Farrel Twin-Screw Sheeter

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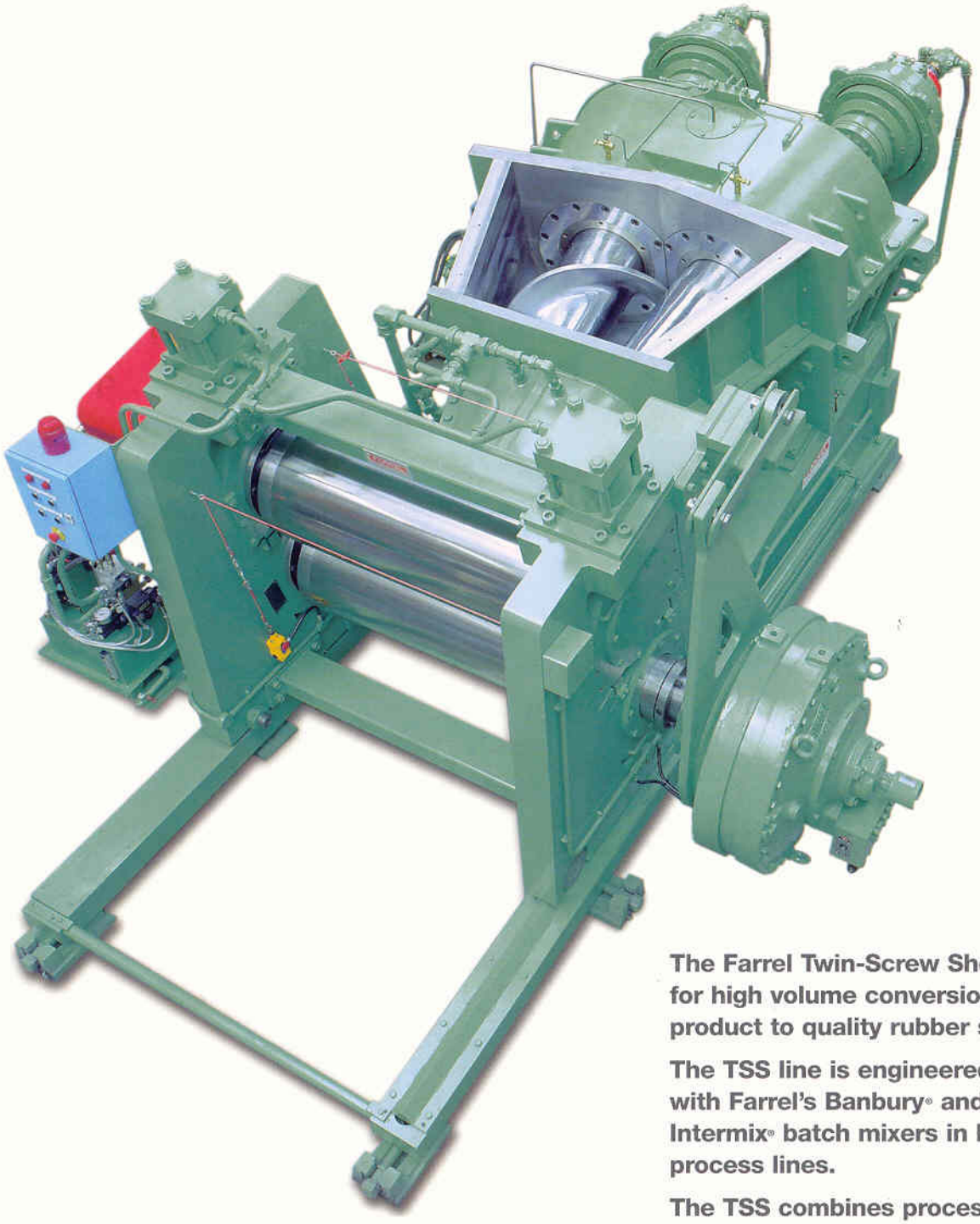


The Farrel Twin-Screw Sheeter is designed for high volume conversion of batch form product to quality rubber sheet.

The TSS line is engineered for integration with Farrel's Banbury® and Farrel Shaw Intermix® batch mixers in both new and existing process lines.

The TSS combines processing, mechanical, and control innovations which overcome the limitations of other types of roller die extruders.

The TSS represents the new standard for batch to sheet conversion.

Farrel Twin-Screw Sheeter

Superior batch to sheet conversion

General Description

The Twin-Screw Sheeter (TSS) integrates a specially engineered twin-screw extruder with a matching two-roll calender. The counter-rotating tapered twin-screws of the extruder ingest the batch discharged from either a Banbury® Mixer or Intermix®, with no need for mechanical pushers. The design of the screws, and the machine's ability to control the temperature of material-contacting surfaces, generally allows feeding of material to the calender with a temperature decrease. The matching two-roll calender uses high heat transfer capacity rolls for additional material cooling.

Feedpath

The entire feedpath from the twin-screw extruder inlet to the calender roll discharge is set at a downward incline to facilitate self-emptying of material.

Drive Options

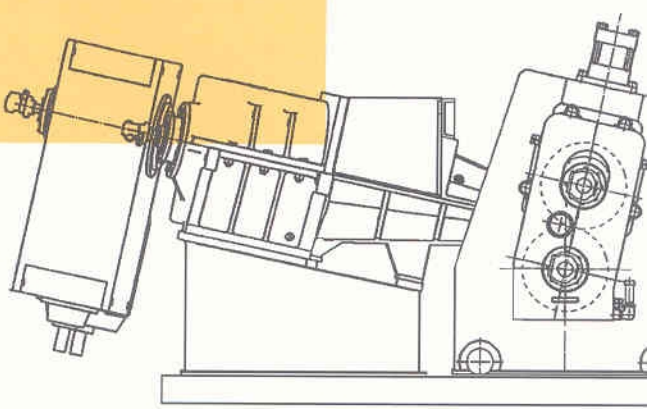
The two main components of the TSS are directly driven by independent variable speed drives mounted on the respective input shafts of the extruder and calender. Electric motors with gear reducer drives, as well as direct coupled high-torque, low-speed hydraulic motor drive options are available.

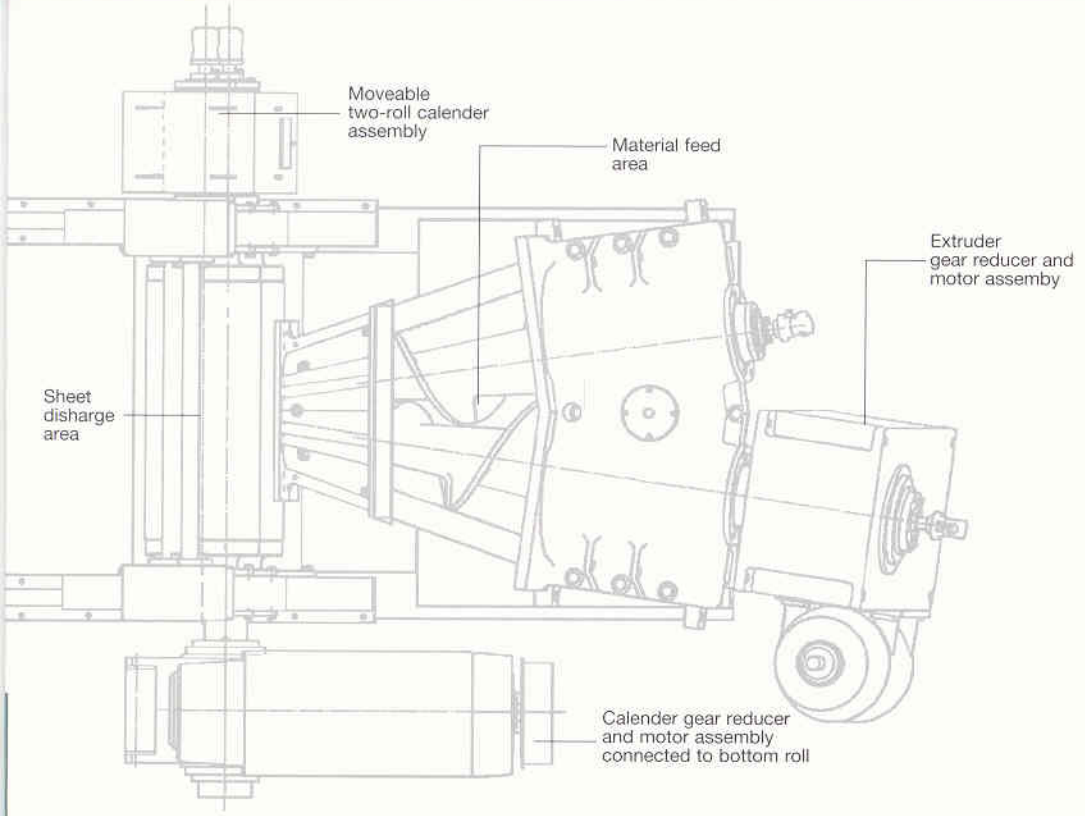
Control Systems

System start-up, initial speed synchronization, and optimum performance are attained rapidly through a responsive Programmable Logic Control (PLC) based control system. The system, by sensing material level in the hopper and material pressure in the extruder/calender interface, synchronizes the extruder screw speed and the calender roll speed to the mixer output. Operating variables are automatically adjusted to provide a continuous, full width sheet.

Primary Advantages

- **Counter-rotating, self-feeding tapered twin screws eliminate the need for mechanical pushers.**
- **Non-contact screws minimize equipment wear.**
- **Water-cooled screws and jacketed housing provide means to control product temperature.**
- **Modular design and movable roller head for ease of maintenance.**
- **Low profile for retrofit under existing mixers.**
- **Integrated controls for the automatic synchronization of batch mixer feed rate, extruder, calender, and cooling line speeds.**
- **Reduced operating expense.**
- **Lower capital cost.**
- **Inclined extruder axis allows for self-cleaning.**





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Design and Engineering Profile

Twin-Screw Extruder
The tapered, intermeshing, and counter-rotating extruder screws are supported by anti-friction bearings in the gear housing. One screw is driven by a directly mounted motor and gear reducer. The second screw is driven from the first screw by connecting gears. With the hydraulic drive option, each screw is directly driven by a hydraulic motor, with connecting gears maintaining synchronization of the screws.

Large Hopper Opening
A large hopper opening allows unrestricted movement of the batch riding on top of the screws. The screw geometry and counter-rotation insures a high rate of batch ingestion, providing a consistent discharge to the two-roll calender.

Process Action
The large open volume of the screw flights, on the large diameter feed end, insures that sufficient rubber is cut from the batch with every revolution to fill the discharge end of the screws. Direct interaction between the screws, and controlled backflow in the screws and hopper section, generates a beneficial stock blending effect.

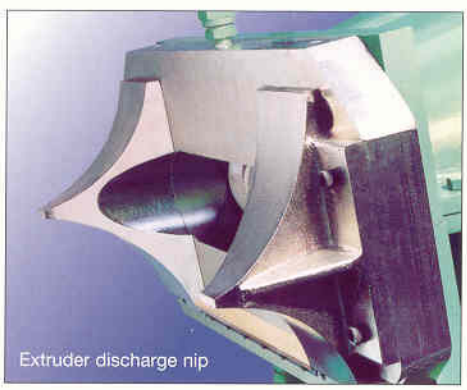
Wear Resistance
Since screw tips do not contact the housing, surface wear is minimized. The screw and housing surfaces which come in contact with processed material are chrome-plated for corrosion and wear protection.

Temperature Control
Screw shafts are drilled and the housing is jacketed for temperature control.

Two-Roll Calender
The calender's fixed-position bottom roll is directly driven by a roll mounted gear reducer and motor assembly, or by a hydraulic motor. The moveable top roll is driven from the bottom roll by connecting gears.

The rolls are steel, shell-type construction for heat transfer and are hardened for wear resistance.

Adjustable Roll Gap
The roll gap is adjustable for gauge control. The standard design allows gap changes with the machine stopped. An option for in-production gauge changes, by either mechanical screw-down devices or hydraulic cylinders, is available.



Seamless Mixer Interface

The Farrel TSS system can be linked without intermediary systems to Farrel's two mixer technologies, the Banbury® Mixer and the Farrel Shaw Intermix®.

The Banbury Mixer
The key process elements of the Banbury Mixer are tangential ST™ Rotors featuring a unique helical four-wing geometry, a closed loop water tempering system for cooling of chamber and rotors, including the rotor tips, and variable speed drives.

Synchronous rotation exposes the entire batch to superior distributive and dispersive mixing. The angular alignment of the rotors can also be adjusted fo specific mixing requirements.

Farrel Shaw Intermix
The Intermix, featuring intermeshing NR Rotors, has demonstrated top performance in rubber and plastics compounding worldwide.

The NR5 rotor's newest interlocking nog geometry assures even distribution and dispersion of ingredients in materials through shear and elongation. The mixer is designed for exact process repeatability for product quality and uniformity.

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Standard Specifications

TSS Model	TSS 3	TSS 7	TSS 9	TSS 12	TSS 28
Extruder Motor Size	60 Hp	125 Hp	150 Hp	200 Hp	400 Hp
Calender Motor Size	60 Hp	125Hp	150 Hp	200 Hp	400 Hp
Roll Diameter x Length:					
mm	460 x 700	500 x 900	500 x 1150	500 x 1150	600 x 1600
in.	18.1 x 27.6	19.7 x 35.4	19.7 x 45.3	19.7 x 45.3	23.6 x 63.0
Maximum sheet width					
mm	600	750	915	915	1400
in.	23.6	29.5	36.0	36.0	55.1
Nominal production rate:					
Kg/hr	3,000	7,000	9,000	12,000	27,500
Lbs./hr	6,600	15,400	19,800	26,400	60,000
Matching Banbury Mixer Model	F80	F200	F270	F370	F620

Approximate Dimensions

Width	mm	3500	4400	3400	3400	3750
	in.	138	173	134	134	148
Length	mm	4400	6100	4900	5200	6200
	in.	173	240	193	205	244
Height	mm	2100	2900	2100	2300	2700
	in.	83	114	83	90	106
Weight	Kg	18,000	22,000	26,000	29,000	52,000
	Lbs.	40,000	48,000	57,000	64,000	114,000

All data are nominal and may vary to suit specific applications.
Specifications are subject to change without notice.

TSS Control Systems

The Twin-Screw Sheeter's control system is based upon a Programmable Logic Controller (PLC) with a touchscreen for operator interface. The control system is housed in two panels: a Local Panel and an Operator Panel.

The Local Panel, mounted directly on the calender frame, is used for adjusting the roll gap. The Operator Panel, located near the TSS, contains the touchscreen for operator access to the TSS control menu, run parameters, and alarm status.

Sensor Arrays for Process Control

Level sensors in the feed hopper adjust the roll speed to balance the material discharge rate with the material input rate from the batch mixer.

A load cell at the discharge end of the extruder measuring the stock pressure in the closed guide section is used to regulate the screw speed. This provides consistent, controlled material flow to the roll nip area.

A dancer roll generating a potentiometer position feedback signal is mounted on the discharge side of the calender. This allows synchronization of the cooling line with the sheet output speed.

Farrel: Leadership in Process Technology, Systems, and Service

Advanced Processing Equipment

The F-Series Banbury Mixer and **Mark 5 Series Intermix** provide superior high-volume batch mixing.
- **Banbury:** tangential four-wing **ST™ Rotors; variable ram pressure** and **ram position indicator** for batch and mixing pattern tracking; **Eco-Gland™** lubeless duststops for the elimination of contaminants
- **Intermix:** intermeshing **NR Rotors;** mix and shear through elongation ideal for technical goods
- **Perfect mixer integration with the TSS**
- Wide range of customizable **Mills, Calenders, and extrusion systems.**

Computer-Assisted Remote Diagnostics (CARD™) System

The CARD System enables the **on- and off-site remote control, diagnosis, and monitoring of equipment and process performance** ■ A modem connection between the equipments' Programmable Logic Controller and a remote computer terminal permits **transmission of data in real time for immediate feedback and response.**

Customer Service Division

Worldwide customer support ■ Genuine parts, 24-hour field service, equipment remanufacture, refurbishing and upgrades.

Process Engineering and Process Consulting

- **Turnkey facilities analysis, planning and design**
- Fully equipped **Process Labs** support customer-driven experimental runs, process formulation and testing.

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