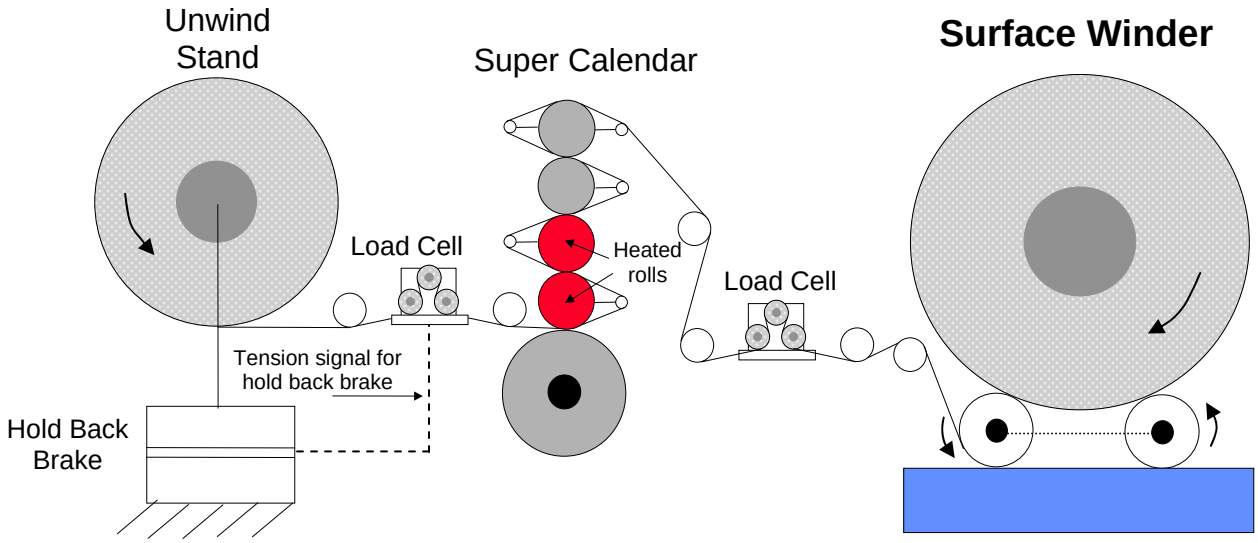
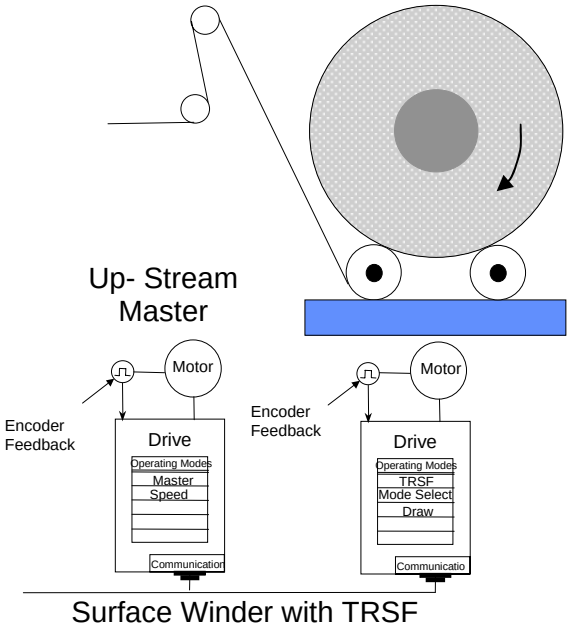
Surface Winders are used to roll up material such as wire, paper, film, metals and textiles. The surface winding method applies the driving power to a fixed diameter roll or rolls, on which the winding roll rests. Thus winding power applied to the surface of the spool or roll being wound. For a surface 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.



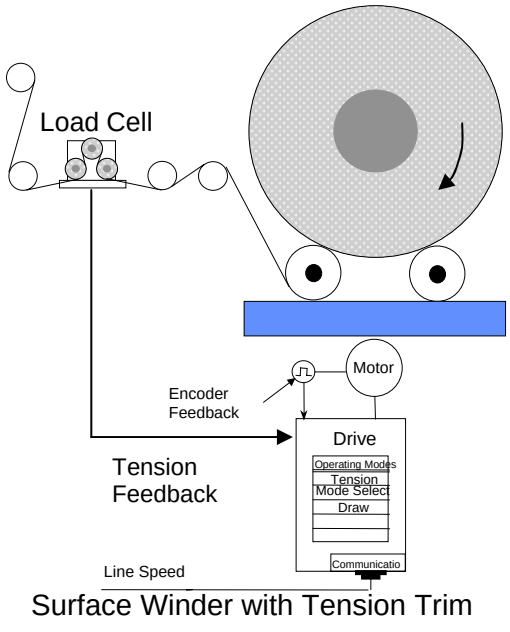
Winders have different names in each industry.

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

Surface Winders Drives are divided into groups based on control function.
Torque Regulator, Speed Follower (TRSF) 70 % of applications
Tension Trim 10 % of applications
Draw 15 % of applications
Dancer Trim 5 % of applications



Surface Winder with TRSF

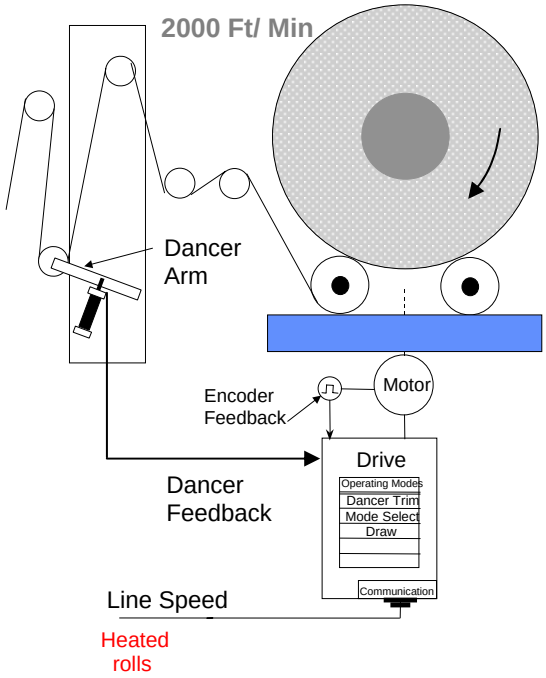


Surface Winder with Tension Trim

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.



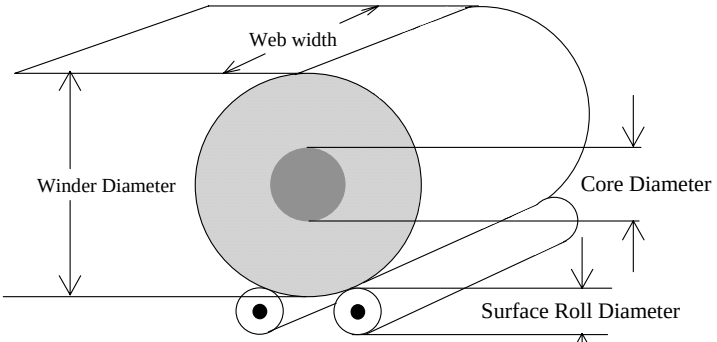
Surface Winder with Dancer Trim

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



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

Torque = Total tension * radius Total tension = total tension at Diameter
Radius = Diameter of winder/2
Total tension = PLI * Web width

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

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

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

Steps Method 1

1. Roll RPM = $\frac{2000 \text{ (Feet/ Min)}}{\pi * 4.5 \text{ in/ } 12 \text{ in/ ft}}$ = 1698 RPM
2. Tension = 72 inch * 4 PLI= 288 lb
3. Torque = 288 lb * 4.5”/2*1/12”= 54 ft Lbs
4. Web HP = 54 * 1698 RPM/5250 = 17.45 HP

Steps Method 2

1. Tension = 72 inch * 4 PLI = 288 lbs
2. Web HP = $\frac{288 \text{ lbs} * 2000 \text{ ft/ minute}}{33{,}000}$
3. Web HP = 17.45 HP *Same answer*
4. Total HP = 17.45 HP + 1.74HP = 19.19 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 for assistance in the calculations.

Customer Data

Company Name	☐End user ☐Distributor ☐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/ Minute[1])

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*FT^2

HP Sizing

① Roll RPM _____

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

② Total tension _____

Total tension = PLI * Web width

③ Total Torque _____

Torque = Total tension * radius

④ Web HP _____

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

⑤ Total HP _____

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

Winding HP

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

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

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

Existing Power Distribution (Required if Yaskawa 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