Advanced Crushing For Today’s Tough Specs

Producing High Quality Products Using Cone crushers
MAXIMIZING
CONE CRUSHER
PERFORMANCE
Before we get started on cones
Basic Terminology

- CSS
- Stroke
- Speed
- Bowl Float / Ring Bounce
- Tramp
- Choke Feed
- Reduction Ratio
- Raw feed
- Standard vs. Shorthead
- P80
- Flats and elongated
- Autogenous
- Open / Closed Circuit
- Segregation
Understanding Crusher Limits

Power Limited:

- Every machine is designed for a maximum power draw
- Typically Power draw will increase as:
  - Feed rate increases
  - Finer material is required
- Exceeded when crusher draws more power than rated for, stalling, bowl float, over amping may occur
Understanding Crusher Limits

Volume Limited:

- A combination of chamber volume, crusher speed and stroke determine this.
- This determines maximum throughput.
- Choke fed condition typically ensures operation at volumetric limit.
- Exceeded when feed material overflows.
- Overflow chutes are preferred.
Understanding Crusher Limits

Force Limited:

- Every machine is designed for a maximum crushing force
- Force increases as:
  - Feed rate increases
  - Finer material / tighter CSS
  - Higher reduction ratio
- Exceeded when adjustment ring bounces
RUN CRUSHERS UP TO, BUT NOT EXCEEDING LIMITS
Understand the application

- What do you want the machine to accomplish?
- Begin at the end......How do we know how to get there, if we don’t know where we are going?
- AGGFLOW is a guide
- Choose the correct manganese set up for success
- Involve factory support
- Finishing screening capacity
Crush in Stages

- Makes best quality product
- Evens out reduction ratio in each stage
- Better product shape
- Balance loads between stages
Understand Reduction Ratio

- Jaw .................................................. 6 to 1
- Cone (SH) ........................................... 6 to 1
- Cone (FH) .......................................... 4 to 1
- V.S.I. (Gravels & Basalts) ....... 6-8 to 1
- V.S.I. (Limestones) ................. 8-10 to 1
- Hammermill ................................. 20 to 1
- Limemill .................................... 30 to 1
- H.S.I. ........................................... 10 to 1
Feed From Surge Piles/Bins

- Steady and consistent feed rate
- Easiest way to achieve a consistent choke fed condition
- Inconsistent or surges in feed rates can lead to inefficient crushing
- Best way to ensure consistent product gradation
Choke Fed Advantages

- Fewer peaks and valleys will improve:
  - Production rate (increase by 5%)
  - Product shape
- Consistent power draw
- Rock on rock crushing/grinding
- Consistent product gradation
- Limits dust being generated
Adjustment Ring Movement / Bounce

- What to do if ring is bouncing
  - Open crusher setting
  - Decrease feed rate

- Reasons for ring bounce:
  - Tramp events
  - Poor feed distribution
  - Feed segregation
  - Too many fines in feed
  - High moisture content
  - Wrong liners
  - Crusher setting too tight
  - Reduction ratio too high
Adjustment Ring Movement / Bounce

- What will ring bounce do:
  - Cause undue strain on entire crusher
  - Wastes power
  - Can lead to expensive repairs:
    - Mainframe
      - Pin wear
      - Tapered seating surface wear
      - Seat liner wear
    - Tramp release cylinder damage
    - Can also cause cracks in mainframe, head and/or bowl
Maintain Proper Cavity Levels

- Consistent product quantity
- Balanced circuit
- Proper cavity level:
  - Up to feed plate in secondary applications
  - Above feed plate in tertiary applications
  - Varying levels result in inconsistent:
    - Product shape
    - Product quantities
  - Most important for tertiary crushers
Feed Distribution

- Fall vertically onto center of crushing cavity
- Poor distribution = Unbalanced loads in cavity
- Velocity of feed into light side of cavity
  - Decrease in voids in cavity
  - Packing
  - Pancaking
  - Erratic power draw
  - Adjustment ring movement
Feed Segregation

- Raw feed and recirculated material should enter the crusher together and mixed as much as possible.
- Having a coarse side and fine side will create unbalanced loads in cavity.
- Decrease in voids in cavity:
  - Packing
  - Pancaking
  - Erratic power draw
  - Adjustment ring movement
Feed Material Height

- Vertically feed to center of crusher
  - Proper distribution of feed
  - Minimizes risk of segregation
- 3’ max feed fall distance
- Too much drop height causes:
  - Power overload conditions
  - Force overload conditions
  - Poor productivity
  - Premature wear and tear
Operating at Consistent Setting

- Ensures a balanced circuit
- Consistent product quality and quantity
- Check and adjust setting frequently
- Several small adjustments throughout shift
- Avoid one large adjustment at end of shift
- Automation can help
Operating at Correct Speed

- Countershaft speed = Number of blows
- If reduced below recommended RPM:
  - Performance adversely affected
  - Can cause stalling
- If increased:
  - Balance affected
  - Cooling of lube oil adversely affected
Correct Liners for application

- Range from extra-fine to extra-coarse
- Different max feed sizes per configuration
- Liner selection based on feed, not product size
- Ideally you would like to crush material throughout the entire length of the chamber
Feed Size Considerations

- Feed shape:
  - Round feed
  - Gravel, pebbles
  - Tendency to “boil” (harder to nip)
  - Select liner with aggressive nip angle
  - Slabby feed fits more easily into cavity

- Crusher Speed
  - Fast speeds make it difficult to enter cavity
  - Slow speeds = drop further into cavity
Timely Liner Changes

- Risks of pushing too long:
  - Poor production rates
    - Feed opening decreases late in life
    - Cupped at bottom late in life
  - Mechanical problems
- Expected Cone Liner Utilization: 50% to 60%
- Thin liners flex; Seating surface damage
Liner Life Tips

- Break-In procedure
- After new liner installation:
  - 50% power, 65% amps, Full cavity for 6 hours
  - 75% power, 80% amps, full cavity for 2 hours
  - 100% power, 100% amps from this point on
- Increases liner life as much as 30%
Automation

Most systems should monitor:

▪ Tank – return / supply / countershaft temps
▪ Lube / clamp / tramp pressure
▪ Lube filter condition
▪ Crushing force
▪ Crusher cavity level
▪ Main motor current or power draw
▪ Crusher setting
▪ Lube oil tank level
▪ Hydraulic tank level

Think of it as an insurance policy for your machine!
Tramp Iron Events

- Many suppliers require the use of magnets or detectors in order for the warranty to be activated.
- Can damage backing material, liners become loose.
- Costly damage to bearings, bushings and main frame components.
Preventative Maintenance

- Fully read and understand the operations and maintenance manuals for the machine
- Establish daily, weekly, monthly and yearly schedules for inspection/maintenance
- Keep a daily log book that tracks production rates, hours of operation, any maintenance performed
- Note anything unusual like, adjustment ring movement, crusher cavity level, noise levels, high vibration levels and high/low power draw
Utilize the factory resources

- Experienced, knowledgeable employees
- Fully trained on your equipment
- Immediate access to drawings, specs and other information
- Most provide 24/7/365 support
Don’t forget about your screens

- Inefficient screening can adversely affect your crushing capacity
- Screen width = tonnage
- Screen length = efficiency
- Crushers are the workhorses but screens are the cash register
- Oversizing screens allows for increases in production
Cone Summary

- Understand the crushers design limits
- Know and verify the application info
- Crush in stages for best results
- Understand reduction ratios
- Feed the machine from bins or feeders
- Choke feed whenever possible
- Avoid adjustment ring movement
- Maintain proper cavity levels
- Distribute feed evenly in the center
- Avoid segregated feed
- Maintain a consistent setting
- Maintain a consistent speed
- Choose the correct liner set up
- Change liners on time
- Use automation when possible
- Avoid tramp iron at all costs
- Set up a good PM schedule
- Utilize your factory resources
Questions?