Turbine Generators**

**GE Frame 9E Synchronous Condensing**

Size 360FT SSS® Encased Clutch was installed in 1995 in a GE Frame 9E peak load gas turbine generator at Indian Queens, England, to provide vars and voltage support for the 400 kV transmission line for the UK’s National Grid Company in Cornwall, England.

**GE LM60000 Synchronous Condensing**

Seven Size 260T SSS® Clutches in Saskatchewan on LM6000 Gas Turbines.

**GE LMS100 Synchronous Condensing**

LM5100 Gas Turbine Generator with size 273T SSS® Encased Clutch at Calpine (formerly Conectiv) Cumberland Energy Center, Millville, NJ.

**Benefits of Synchronous Condensing/Grid Inertia/Spinning Reserve**

- Provide/absorb vars: used in small increments to correct lagging/leading power factor.
- Meet peak var requirements: without reducing Watts of generators in operation.
- Power Factor/Voltage Support for Transmission Lines: used at end of a long transmission line provides stability and enables more Watts to be transmitted.
- Power Factor/Voltage Support in Urban Centers and Industrial Areas: provides stability and enables more Watts to be transmitted.
- Grid Inertia: can provide rotating mass and “Dynamic vars” to stabilize grid system, particularly when loads vary quickly.
- Synchronized Reserve: generator operating as synchronous condenser could possibly qualify for synchronized reserve spinning reserve requirements or credit.
- Complements Static Capacitors: by providing infinite adjustments of vars reducing need to switch capacitors off and on, extending their service life.
- Reactive Power: Synchronous Condenser provides Reactive Power for both high and low voltage.
- Correct High Voltage Problems: can balance vars at the end of underground cables to correct high voltage problems.
- Ancillary Service Revenue: Synchronous Condenser can be an Ancillary Service Revenue in a deregulated market.

**Maximizing the Contribution of Renewable Sources of Energy**

First SSS® Clutch supplied for Synchronous Condensing approximately 45 years ago.

**Siemens V94.2 and V84.3A Synchronous Condensing**

Size 280T SSS® Encased Clutch Rated for 176 MW

- Siemens SGT6-5000F (V84.3A) Kansas City
  - 176 MW/3000 rpm
  - 7 units supplied in 2006
  - Average 4 hours/day generating
  - Average 10 hours/day synchronous condensing

**Southern California Edison Santiago Substation, Irvine, California**

Three Size 68FT SSS® Clutches for Synchronous Condensing

**B.C. Hydro Canada**

**Comm. Ed, Zion Nuclear Plant**

**Acceleration Systems**

**Keys Energy, Key West, Florida**

Synchronous condensing starting package. SSS® Encased Clutch contains SSS® Disconnect Clutch, for starting system, turning gear with second SSS® Clutch, and new generator thrust bearing.

Stand-Alone Generator Turned Into Synchronous Condenser. Graph of transmission capacity before and after conversion of generator to synchronous condenser. Work was completed in July of 1997.