SCOTT EQUIPMENT COMPANY

Achieving a Successful Mix

Scott Equipment Company is the Nation's Leading Industrial Equipment Manufacturer

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What Is Successful Mixing?

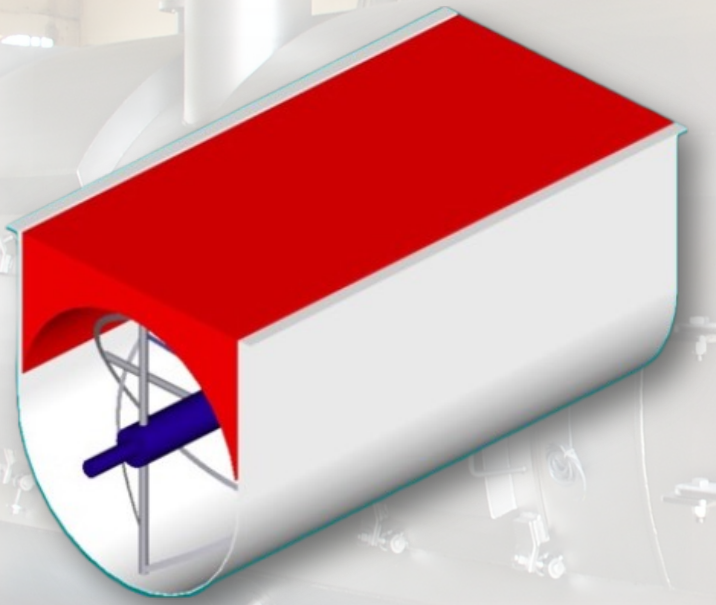
- Choosing the right Mixer (Surge) for your needs
- Following a mix cycle that falls within the capabilities of the machine
- Placing the ingredients in the right spot
- Testing to ensure accuracy
- Maintaining the mixer through a simple yet disciplined procedure/schedule

Successful Mixing

Choosing the right mixer (Surge) for your specific requirements

- How big of a batch do you want to achieve?
- How small of a batch do you want to achieve?
- How many batches do you want per hour?

Mixer Sizing



Sizing is determined by the volumetric displacement of the agitator

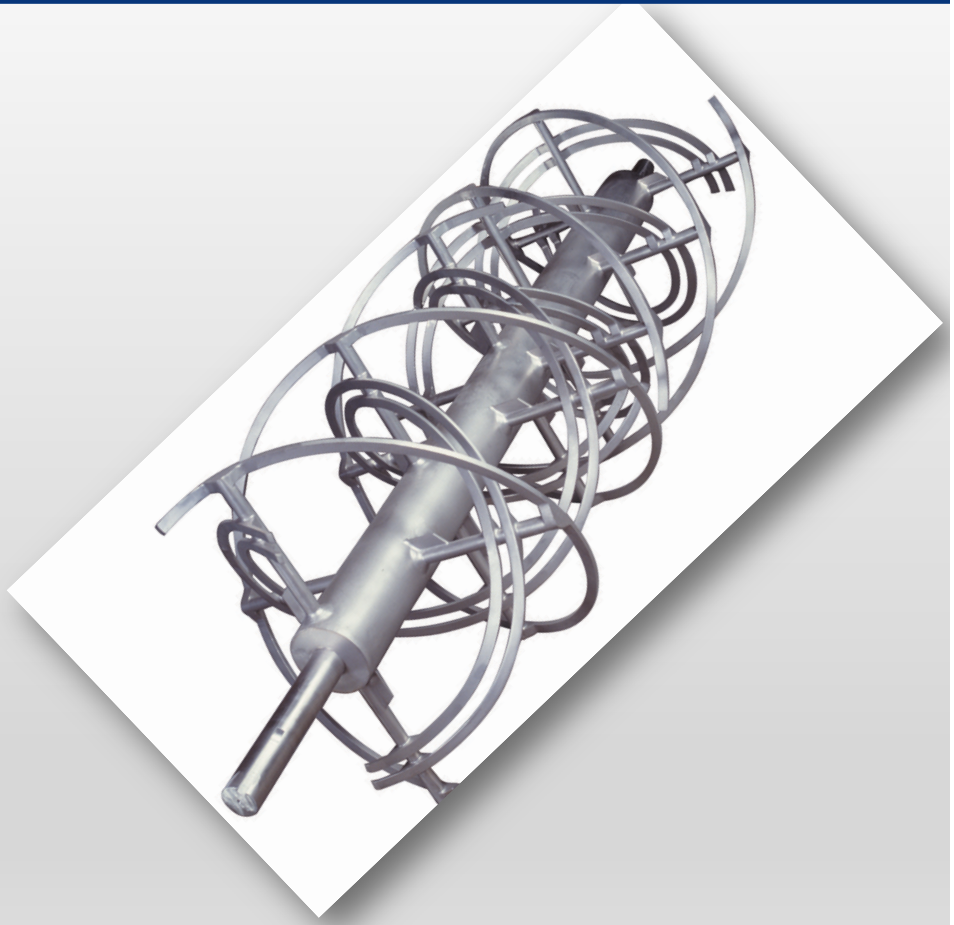
The formula is $\pi \times r^2 \times L \div 1728 = \text{cu.ft.}$

The “working capacity” is then determined by using a percentage of the total displacement

Double Ribbon Agitator Design

BENEFITS

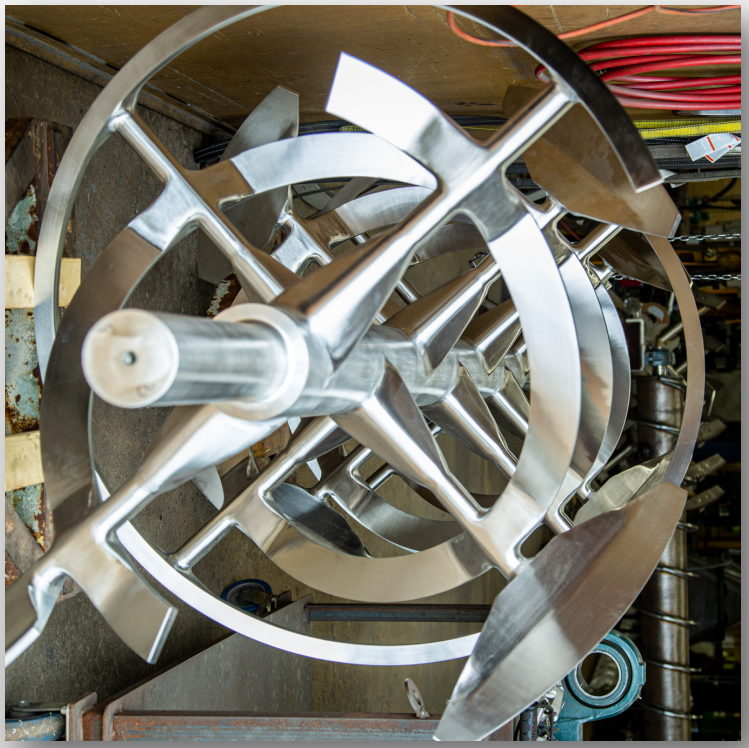
- Standard and highly efficient designs are considered
- Design offers discharge locations at center, end, through the endplate of the mixer or full drop bottom without *sacrificing* quality
- Blends up to 5-7% of liquids to dry material



CONSIDERATIONS

- Ribbon agitators produce some degree of shear which may damage fragile products

Paddle/Ribbon Agitator Design



- Outside paddles lift and fold product, cross mixing a homogeneous blend.
- Inside flighting provides circulation

BENEFITS

- Gentle on friable products
- Provides cross mixing of material
- Compromise of paddle and ribbon features

CONSIDERATIONS

- When used in a single agitator approach, is typically less efficient than a double ribbon

Paddle/Ribbon Agitator Design

- Outside paddles lift and fold product, cross mixing a homogeneous blend.
- Inside Paddles Convey Product

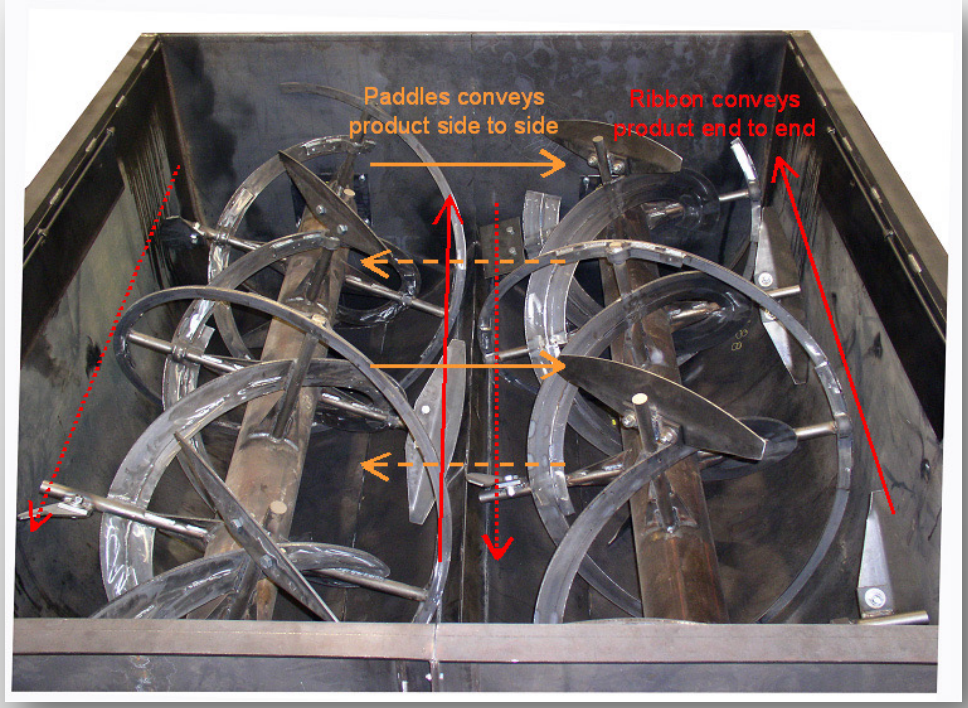
BENEFITS

- Gentle on friable products
- Better at mixing ultra fine products
- Great for liquid additions

CONSIDERATIONS

- Least efficient mixer design.

Twin Shaft Agitator Design



- Outside paddle/ribbon combination conveys while cross mixing
- Inside ribbon flighting conveys the opposite direction of the paddle/ribbon. In effect circulating ingredients as it cross mixes.

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Twin Shaft Agitator Design

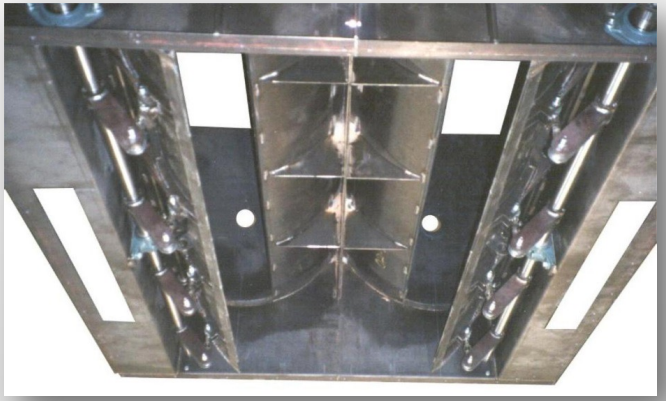
BENEFITS

- Shorter mix times
- Highest efficiency agitator design
- Low Coefficient of Variables
- Greatest batch size range from 15-85% fill levels

CONSIDERATIONS

- Additional agitator, drive and gate could add to maintenance

Full Drop Gate Discharge Design



BENEFITS

- Bottom 1/3 of the mixer tub opens for discharge.
- Complete clean-out
- Fast evacuation of product (3-5 seconds) speeds batch times

CONSIDERATIONS

- Fine powders may leak pass seals
- Not a metering gate

Determining Horsepower

A general rule of thumb: 10 HP per ton of complete feed (fat addition included)

- When adding molasses up to 5%, 20 HP per ton
- Mineral or product heavier than complete feed is between 10 – 20 HP per ton, depending on agitator design
- Product reaction to agitation may require more horsepower as mixing progresses

Successful Mixing

The Mix Cycle

Sequencing

- Adding dry ingredients: Majors, Minors, Micros, Hand Adds
- “Dry” mix time
- Liquid Inclusion
- “Wet” mix time
- Discharge

Factors which affect the mix cycle required:

- Ingredient Sequence
- Location of micro ingredient inclusion

Mix Cycle Times

MIX CYCLE TIMES

(SECONDS)

MAJOR INGREDIENTS	15	15	15	15	15
MINOR INGREDIENTS	20	20	20	20	20
MICRO INGREDIENTS	15	15	15	15	15
DRY MIXING	60	60	45	45	30
LIQUID ADDITION	120	60	45	45	30
WET MIX	60	60	60	30	30
***DISCHARGE**	10	10	10	10	10
TOTAL SECONDS	300	240	210	180	150
TOTAL MINUTES	5	4	3.5	3	2.5

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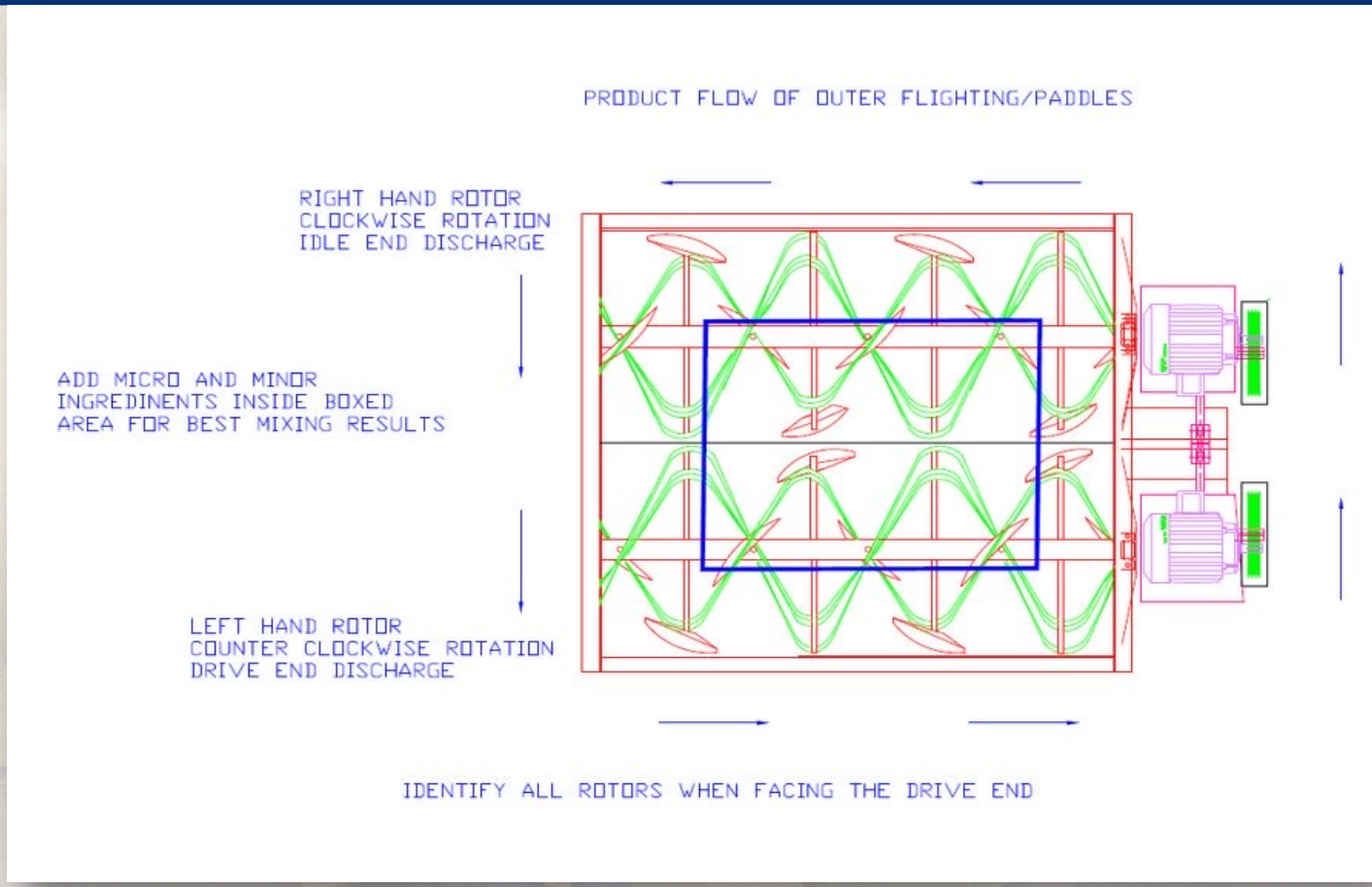
Successful Mixing

Placing Ingredients into the Right Spot

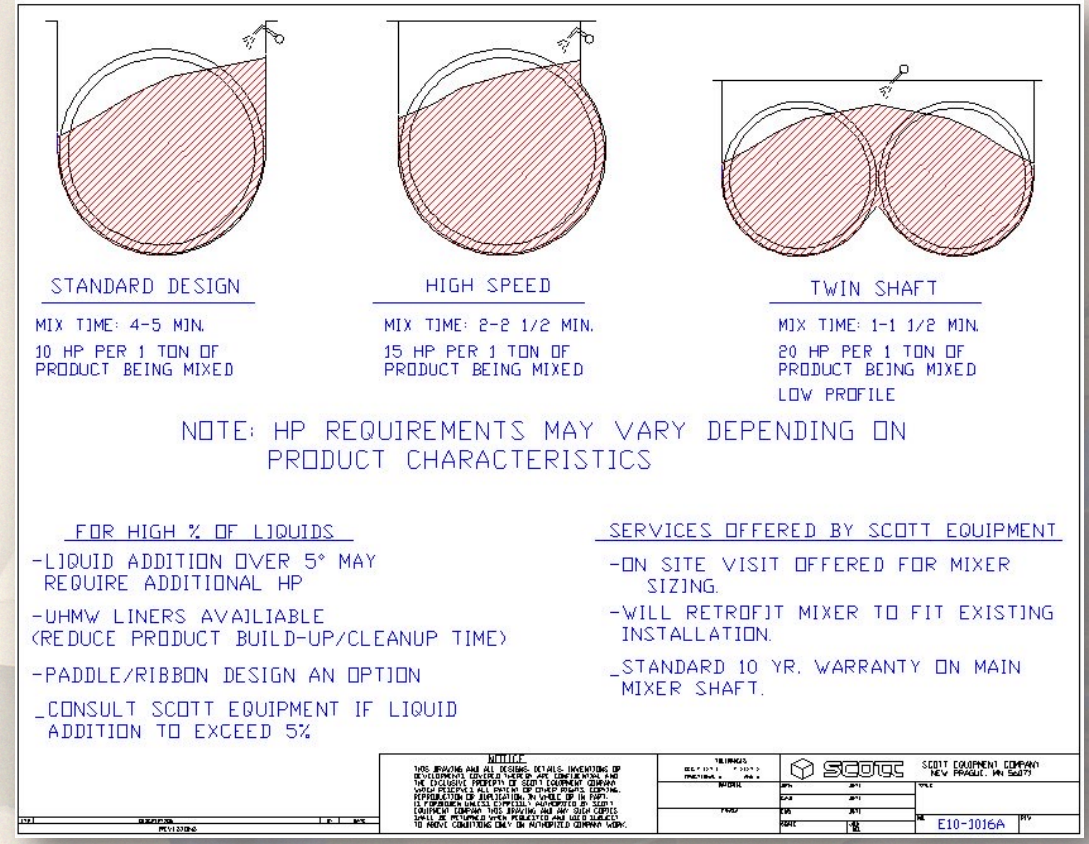
- Micro/Minor Ingredients in the middle 1/3



Successful Mixing

Placing Ingredients into the Right Spot

- Liquid Placement on the “high” side of feed.
- Avoid liquid hitting metal at all costs



Successful Mixing

Testing to Ensure Accuracy (CV Tests)

Test Procedure

- Test in the Mixer
- Test in the Surge
- Test at the leg transition (determine time required to empty the surge and divide by 12)

Tracer (Zinc, Manganese)

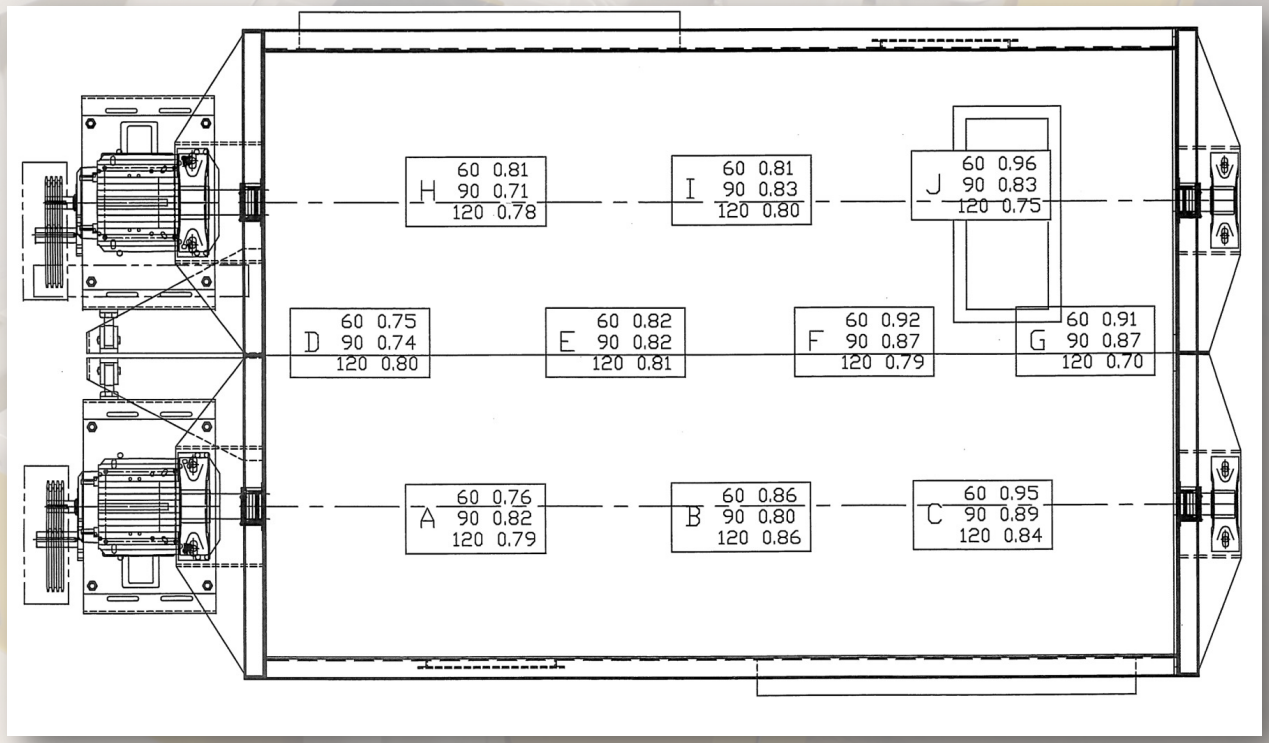
Maintain Consistency

- Obtain test samples as close to the mixer as possible
- If static, dig down into the material to obtain a proper sample
- Label all sample bags to match the location if taken from the surge or mixer and sequence if taken from the leg transition
- Choose a reputable lab

Twin Shaft Sample Locations

Sample locations A-H
time/trace concentration

Results:
@60 sec. CV 8.95
@90 sec. CV 6.93
@120 sec. CV 5.61



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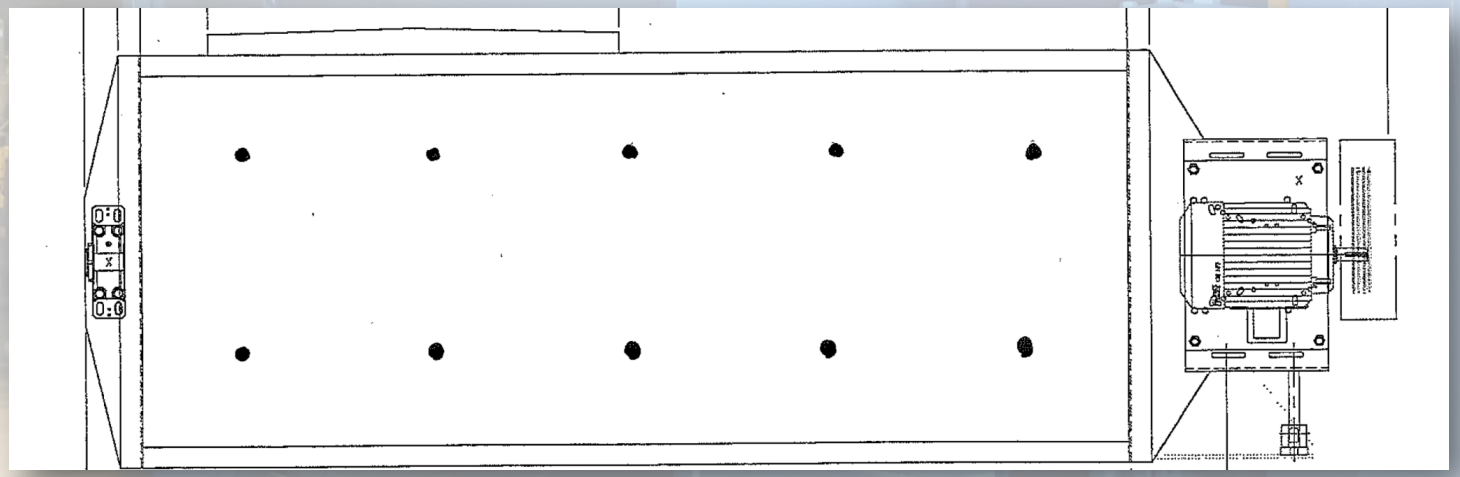
Single Shaft Sample Locations



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Mixer Distribution Fails

The mixer may be overfilled

- Density of ration may have changed
- Putting more feed in the mixer to meet production goals

Mix Sequence

- Not enough dry mix time
- Determine the length to width ratio

Product addition location

Test Procedure

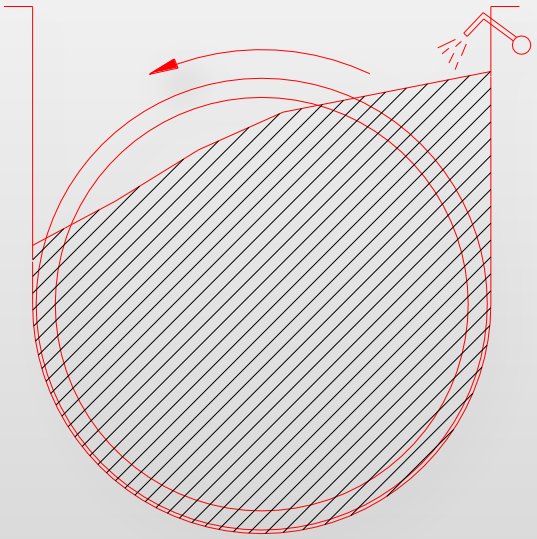
- Consider how and where the test samples are being taken

Agitator wear and/or missing pieces

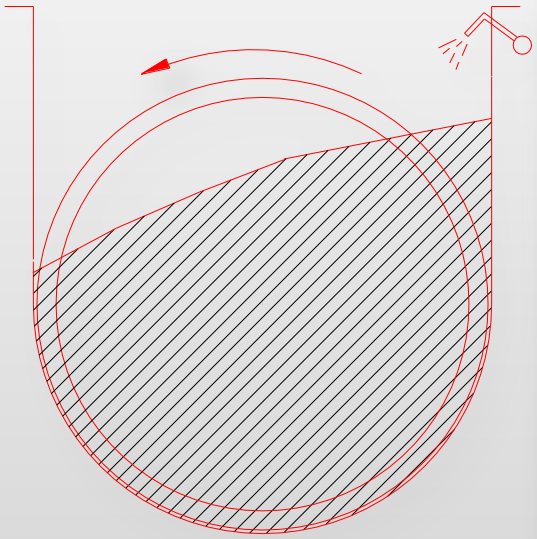
Product build-up on the agitator

Contact Scott Equipment Company

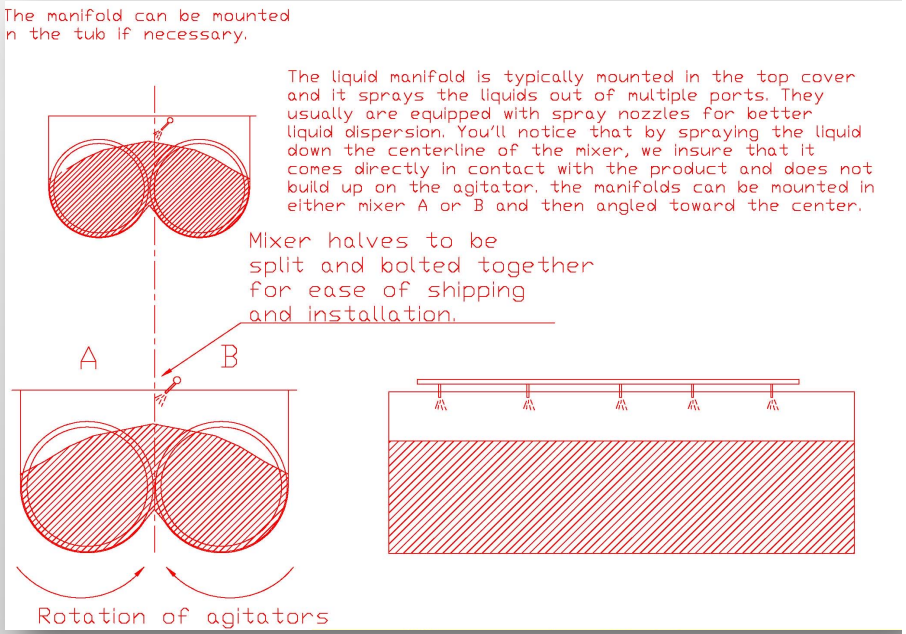
Mixer Level Examples



STANDARD MIX LEVEL



REDUCED MIX LEVEL



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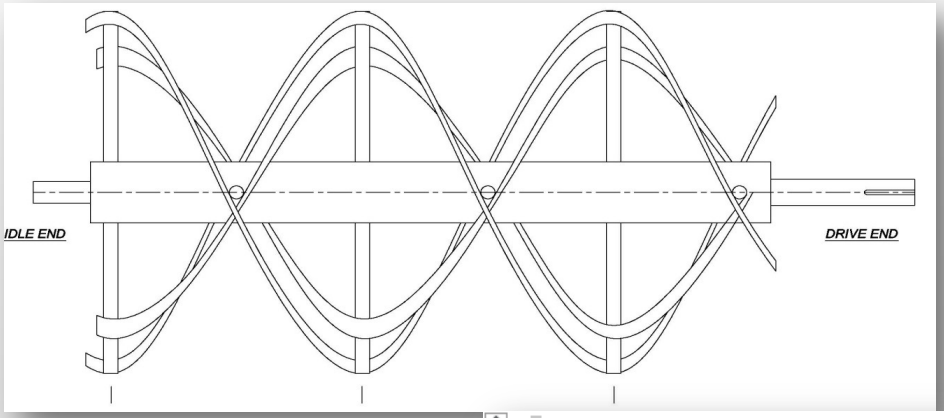
Measuring Wear



T/P Clearance _____	T/P Clearance _____	T/P Clearance _____
T/P Clearance _____	T/P Clearance _____	T/P Clearance _____
Ribbon H _____W_____	Ribbon H _____W_____	Ribbon H _____W_____
Ribbon H _____W_____	Ribbon H _____W_____	Ribbon H _____W_____
Ribbon H _____W_____	Ribbon H _____W_____	Ribbon H _____W_____
Tub _____	Tub _____	Tub _____
Tub _____	Tub _____	Tub _____
Pin_____	Pin_____	Pin _____

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Inspection Checklist

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Mixer Evaluation/ Location: _____

Discharge Gate Type _____ Comments_____

_____

Bearings: Good condition **Y** / **N** Grease: **Y** / **N** Comments _____

_____

Seals: Leaking **Y** /**N** Comments _____

_____

Gearbox: Leaking **Y** / **N** Type _____ Comments _____

_____

Air Exchange Mixer to Surge **Y** /**N** Type _____

Comments: _____

_____

Air Exchange Mixer to Scale **Y** /**N** Type _____

Comments: _____

Flighting Intact: **Y** / **N** Comments _____

_____

Pins Okay: **Y** / **N** Comments: _____

_____

Liquid Manifolds **Y** / **N** Comments _____

_____

Mixer Cover: **Y** / **N** Comments _____

Surge Hopper **Y** / **N** Bent Paddles Y / N Number _____

Comments _____

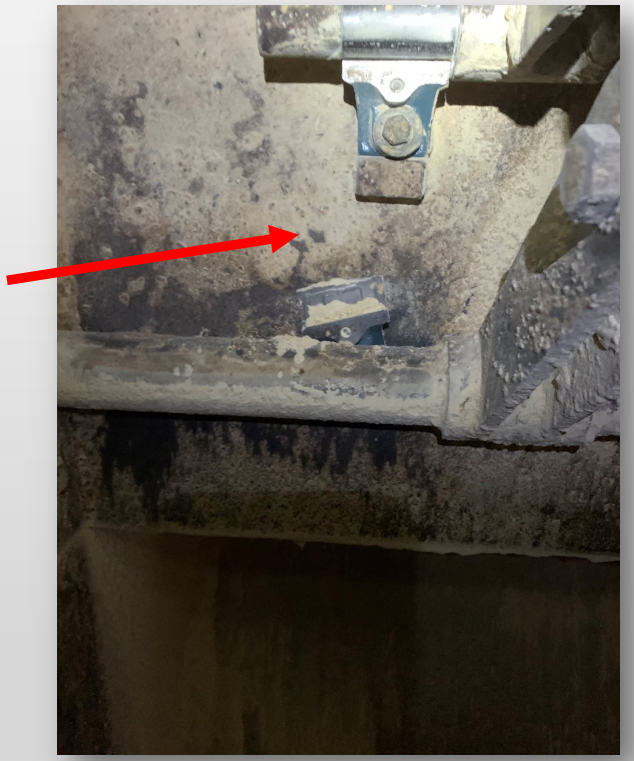
Air Clevis _____

Mixer Cleanliness

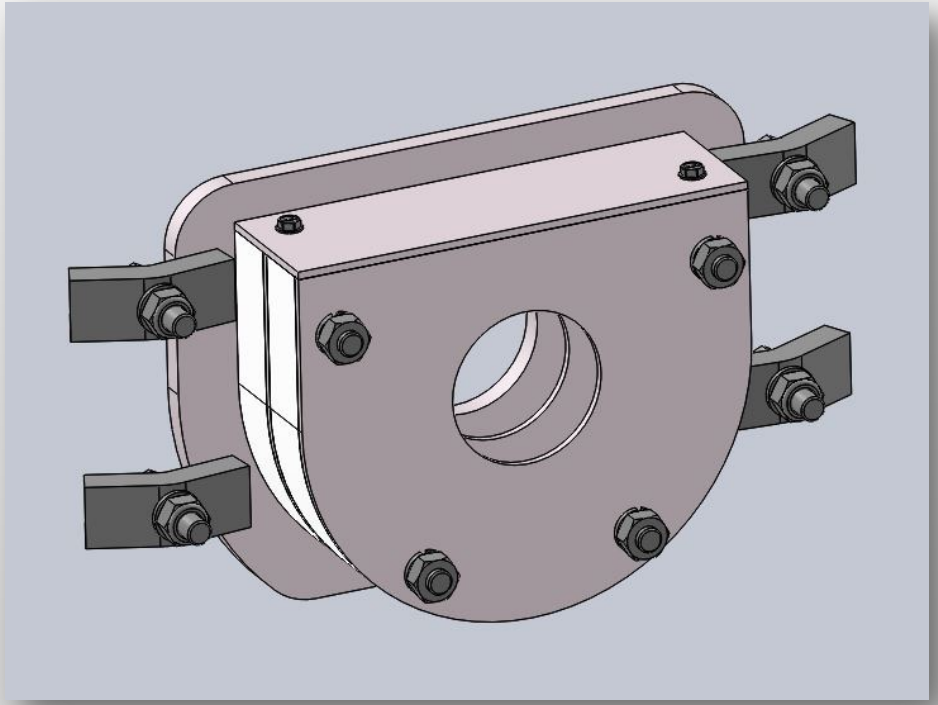
Leaking Manifolds

Ovaling Pin

Broken Components



Shaft Seals



Optimize my Existing Mixer

Establish a benchmark – Where are you now?

- What is your current mix cycle?
- What is your current mixer throughput?
- What is your current CV?
- What is the current amperage draw of the mixer with a full batch?
- What is the maximum capacity that your elevator leg/take-away conveyor can handle?

Goals

- What capacity do you require?

Increased Throughput

Increase production with an existing mixer while maintaining quality?

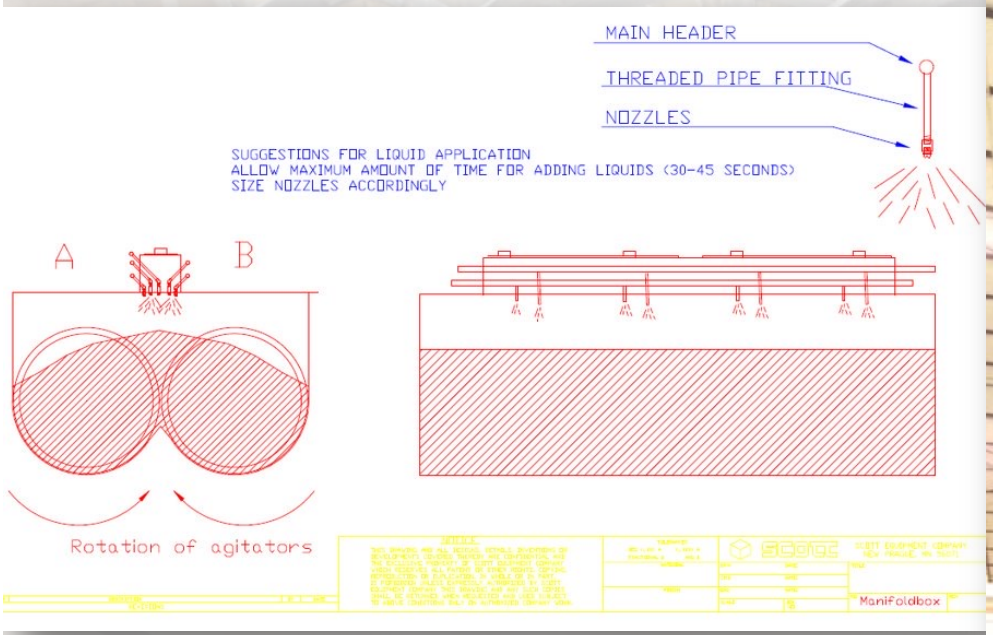
- Increase rotor speed (full amp load allowing)
- Add flighting, (dependent on agitator main shaft design and amp load)
- Each approach will allow a decrease in cycle time raising the batches per hour allowable.
- Weigh-up and take-away will need to also be considered.

Mix Time/Production Rates

BATCH SIZE (ton)	CYCLE TIME (minutes)	CYCLES/HOUR	TONS/HOUR	TON/DAY (24 hr. day)	TONS/WEEK (5 days)	TONS/YEAR
4.5	2.5	24	108	2,592	12,960	673,920
4.5	2.75	21.8	98.1	2,354	11,770	612,040
4.5	3	20	90	2,160	10,800	561,600
4.5	3.25	18.46	83	1,992	9,960	517,920
4.5	3.5	17.14	77	1,848	9,240	480,480
5	2.5	24	120	2,880	14,400	748,800
5	2.75	21.8	109	2,616	13,080	680,160
5	3	20	100	2,400	12,000	624,000
5	3.25	18.46	92.3	2,215	11,075	575,900
5	3.5	17.14	85.7	2,057	10,285	534,820
5.5	2.5	24	132	3,168	15,840	823,680
5.5	2.75	21.8	119.9	2,878	14,390	748,280
5.5	3	20	110	2,640	13,200	686,400
5.5	3.25	18.46	101.5	2,436	12,180	633,360
5.5	3.5	17.14	94.3	2,263	11,315	588,380
6	2.5	24	144	3,456	17,280	898,560
6	2.75	21.8	130.8	3,139	15,695	816,140
6	3	20	120	2,880	14,400	748,800
6	3.25	18.46	110.7	2,657	13,285	690,820
6	3.5	17.14	102.8	2,467	12,335	641,420

Whats New in Mixing

Manifold Box



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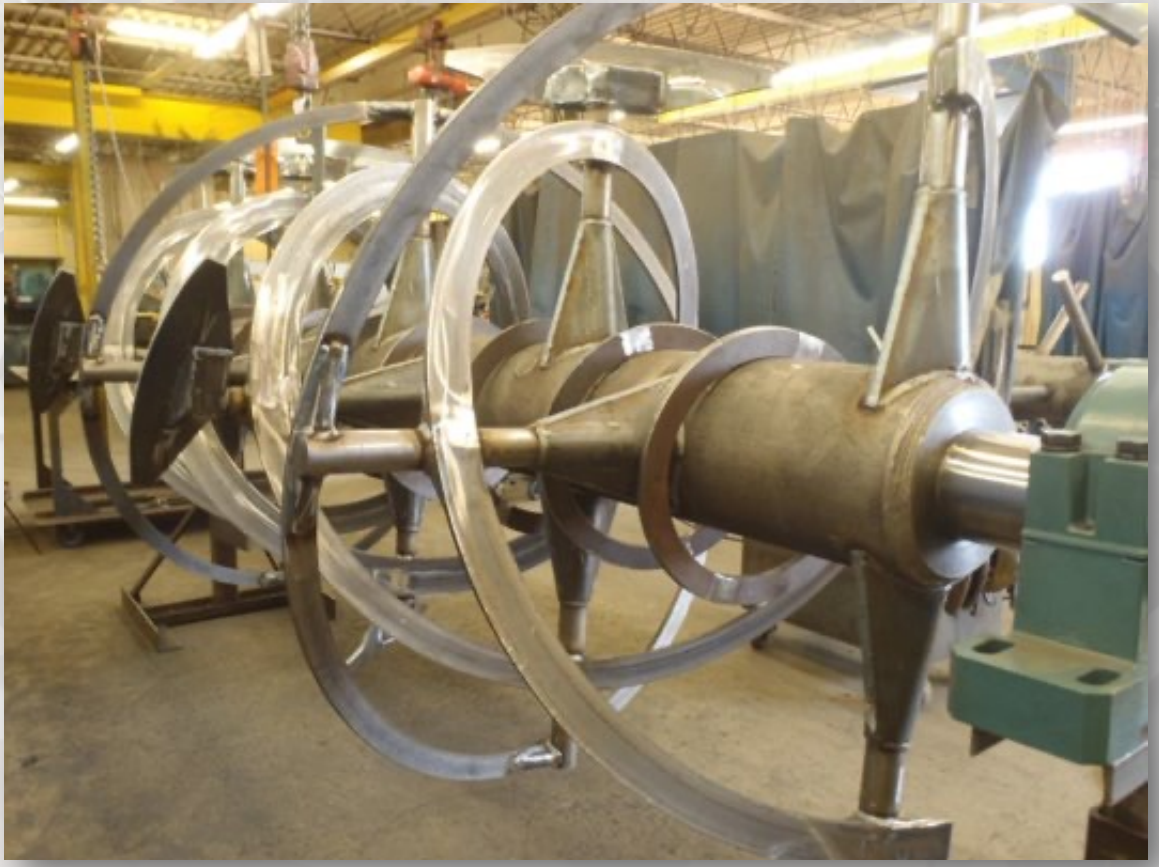
Whats New in Mixing

EZ Clean Agitator



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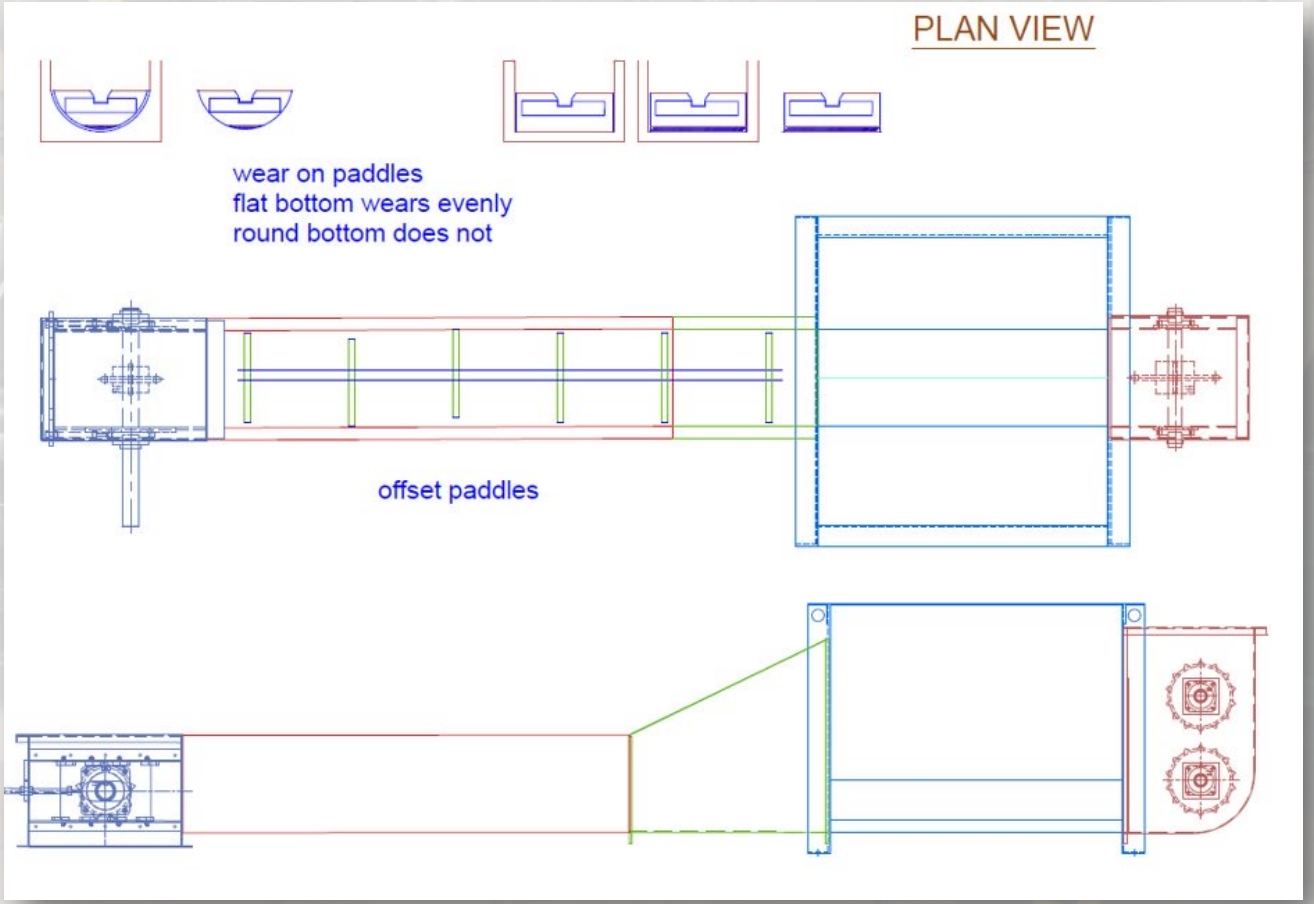
Whats New in Mixing

Offset Drag Paddles



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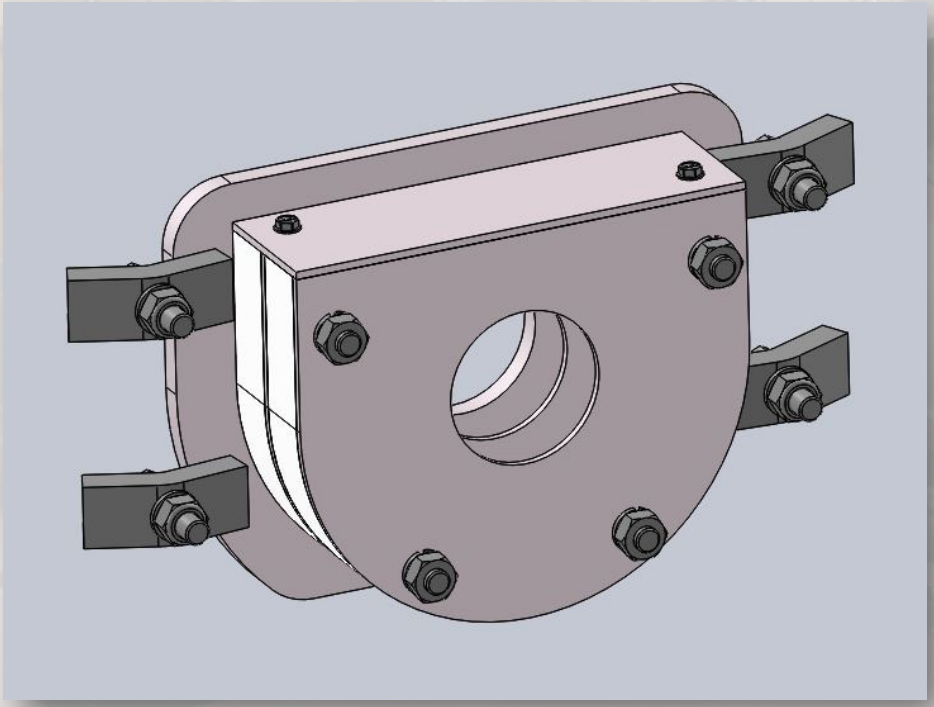
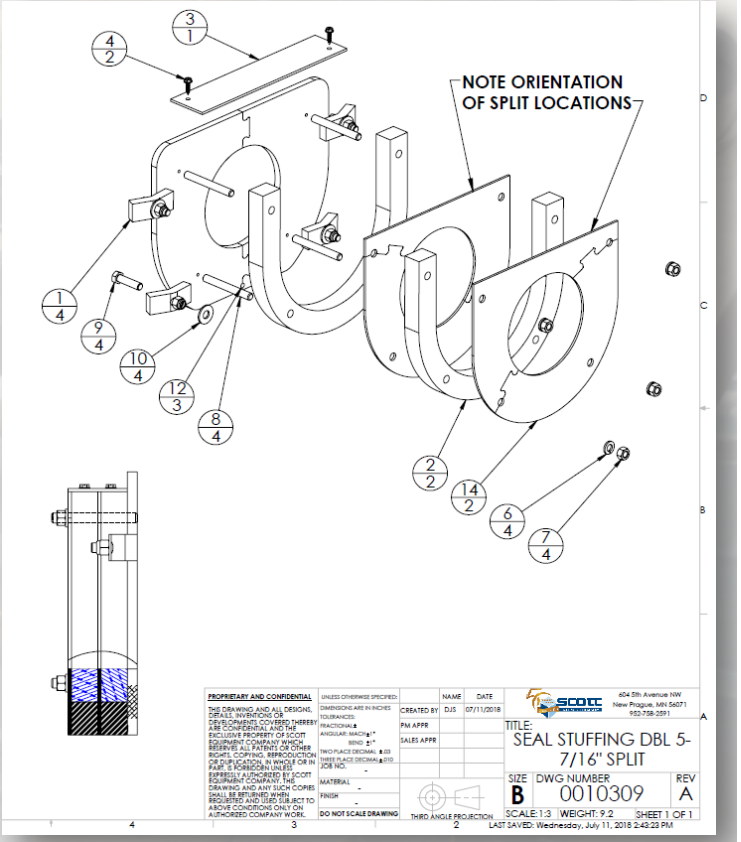
Whats New in Mixing



Dual Chamber Stuffing Box Seals



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Whats New in Mixing

Access Doors

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Custom

Each mill will have slightly different procedures and requirements. A change or modification that works for one installation may not work for the next. Utilize manufacturers that can customize to your requirements.

Conclusion

Successful Mixing Is….

- Choosing the right Mixer (Surge) for your needs
- Following a mix cycle that falls within the capabilities of the machine
- Placing the ingredients in the right spot
- Testing to ensure accuracy
- Maintaining the mixer through a simple yet disciplined procedure/schedule

Thank You!

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