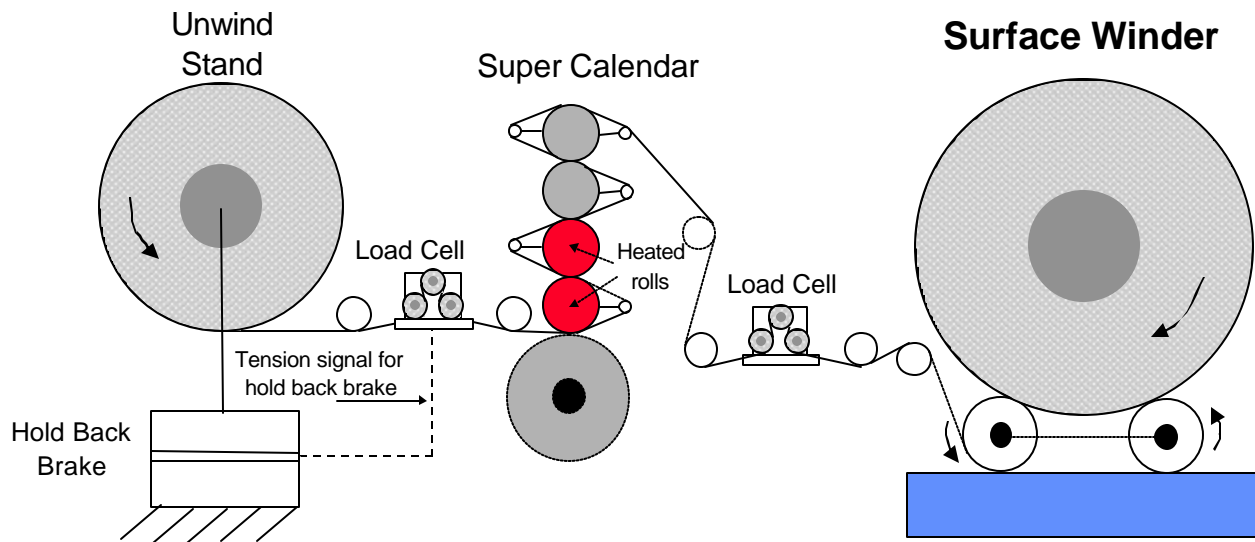


Surface Winders are used to roll up material such as wire, paper, film, metals and textiles. The surface winding method applies the driving power to a fixed diameter roll or rolls, on which the winding roll rests. Thus winding power applied to the surface of the spool or roll being wound. For a surface winder, the surface speed of the winding roll is constant for a given line speed. The rotational speed (RPM) of the roll decreases with roll build up. The wind tension and speed remains constant, and so the load characteristic of this application is constant torque.

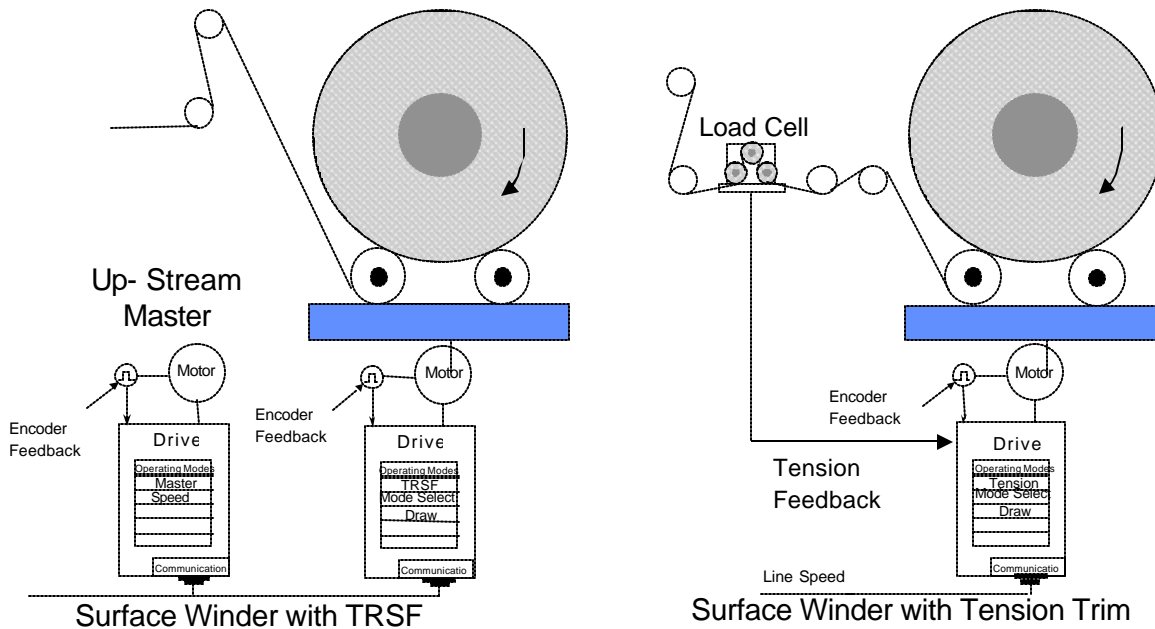


Winders have different names in each industry.

<u>Industry</u>	<u>Winder Name</u>	<u>Roll Name</u>
Paper, Textile, Film	Winder	Roll
Textile	Beamer	Beam
Wire	Takeup, Reeler	Reel
Wire	Spooler	Spool
Metal	Coiler	Coil

Surface winder drives are divided into groups based on control function.

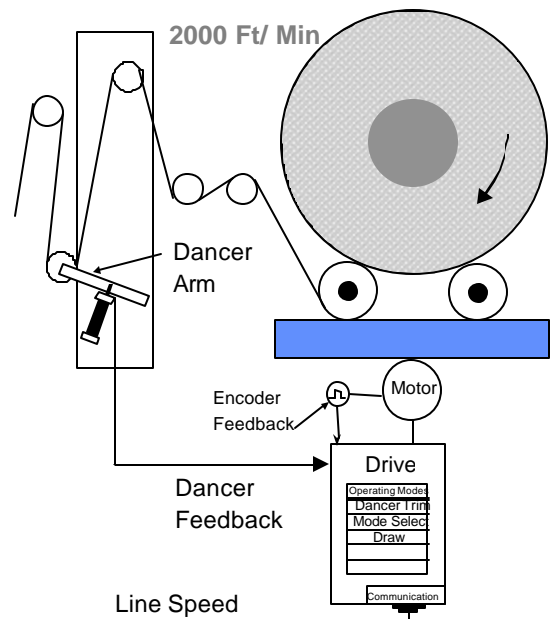
- | | | |
|----|--|----------------------|
| 1. | <i>Torque Regulator, Speed Follower (TRSF)</i> | 70 % of applications |
| 2. | <i>Tension Trim</i> | 10 % of applications |
| 3. | <i>Draw</i> | 15 % of applications |
| 4. | <i>Dancer Trim</i> | 5 % of applications |



TRSF (*Torque Regulator, Speed follower*) provides indirect tension control for a sectional or surface winder drive by providing a trim adjustment to a precise speed follower control. Regulating motor current and voltage provides tension control. Under normal operating conditions drive torque (motor current) is controlled, however speed follower control without torque trim is also provided for setup operation or as a maximum speed limit in the event of a web break.

Draw control of the Surface winder is achieved by applying a percentage of speed offset to the speed reference that is sent from the master section. The line speed (Ft/Min) = Speed reference * (1 + Draw %).

Tension Trim in the Surface winder controls the tension of the material used, with tension feedback from a load cell upstream of the winder. Tension is measured and controlled by transducer (load cells) directly actuated by the web. The regulator will automatically adjust the motor speed to compensate for change in tension of the force transducers.



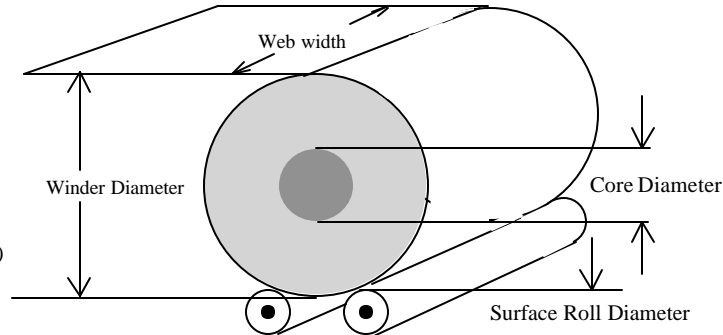
Heated rolls
Surface Winder with Dancer Trim

Dancer Trim indirectly provides tension control for a surface winder drive by providing a trim adjustment to a precise speed follower control. Position of a dancer roll is measured and controlled to maintain the dancer roll in a relatively fixed position; web tension is established by the weight of, or a force imposed on, the dancer mechanism. Under normal operating conditions, speed is adjusted to maintain the dancer at the midpoint of its allowable range, however, speed follower control without position trim is also provided for setup operation or as a maximum speed limit in the event of a web break

Sizing Example

Example:

Web width = 72 inches
 Core Diameter = 6 inches
 Surface Roll Diameter = 4.5 inches
 Max roll diameter = 30 inches
 Line Speed = 2000 ft/ minute
 Tension = 4 PLI (lbs per linear inch)
 Taper: None



$$\text{Roll RPM} = \frac{\text{Line Speed (Feet/ Min)}}{\pi * \text{Diameter Surface roll}} \quad \text{Diameter} = \text{Diameter of winder Ft}$$

$$\text{Torque} = \text{Total tension} * \text{radius} \quad \text{Total tension} = \text{total tension at Diameter}$$

$$\text{Radius} = \text{Diameter of winder}/2$$

$$\text{Total tension} = \text{PLI} * \text{Web width}$$

$$\text{Web HP} = \frac{\text{Torque} * \text{RPM}}{5250} \quad \text{Torque} = \text{lb} * \text{Ft}$$

$$\text{Web HP} = \frac{\text{Total Tension} * \text{Line speed}}{33,000} \quad \text{Line Speed} = \text{Ft / Minute}$$

$$\text{Tension} = \text{lbs}$$

$$\text{Total HP} = \text{Web HP} + \text{Losses} \quad \text{Losses} = 10 \% * \text{Winding HP}$$

Steps Method 1

$$\textcircled{1} \text{ Roll RPM} = \frac{2000 \text{ (Feet/ Min)}}{\pi * 4.5 \text{ in/ 12 in/ ft}} = 1698 \text{ RPM}$$

$$\textcircled{2} \text{ Tension} = 72 \text{ inch} * 4 \text{ PLI} = 288 \text{ lb}$$

$$\textcircled{3} \text{ Torque} = 288 \text{ lb} * 4.5''/2 * 1/12'' = 54 \text{ ft Lbs}$$

$$\textcircled{4} \text{ Web HP} = 54 * 1698 \text{ RPM}/5250 = 17.45 \text{ HP}$$

Steps Method 2

$$\textcircled{1} \text{ Tension} = 72 \text{ inch} * 4 \text{ PLI} = 288 \text{ lbs}$$

$$\textcircled{2} \text{ Web HP} = \frac{288 \text{ lbs} * 2000 \text{ ft/ minute}}{33,000}$$

$$\textcircled{3} \text{ Web HP} = 17.45 \text{ HP} \quad \leftarrow \text{Same answer}$$

$$\textcircled{4} \text{ Total HP} = 17.45 \text{ HP} + 1.74 \text{ HP} = 19.19 \text{ HP}$$

In this example calculation, the horsepower rating of the surface winder is 17.45 HP plus the estimated 10 % friction loss of 1.74 HP. The web horsepower is the same as the winding horsepower in this type of configuration. This is due the constant diameter of the surface winder roll.

There are several different ways to calculate Web horsepower. It can be done be either using the torque calculations (Method 1) by inserting the RPM of the driven roll or tension (Method 2) using line speed.

Note: The acceleration and deceleration HP was not taken into consideration. Please call Yaskawa for assistance in the calculations.

Customer Data

Company Name	<input type="checkbox"/> End user <input type="checkbox"/> Distributor <input type="checkbox"/> OEM
Contact Name #1	Contact Name #1 e-mail
Contact Name #2	Contact Name #2 e-mail
Address	City
State	Zip
Phone	Fax

Machine Data

Type of material (paper, Textile, Plastic Film, Metals and Foils) _____

Machine Design speed _____ (Feet/ Minute¹) Machine Design Core Diameters _____ inches

Machine Design Max roll Diameter _____ inches Machine Design Max roll width _____ inches

Web Width _____ Inches Acceleration time ___ Sec deceleration time ___ Sec

Machine Design Tension _____ PLI Surface roll Diameter _____ inches

Roll inertia _____ LB*FT²

HP Sizing

- ① Roll RPM _____
 - ② Total tension _____
 - ③ Total Torque _____
 - ④ Web HP _____
 - ⑤ Total HP _____
- Winding HP

$$\text{Roll RPM} = \frac{\text{Line Speed (Feet/ Min)}}{\pi * \text{Diameter Surface roll}}$$

Total tension = PLI * Web width

Torque = Total tension * radius

$$\text{Web HP} = \frac{\text{Torque} * \text{RPM}}{5250}$$

Total HP = Web HP + Losses Losses = 10 % *

Drive Data

Manufacture _____ Model # _____

Horse Power _____

Winder Drive New Application Retrofit

Existing Voltage 230VAC 460VAC 575VAC

Existing Drive system AC drive DC drive Eddy Current

¹ Ft/minute Max RPM = π * Core Diameter (Ft)

Motor Data

Existing motor Manufacture _____ Model # _____

New motor required Yes No

Existing motor full load ratings: _____ AMPS
 _____ Volt
 _____ RPM (850, 1150, 1750)

Conduit Box location (if motor is to be replaced) F1 F2 F3 or NA

Existing Blower Motor. _____ Voltage, _____ Amps or NA

Existing Encoder Manufacture _____ NA

Existing Encoder Digital Analog AC Analog DC

Existing Encoder Manufacturer. _____ NA

Resolution Existing Encoder (PPR) _____ or Volts/RPM _____

Encoder Pickup Optical Magnetic pickup

Existing Gear Box

Gear Box Ratio _____

Existing Gear Box Manufacture _____ Model # _____

New Gear Box required Yes No

Existing Gear Box ratings: _____ Gear Box Ratio
 _____ Frame Size
 _____ C Face

Drive Enclosure information

Ambient Temperature in control room _____ °F or _____ °C

Existing Drive Enclosure NEMA 1 NEMA 12 NEMA 4X Air conditioning

New Enclosure Spec NEMA 1 NEMA 12 NEMA 4X Air conditioning

Enclosure options Duplex outlet Lights Empty cabinet for future use

Other _____

Existing Power Distribution (Required if BIS Automation is providing a drive system)

- Isolation Transformer _____ KVA Primary Voltage _____ AC Secondary voltage _____ AC
- Line Reactors Impedance _____ (%) Load Reactors Impedance _____ (%)
- Dynamic Braking Resistor: Duty Cycle i.e. 3%, 5% _____ % Resistance _____ Ohms
 Dynamic Resistor Power rating _____ Watts

Drive Communication Requirements

- Modbus Plus Modbus Device Net Profibus Arcnet LAN
- Other _____

Drive Input Requirements

- Start Stop Forward Reverse Run
- Jog Taper on Preset Speed1 Preset Speed 2
- Other _____

Drive Output Requirements

- Drive alarm fault Drive severe fault Run Zero speed At speed
- Encoder feedback pass through (PGX card)
- Other _____

Analog Input

- Speed reference 0-10VDC 4-20ma Other _____

Analog Output

- Drive Speed (FPM) Bus Voltage Other _____

Special Types of Control

- Drive system start Drive system stop Regenerative to fast stop - full current limit or ramped
- DC Bus Over Voltage Suppression (Used to prevent overvoltage tripping from an unbalanced load)
- In Window, or OK to feed product. Counter for # of parts produced
- Other _____