Applying Control Systems to the New Air Dried Tissue (ADT) Machine Concept

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Air Dried Tissue (ADT) offers advantages over traditional Crepe or TAD Tissue Machines.

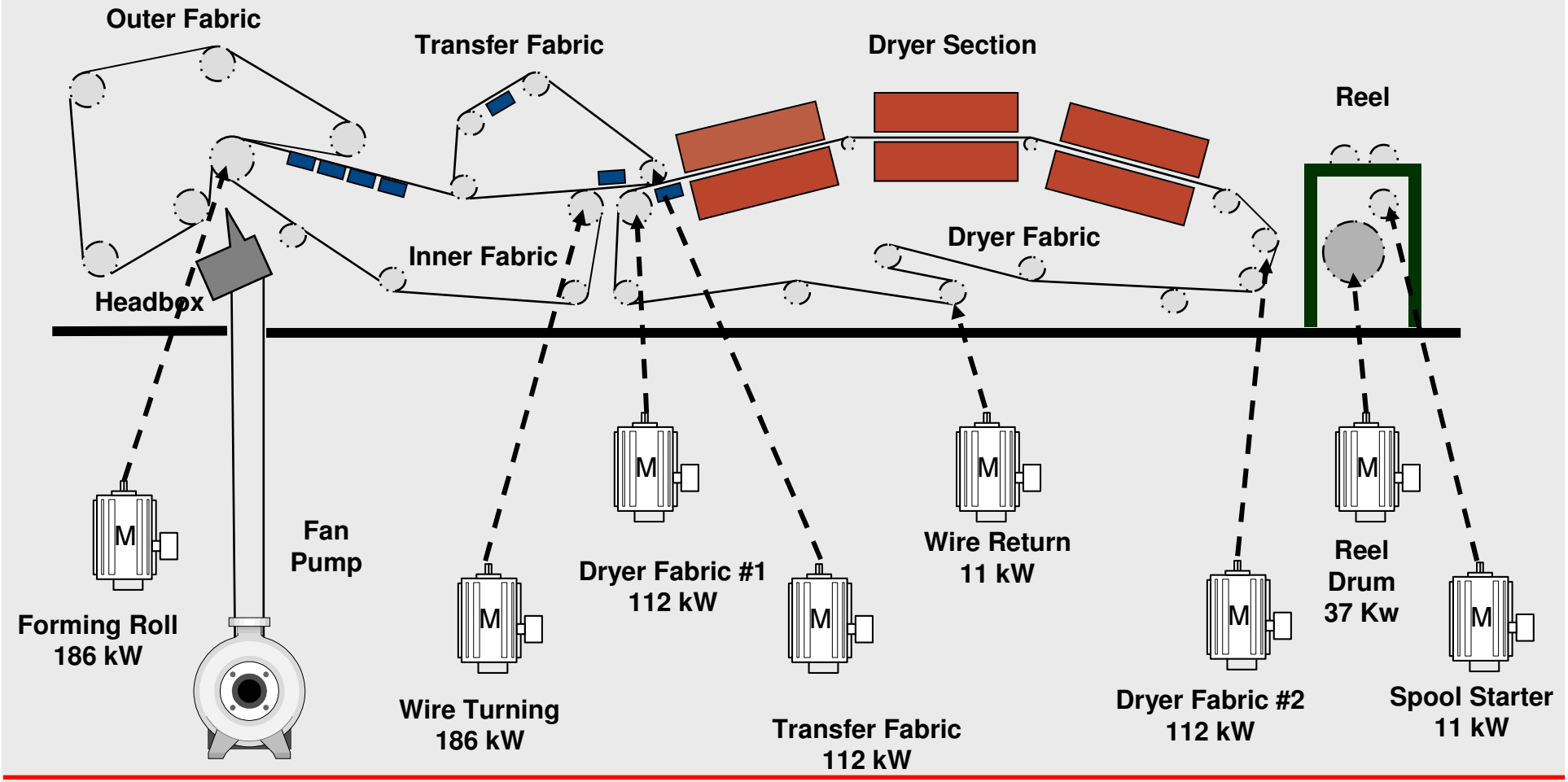
1. Present Size limitations exceeded {400 inch (10.2 m) CD width possible}
2. Present Speed limitations are surpassed
3. Energy consumption reduced by more than 14%
4. Steam Heated Yankee Dryer not necessary
5. Reduction of ceiling height of machine room

Ref: Ed Graf, "TAD's latest challenger," Tissue World Dec/Jan 2007: 15.

Energy Consumption Values

	Conventional TAD	ADT
Gas Consumption KWH/ Ton:	3840	Greater than 25% reduction
Steam Consumption KWH/Ton:	942	
Drive Energy Consumption KWH/ Ton:	1987	Same as conventional
Total Energy (KWH/Ton) Use:	**6769**	**Greater than 14% reduction**

ADT Tissue Machines
(Air Dried Tissue)



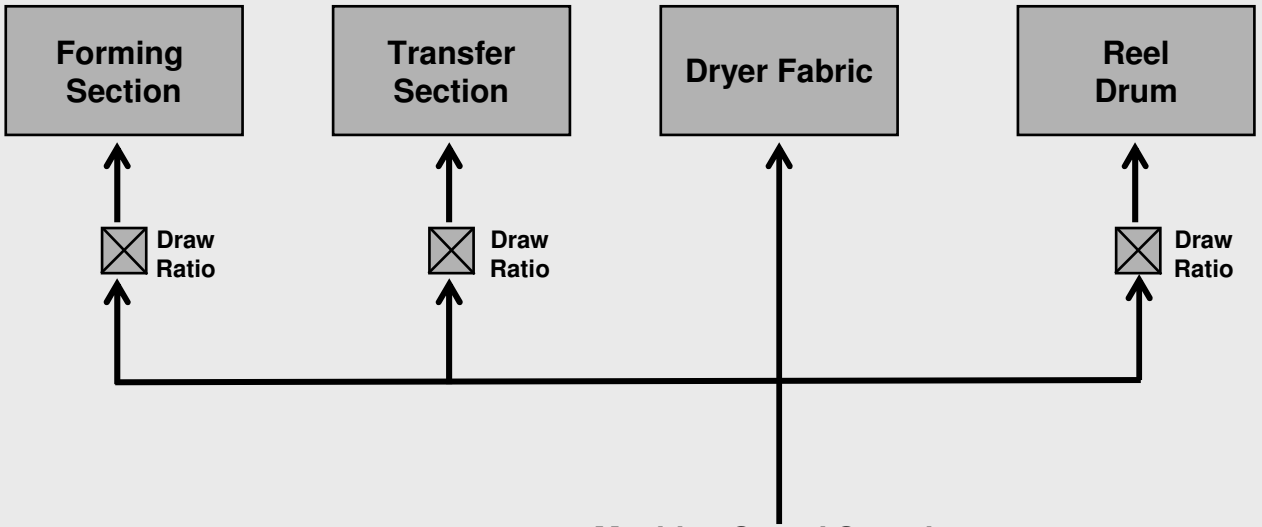
Power Calculations Results

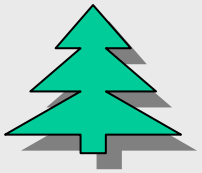
1580 m/min and 2800 mm

	HP Requirements	kW Requirements
Forming Roll	250 HP	186 kW
Wire Turning	250 HP	186 kW
Transfer Roll	150 HP	112 kW
Dryer Fabric #1	150 HP	112 kW
Dryer Fabric #2	150 HP	112 kW
Wire Return	15 HP	11 kW
Reel Drum	50 HP	37 kW
Spool Starter	15 HP	11 kW
Total Power	1030 HP	768 kW

Power Calculations are based on Tappi constants.
Tappi – Technical Association of the Pulp and Paper Industry.

Tissue Machine – Speed Control





Speed Setpoint = 1000 m/min

Section	Draw Ratio	Speed m/min	Draw
Forming Section	0.98	980 m/min	10 m/min
Transfer Section	0.99	990 m/min	10 m/min
Dryer Fabric	-	1000 m/min	-
Reel Drum	0.9	900 m/min	100 m/min

Speed Setpoint = 2000 m/min

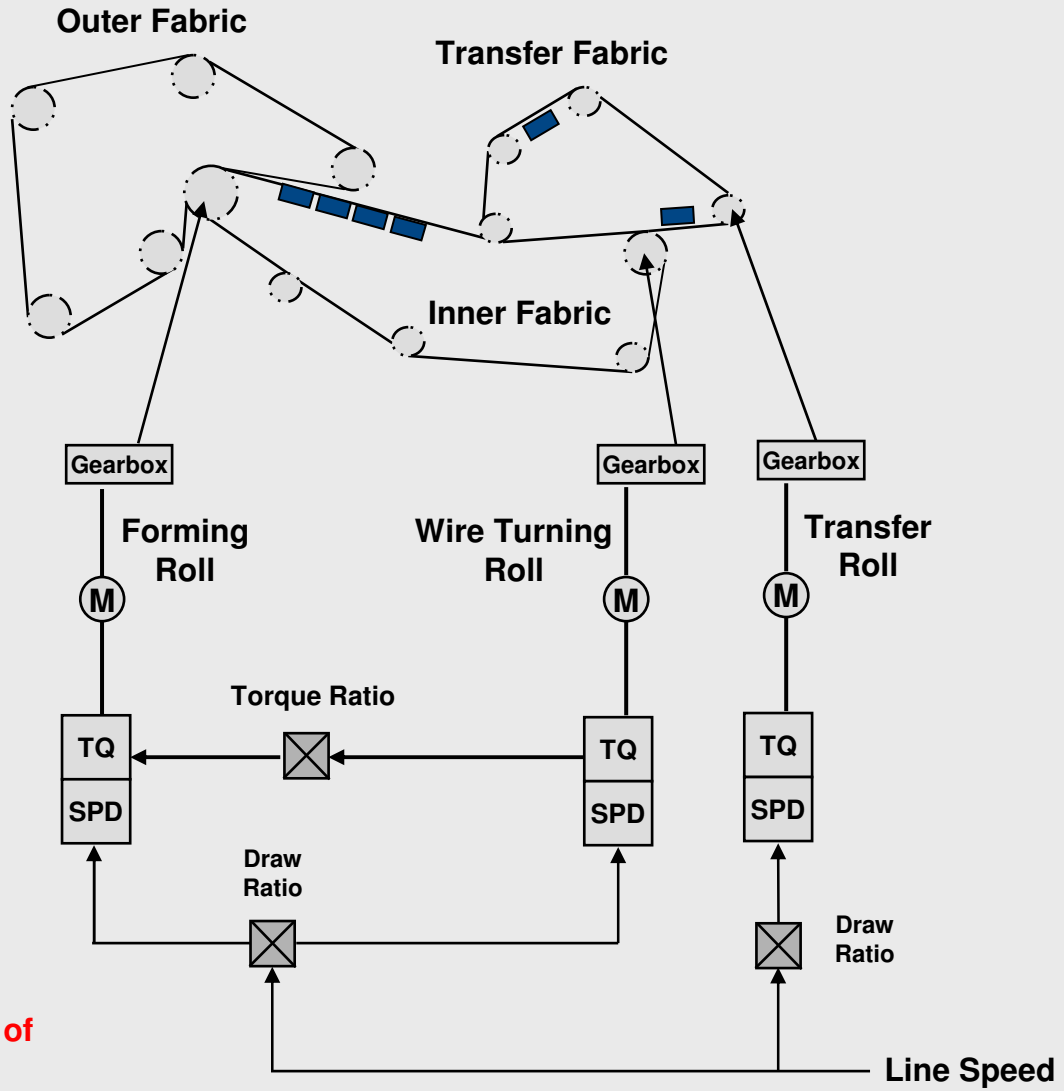
Section	Draw Ratio	Speed m/min	Draw
Forming Section	0.98	1960 m/min	20 m/min
Transfer Section	0.99	1980 m/min	20 m/min
Dryer Fabric	-	2000 m/min	-
Reel Drum	0.9	1800 m/min	200 m/min

Forming Sections

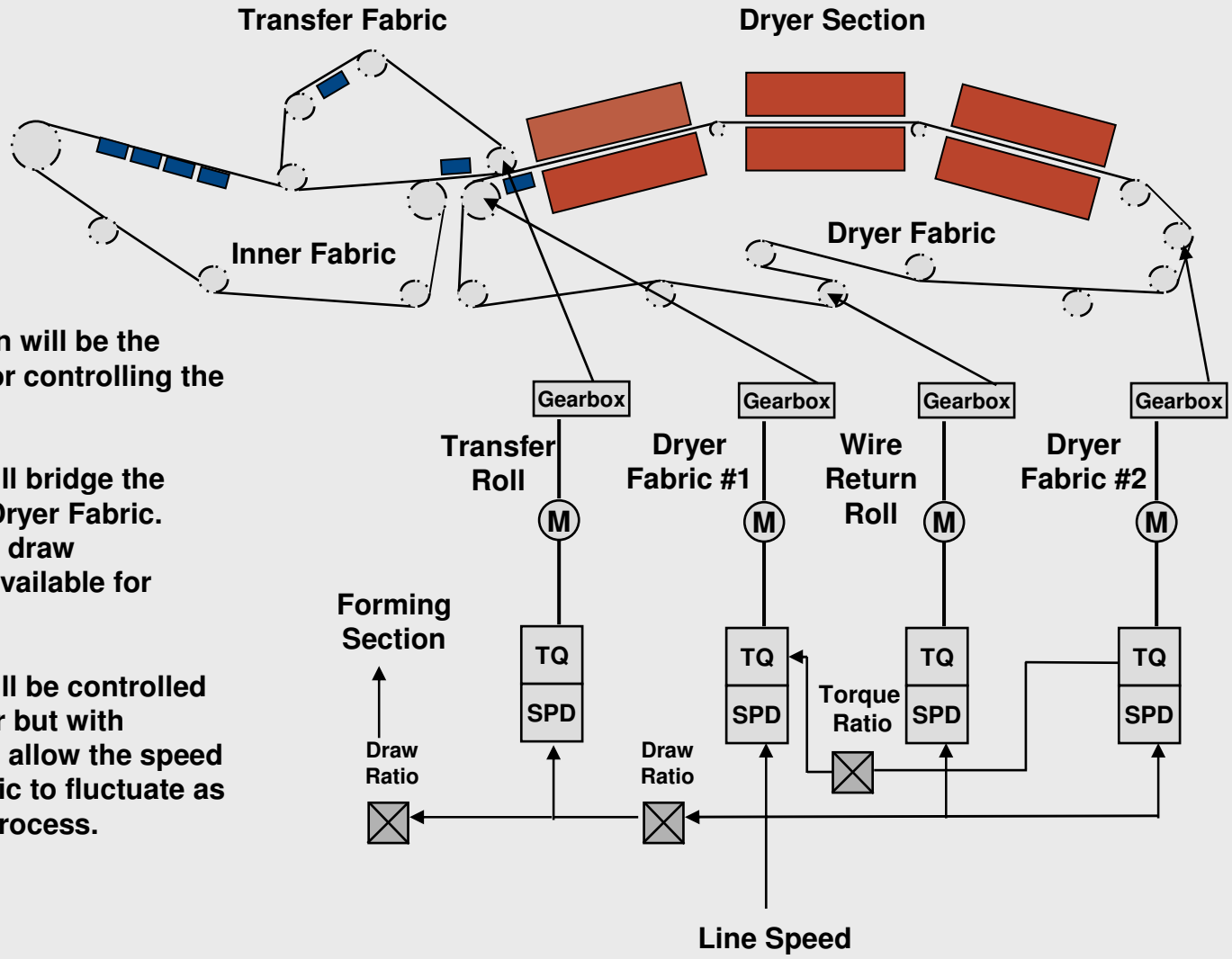
- Forming Roll will follow the torque reference of the Wire Turning.
- Wire Turning will be a speed regulated motor with operator draw adjustment.

	Speed	Torque	Torque Ratio
Dryer Section	2000 **m/min**	50%	
Wire Turning	1960 **m/min**	60%	
Forming Roll	1960 **m/min**	48%	80%

80% Setpoint would be a 80% of Wire Turning Torque

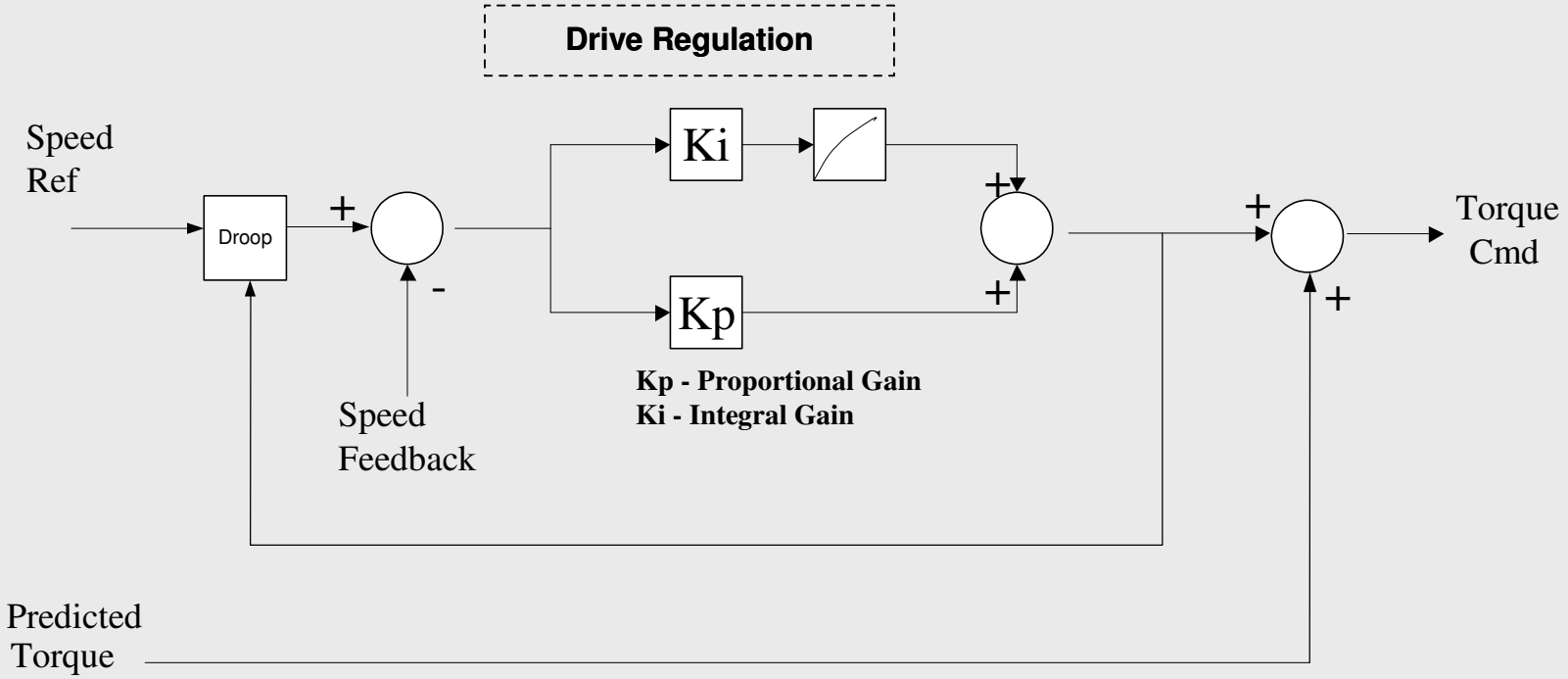


Transfer Section – Biggest Challenge



- The Transfer Section will be the biggest challenge for controlling the ADT machine.
- The Transfer Roll will bridge the Inner Fabric to the Dryer Fabric. Optionally, operator draw adjustment will be available for Forming Section.
- The Transfer Roll will be controlled as a speed regulator but with "droop." Droop will allow the speed of the Transfer Fabric to fluctuate as needed due to the process.

Transfer Section – Speed Regulator Droop Control



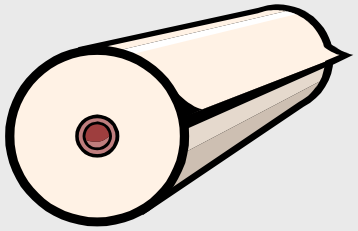
The above droop regulator is excellent for an application where low nip pressure "Soft Nip" exists between felts.

Tissue Machine - Reel

2 methods exist for the Tissue Reel

1. **Standard method – Reel Drum with Spool Starter. The Spool Starter is accelerated to running speed, the sheet is cut and attaches to a new spool.**

2. **Centerwind method – The Jumbo Roll has 2 motors that clutch into the spool to assist the Reel Drum in reeling the sheet.**



ADT – Air Dried Tissue - Summary

- The advanatges of ADT include:
  Reduction of Energy Consumption.
  Reduction of height of production area.
  Increase of Tissue Machine speeds.
  Increase of Tissue Machine width.
- The power requirements of the drive system for an ADT machine will be similar to TAD or Yankee Machine.
- The Dryer Fabric will be the master section.
  The transfer fabric will be speed regulated with droop.