

# SSS Clutch Operating Principle

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# SSS Clutches transmit over 100 million kW

## Basic Principles of Operation

The initials “SSS” denote the ‘Synchro-Self-Shifting’ action of the clutch, whereby the clutch teeth are phased and then automatically shifted axially into engagement when rotating at precisely the same speed. The clutch disengages as soon as the input speed slows down relative to the output speed.

The basic operating principle of the SSS Clutch can be compared to the action of a nut screwed on to a bolt. If the bolt rotates with the nut free, the nut will rotate with the bolt. If the nut is prevented from rotating while the bolt continues to turn, the nut will move in a straight line along the bolt.

In an SSS Clutch the input shaft (E) has helical splines (D) which correspond to the thread of the bolt. Mounted on the helical splines is a sliding component (C) which simulates the nut. In the diagram, the sliding component has external clutch teeth (B) at one end, and external ratchet teeth (G) at the other.

When the input shaft rotates, the sliding component rotates with it until a ratchet tooth contacts the tip of a pawl (A) on the output clutch ring (F) to prevent rotation of the sliding component relative to the output clutch ring. This position is shown in Figure 1.

As the input shaft continues to rotate, the sliding component will move axially along the helical splines of the input shaft. When a ratchet tooth is in contact with a pawl tip, the clutch engaging teeth are perfectly aligned for inter-engagement and thus will pass smoothly into mesh in a straight line path.

As the sliding component moves along the input shaft, the pawl passes out of contact with the ratchet tooth, allowing the clutch teeth to come into flank contact and continue the engaging travel as shown in Figure 2. Note that the only load on the pawl is that required to shift the lightweight sliding component along the helical splines.

Driving torque from the input shaft will only be transmitted when the sliding component completes its travel by contacting an end stop on the input shaft, with the clutch teeth fully engaged and the pawls unloaded as shown in Figure 3.

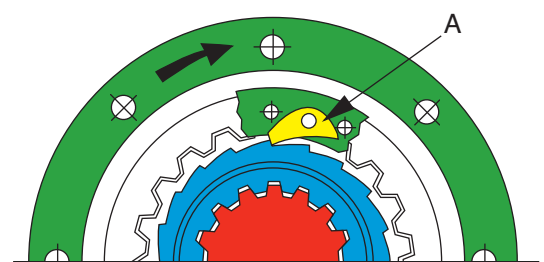
When a nut is screwed against the head of a bolt, no external thrust is produced. Similarly when the sliding component of an SSS Clutch reaches its end stop and the clutch is transmitting driving torque, no external thrust loads are produced by the helical splines.

Where necessary, an oil dashpot is incorporated in the end stop to cushion the clutch engagement.

If the speed of the input shaft is reduced relative to the output shaft, the torque on the helical splines will reverse. This causes the sliding component to return to the disengaged position and the clutch will overrun.

At high overrunning speeds, pawl ratcheting is prevented by a combination of centrifugal and hydrodynamic effects acting on the pawls.

The basic SSS Clutch can operate continuously engaged or overrunning at maximum speed without wear occurring.



### Proven Design

Over 630 SSS Clutches are used in more than 600 gas turbine generator sets in 55 countries. Total power transmitted is over 26 000 000 kW and the maximum power transmitted through a single clutch is 300 000 kW at 3000 rpm.

### High Reliability

Proven by its selection for important functions such as transmission of propulsive power in over 530 fighting ships for 28 Navies.

### Automatic Action

The basic SSS Clutch is a true freewheel device requiring no friction plates, hydraulics, electromagnetic devices, or any operator action.

### Positive ‘No Slip’ Drive

Hardened gear teeth transmit torque without power loss.

### Negligible Wear

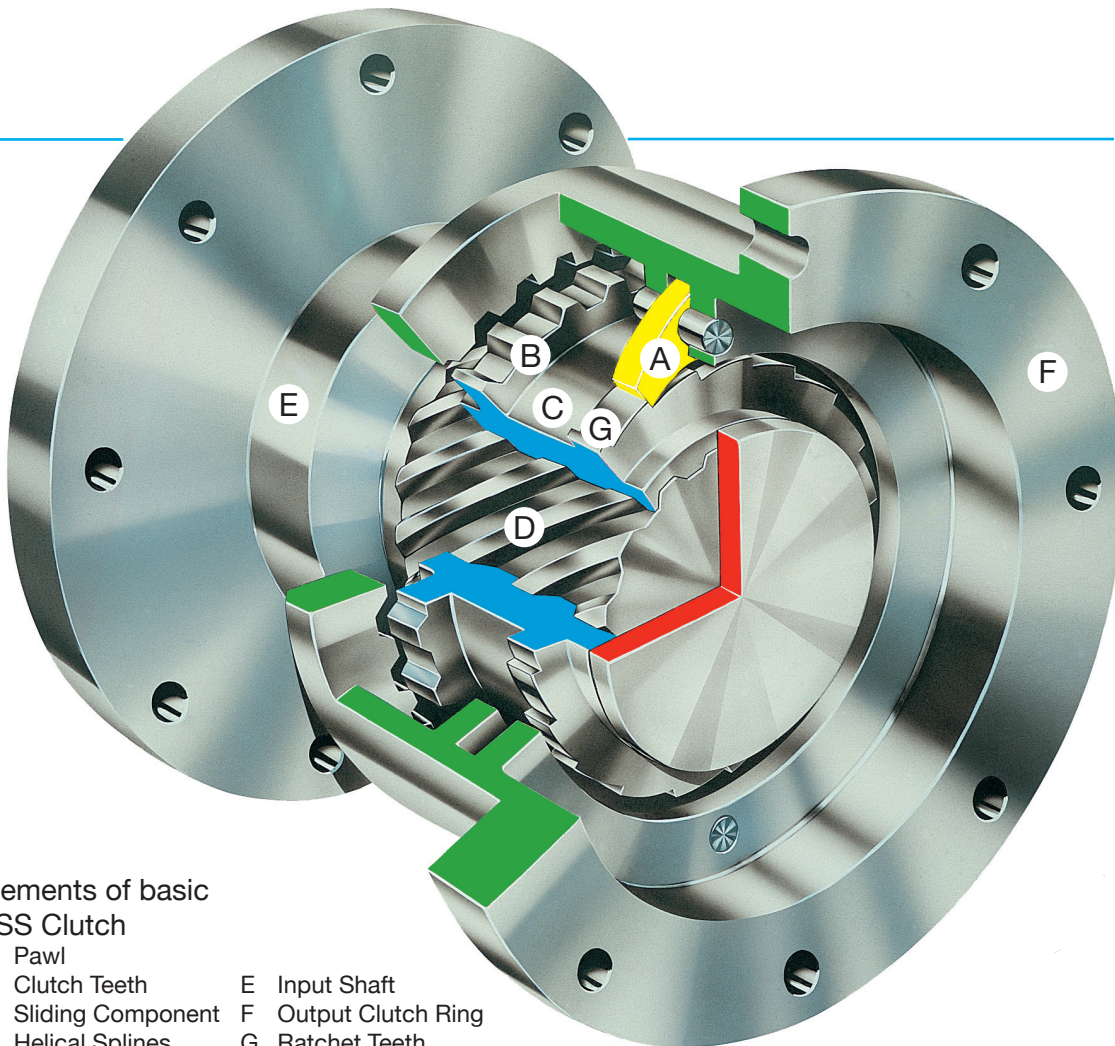
The clutch synchronising components are inoperative during torque transmission or when the clutch is overrunning at high speed.

### Smooth Running

Dynamic balancing of simple cylindrical components with easily controlled clearances ensures low vibration levels.

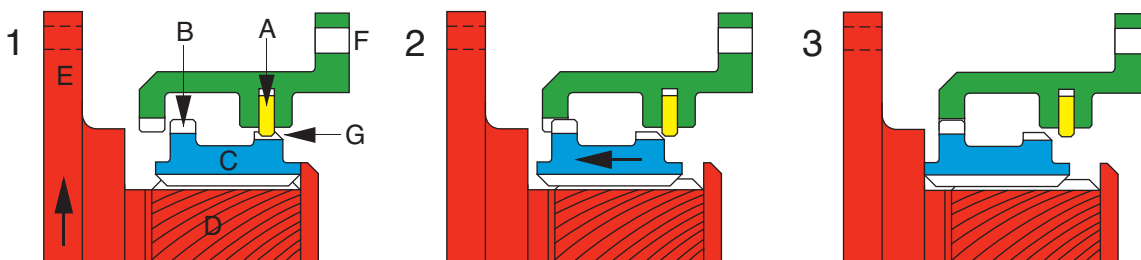
### High Overload/Overspeed Capability

Torque is transmitted through large surface area of the clutch teeth. There are no ‘line contact’ rollers or cams easily overloaded by combined torque and centrifugal forces.



#### Elements of basic SSS Clutch

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



#### Optional Extra Features

Lock-in Control_____	To prevent clutch disengagement
Lock-out Control_____	To prevent clutch engagement
Flexibility_____	To accommodate shaft axial and radial movement
Encased Design _____	A robust self-supporting unit for foot mounting
Position Indication_____	To give local or remote indication of clutch position

Link to YouTube video demonstration  
[www.youtube.com/watch?v=rOT4O-lwzu8](https://www.youtube.com/watch?v=rOT4O-lwzu8)



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## Typical Applications

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Naval Multi-engine Propulsion Systems  
Energy Recovery Turbines  
Dual Driven Pumps  
Compressors and Fans  
Co-generation Plant  
Uninterruptible Power Supplies  
Combined Cycle Plant  
Electric Power Generation  
Synchronous Condensing Plant  
Air or Water Pumped Storage Plant  
Turbine Turning Gear Drives  
Gas Turbine Starting Drives  
High Torque Back Stops

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## Other SSS Publications

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	Publication Number
Encased Clutches	NR2200
Semi-Rigid Clutches	0597/3
Spacer Clutches	0597/2
Turning Gear	NR2126
Clutch Couplings	NR2123
Combined Heat & Power	0297/5
Synchronous Condensing	NR2201
Combined Cycle	0297/4
Pinion Clutches	1197/1
User Reference Lists:	
Turbo-generator Plant	0391/1
Marine	0391/2
Pump/Compressor/Fan Drives	0391/3
Combined Cycle	1292/3

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