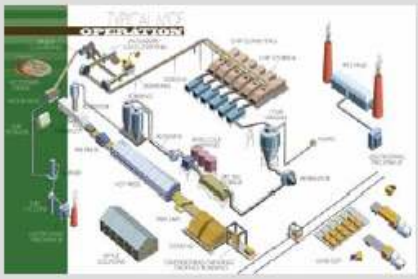


Wood Hog Motor Application

In the

Paper and Forest Products Industry

Andres Torres

Tony Carosella

Mike Kozlowski
Paper and Forest Products Industry Engineer
864-281-2191

Background

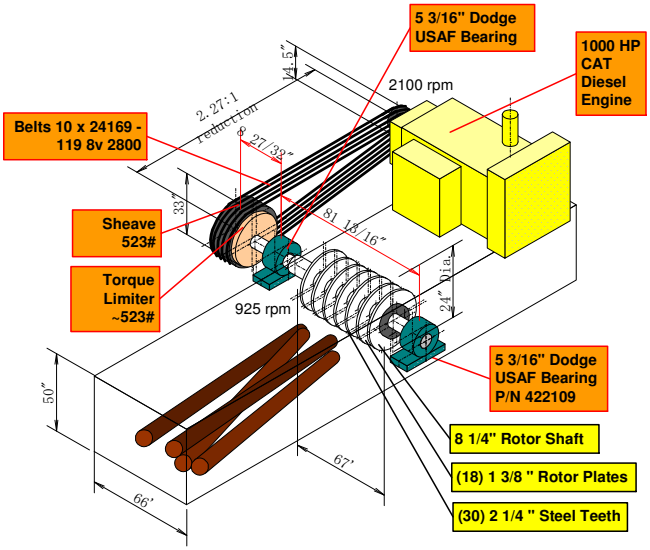
What is a Wood Hog?

A "Wood hog" is a general classification for a machine used for reducing wood and other material into smaller pieces for later consumption by some other process. The broad category of this machinery is called "size reduction equipment".

Mechanically powered wood hogs can be portable, being mounted on wheels on frames suitable for towing behind a truck or van. For mobile hogs, power is generally provided by an internal combustion diesel engine from 5 to 1,200 horsepower.

To the left and below right are examples of a tub style wood hog and the mechanical arrangement and power transmission scheme of a large drum type wood hog.

Generally, wood hogs rely less on energy stored in the heavy drum to do their work than chippers do. The chipping blades (also called hammers) are mounted on the face of the drum; the drum is accelerated to its operating speed by an electric motor or internal combustion engine. As larger portions of a tree are consumed by the machine, it causes the prime mover to temporarily slow down. When smaller portions of the tree, (say a branch), is consumed, the lesser load allows the prime mover it to speed up again to target speed.



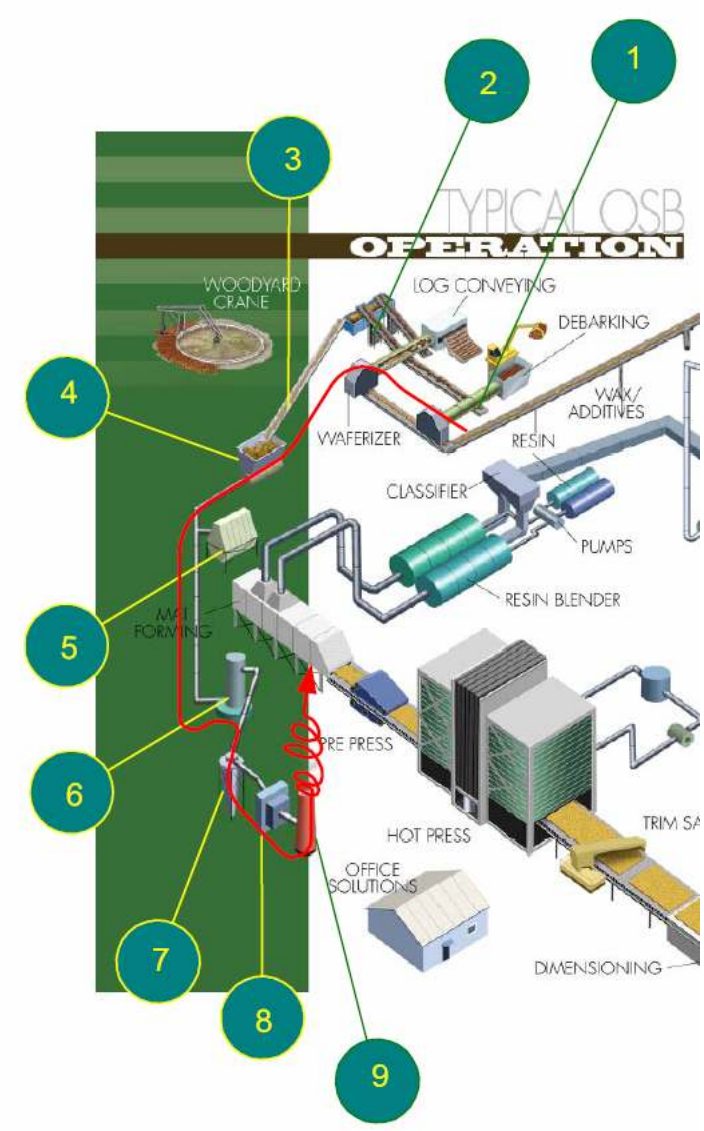
Large wood hogs are frequently equipped with grooved rollers in the throat of their feed funnels. Once a branch has been gripped by the rollers, the rollers transport the branch to the chipping blades at a steady rate.

The first commercially marketed hogs were of a design that was drum-based (as opposed to a disk type) chipping design. The chipping mechanism in a drum style hog is large steel drum powered by the motor, usually by a belt. It is mounted perpendicular to the hopper and spins towards the output chute. The drum also serves as the feed mechanism, drawing the material through as it shreds it.

Where is a Wood Hog used in a Paper and Forest Products Facility?

Electric motor driven drum wood hogs are very common at most paper and forest products facilities. They are used to reduce the size of bark and general woodyard scrap into a form (typically less than 3" length, 3" width and 3" high) that can be readily consumed in the combustion furnace of a boiler.

The Heat generation process is as follows:



1. **Debarking:** Debarking is the process of removing the bark from cut logs. The bark stripped from the logs is either packaged and sold as commercial mulch or is sent to the wood yard hog, a heavy duty shredder, which further chops up the bark into small chips to be burned for process heat.
2. **Mulch:** The bark that is removed from the logs does not go to waste. It can be converted into mulch and sold commercially or processed further and used as an energy source.
3. **Chip Conveying:** A conveyor system is used to transport the bark to the mulch conveyor or to the wood hog.
4. **Wood Hog:** If the bark that is removed from the logs is not converted into mulch, it is sent to the wood hog. A conveyor system is used to transport the bark to the wood hog. The wood hog is used to grind up the bark so that it can be burned and used as an energy source.
5. **Fuel Storage:** Some bark and wood chips that are of poor quality or incorrect size for sale as mulch after hogging are transported by belts or screw conveyors to temporary fuel storage bunkers. These bunkers provide buffering for chip overflows and reduced flow in order to keep consistent chip flow into the burner.
6. **Process Heat:** Many processes in the manufacture of wood products require process heat for thermal oil, drying and other processes. The wood chips are burned in a **combustion burner** represented by (6) then the exhaust gasses are cleaned by a **cyclone** (7) then further scrubbed by an **electrostatic precipitator**, shown as (8). The cleaned exhaust gasses are then vented to atmosphere by a **smokestack**, represented by (9).

What does the Wood Hog Produce?

Hog or "hogged fuel":
The hog (shredder, tub grinder, etc.) uses rotating hammers and stationary anvils to smash, crush and tear large wood into smaller fragments. Maximum output particle dimension is less than 3 inches (7.62 cm) in length and width.

Raw materials that are hogged include: debarker residues, log and sort yard debris, cull and trim, land clearing debris (brush, stumps, etc.), municipal yard wastes (brush, leaves, branches), industrial packaging (pallets, boxes, crates), and construction/ demolition wood wastes

Typically clean wood is chipped while low value dirty materials are hogged. Hog fuel from sawmills often includes sawdust, shavings and chip fines mixed with the hogged bark and trim, while hog fuel from a pulp mill wood room may contain clarifier sludge.

In general, hog fuel is more difficult to handle than waste wood chips since it is more fibrous, has a lower bulk density and contains a wide range of particle sizes. Moisture content is usually high and the ash content can be significant (from 2% to 3% to as high as 20%). The quality and component mix of hog fuel can vary considerably, as it can be mixed with anything!

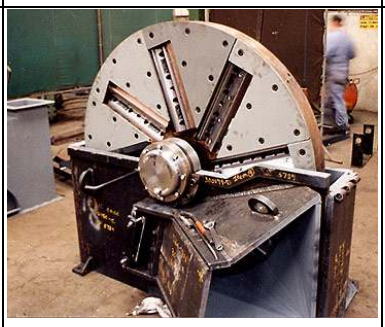
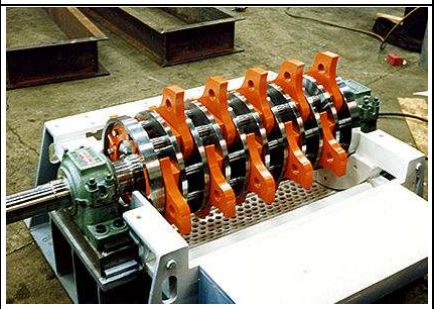
As a fuel source, hogged fuel is the least expensive fuel.

Comparative Fuel Prices

Fuel	Fuel unit	Fuel price range per unit	Gross fuel cost per MMBtu	Net fuel cost per MMBtu
Hardwood Chips	ton	$20 – $34.00	$2.00 – $3.45	$3.10 – $5.30
No. 2 Fuel Oil	gal	$.80 – $1.40	$5.90 – $10.30	$7.85 – $13.75
No. 6 Fuel Oil	gal	$.80 – $1.20	$5.70 – $8.55	$7.60 – $11.45
Electricity	kwh	$.06 – $.15	$17.60 – $43.95	$17.60 – $43.95
LP Gas	gal	$.80 – $1.50	$8.70 – $16.30	$10.85 – $20.40
Natural Gas	ccf	$.65 – $1.00	$6.50 – $10.00	$8.15 – $12.50
Coal	ton	$100 – $150	$4.00 – $6.00	$5.70 – $8.55

Is a Wood Chipper the Same as a Wood Hog?

Short Answer --- NO! …there are some fundamental differences

Comparison	Wood Chipper	Wood Hog	Differences
Construction			The fundamental difference is in the construction of the cutting device. Chippers use long, radial sharp blades to do high speed slicing. Wood Hogs use hardened hammers to lacerate and shred the wood. Chippers reduce logs to chips. Wood Hogs reduce scrap wood to a more consumable format.
WK^2	 Relatively High; 20,000 – 30,000 lb-ft^2	 Relatively Low; 5,000- ~20,000 lb-ft^2	The nature of the chipper is that it relies on the huge rotational inertia stored in the rotating disk to slice the radially mounted blades through wood logs. The Wood Hog drum and hammers has a lot less inertia and will rely more on the motor to supply energy to lacerate the wood.
Motor HP	50 – 3000 some chippers can be very large	5- ~2000 for "typical" woodyard applications	
Product			Hogged material will contain more fines – which will require post clarification (or screening) to ensure the end product will have proper BTU content to be used in the combustion burner.
Location	Mostly outside, sometimes inside under a steel roof structure. Always in the woodyard.	Almost always outside, but is located near the conveying system near the power plant.	

Drive			**Both can be direct driven, but typically chippers are powered by a 1200-1800 RPM motor and rotational speed is reduced by a sheave and belt arrangement. Wood hogs are "typically" direct driven and motor RPM is selected to provide proper throughput.**
RPM of driven equipment	**Typically 300-600**	**Typically 900-1200**	
Reduction method	**Belts and Sheaves; direct drive possible with a many pole motor (large)**	**Typically direct driven**	

Wood Hogs can be applied using stationary hammers or rotating hammers. Quite often, the more generic term "hammermill" is used to interchangeably with "Wood Hog". OEMs sometime use the phrase "hammermill" and woodyard operators use "hog".

Hogs have been used for many years to shred bark in hog fuel preparation. Bark shredding units normally operate at 800-900 RPM with about 600- 2000 HP motors and handle from 20-60 tons per hour of wood throughput.

Bark shredder installations are relatively simple. They are frequently located outdoors (with rain shed roofs). Delivered loads are dumped by hydraulic lift, or live bottom trailer, metered onto feed conveyors and fed across sizing screens such as disc screens. The wood scraps pass through the shredder and are reduced to 2-3" size, and are combined with screen undersize material which drops to a conveyor below the shredder to produce a properly sized material for mixing and producing hog fuel.

Hogs usually are designed for steel or belt conveyor or vibrating pan feed through an opening near the top of a heavy metal hopper set above the shredder rotor (usually horizontal). The rotor is fixed in place with bearings on each end and is usually made up of a solid steel center shaft up to 2' in diameter (largest units) to which is fastened a series of heavy duty discs from about 1 to 7' in diameter. Long cylindrical pins from under 1" to over 6" in diameter pass through holes in the discs usually at the quarter points and provide a fastening base for either fixed or free swinging hammers, which may weigh from a few pounds to several hundred pounds each. The rotors are turned from about 400-1800 RPM depending on design application. Feed material drops on top of the rotor and is impacted and crushed against heavy steel breaker plates and or grate bars which retain the feed until it is sized small enough to pass through the grate.

Good Cut Sheet Specification for a Wood Hog Motor

Parameter	Description	Comment
Motor Horsepower (HP)		Per OEM or retrofit NP HP
Motor (RPM)		Application specific
Motor Voltage (VAC)	3 phase	460, 2300 or 4160 vac
Application	Waste wood Hog	
Motor Frequency (Hz) (50) or (60)		Typically 60 Hz for North American operation
Type of Motor	Squirrel Cage Induction Motor	Excellent fit for Induction motor – too small for synchronous motor
Mounting	Horizontal Foot	99% Typical
Enclosure	TEFC	ODP is pervasive TEFC more robust design
Service Factor (1.0) or (1.15)	1.15	Prefer 1.15 – more expensive but will last longer
Coupling (Direct) or (Belted)		Will affect DE bearing
Pull-Out Torque (%)	200-250%	(Critical) in order to power through peak wood jams during shredding (prevents slowdown)
Locked Rotor Torque (%)	180-220%	(Critical) in order to provide enough starting torque to
Rotor Construction	Copper Bar Rotor	CU Bar Rotor Recommended for rotor longevity (see IAS)
Type of Insulation	Class F	F is typical
Vacuum Pressure Impregnation process	Two cycles	Important considering the equipment will be located outdoors
Temperature Rise	B	
Locked Rotor Code	(if specified)	* = see below (not to exceed)
NEMA Design	B	Typical design for the application. Note – we may need to change the design in order to meet customer torque specifications
Slip Capability	3% to 5%	Standard. Low slip design not needed
Across the line starting acceleration time	5 to 10 seconds	Typically 20 seconds or more will overheat rotor
Current Imbalance Capability	20% for 60 sec	The service factor will compensate for heating produced by this condition
Stator Thermal Overloads RTD's	Two per phase	Need external alarm and trip equipment
Bearing RTD's	One each Bearing	Need external alarm and trip equipment
Accessories:	☐ Surge Capacitors ☐ Lightning Arrestors ☐ Anti condensation winding space heaters	* See cut sheet specification. This is important if the motor is to be located in a "lightning strike" area.
Conduit Box Location (F1, F2)		Customer Preference
Thrust load from hog to motor (Lbs)	None	Typically this should be very little to none
Starts Per Hour (Maximum)	Two	
Environment	High concentration of wood dust, high moisture	Select DE Inpro seals
Hog Rotor WK^2 ($Lb\text{-}ft^2$)		From Hog OEM

* Locked Rotor code explanation

Note: There is usually a misnomer here sometimes customers will mistakenly specify "Inrush code" as "locked rotor code". The correct way to use the locked rotor code is listed below. (See customer specification)

Locked Rotor for the motor listed on our specification is calculated as:

$$LockedRotorAmps = \frac{[MotorNameplateHP] \times [LockedRotorCode]}{[MotorNameplateKV] \times \sqrt{3}}$$

For this example, with NP HP = 1250 HP and Motor Voltage at 2.3 KV, Locked Rotor Code "J"

- ☐ **Min Locked Rotor Amps = (1250 x 7.1) / (2.3 x 1.732) = 2227 AAC**
- ☐ **Max Locked Rotor Amps = (1250 x 8) / (2.3 x 1.732) = 2510 AAC**

Locked-Rotor Code, kVA/hp			
A	0-3.15	G	5.6-6.3
B	3.15-3.55	H	6.3-7.1
C	3.55-4.0	J	7.1-8.0
D	4.0-4.5	K	8.0-9.0
E	4.5-5.0	L	9.0-10.0
F	5.0-5.6	M	10.0-11.2

While NEMA Design B standards limit locked-rotor current, no standard limits the peak-inrush current. Fortunately, peak-inrush current is usually not a problem because it lasts only a few milliseconds. However, it can be a problem when the motor controller uses instantaneous magnetic-only circuit protectors that react in less than a single AC cycle. That is because peak inrush can be as high as 2.8 times the RMS locked rotor current and may exceed the circuit protector current setting. A motor may trip on peak-inrush current and start successfully on the next attempt. The exact peak-inrush current depends on the moment when contacts close in the AC voltage cycle, and how close to simultaneously the three-phase contacts close.

For a large motor, one does not typically specify a high Locked rotor amp rating. If there is a customer requirement for high efficiency – this could then dictate in the design that would have higher locked rotor current and would require the motor to be name plated with a "J" locked rotor current rather than say a "G". Usually a lower Locked Rotor Code rated motor will be easier on the customer's power system. In any case, it will assist the end user in specifying the rating of the disconnect device upstream in the power system.

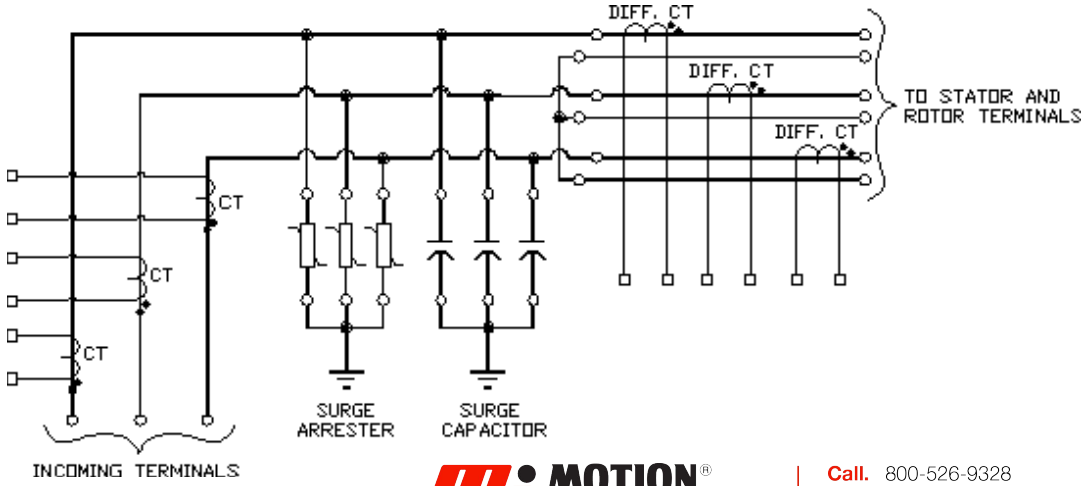
* Surge Capacitor Application (Accessories)

A surge capacitor is a device designed to absorb surges and/or reduce the steepness of their wave front. A capacitor is able to absorb and hold a charge of electricity, returning it to the circuit at a later time. Since the surge capacitor is always connected to the power circuit, current flows at all times. When a surge occurs, the additional current flows into the capacitor, thus decreasing the intensity of the surge voltage.

The amount of current the capacitor can absorb depends on the size of the capacitor, and the amount of voltage pushing the current.
If the surge is of a low current relative to its voltage intensity, the capacitor will absorb it. If the surge has high current, the capacitor cannot absorb it.

By contrast, a lightning arrestor takes no current from the line during normal operation. When a surge occurs, the arrestor turns on to provide a discharge path. When the surge is gone, the arrestor turns off. The arrestor will handle unlimited amount of current, although amounts exceeding 100,000 amps will generally damage the arrestor.

The main advantage of a capacitor is that there is no time delay in turning on as it always conducts. The disadvantage is that the amount of current it can handle is limited to a few amps, depending on the surge voltage. For this reason, an arrestor should always be installed with a capacitor to protect it from intense surges.



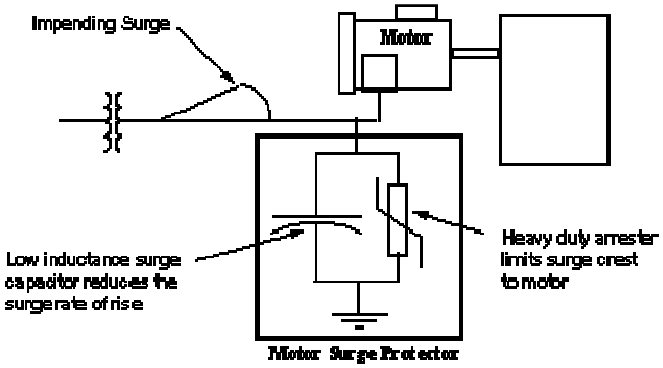
Guide Form Specification for Medium Voltage Motor Surge Protectors

This specification is for a _____ kV medium voltage three phase motor surge protector that is designed to protect medium voltage motors from voltage surges due to lightning and switching events. The Motor Surge Protector will be placed on a _____ kV system (Line-Line Voltage) that is _____ grounded. (*Ungrounded, solidly grounded, or resistance grounded*) The surge protector shall come fully assembled and ready for interconnection.

All exceptions to this specification shall be clearly stated with your bid. If no exceptions are taken, the bid should include the phrase "no exceptions have been taken".

1. Enclosure

1.1 The medium voltage motor surge protector shall be housed in a NEMA 1, 3R, 12 *(specify 4X when required and delete 1, 3R, and 12) 11* gauge galvaneel steel all-welded enclosure. The base of the unit shall consist of C2 channel for floor mounting and skidding into place.



1.2 The enclosure shall be equipped with a hinged door for maintenance and termination. The hinged door shall bolt close with two 3/8”x16 stainless steel bolts. The hinges shall be stainless steel. The door shall be removable when in the open position.

1.3 High voltage warning signs and a nameplate showing rating information shall be located on the front of the enclosure.

1.4 The design shall accept bottom or top entry.

2. Capacitors

2.1 A low inductance three phase, all-film surge capacitor shall be provided for decreasing the slope of impending voltage surges. The capacitor shall be rated _____ micro-farads to ground and have a _____ voltage rating.

2.2 The capacitor shall be equipped with discharge resistors that reduce the capacitor voltage to 50 volts in 5 minutes when disconnected from the source.

2.3 The surge capacitor shall be capable of operating in the temperature range between -40 degree Fahrenheit and +115 degree Fahrenheit.

3. Surge Arrester

3.1 The medium voltage motor surge protector shall be equipped with three heavy duty distribution class *(specify station class if desired)* lightning arresters for limiting the crest of impending voltage surges to safe values.

3.2 The surge arrester shall be silicone rubber housed and shall utilize MOV blocks. The arresters shall comply with ANSI/IEEE C62.11 standards.

3.3 The voltage rating and MCOV shall be appropriately rated for the system voltage and grounding as specified above.

4. Differential Current Transformer *(This option can be deleted if not desired)*
4.1 Differential current transformers shall be supplied to allow for differential protection of the motor. The differential current transformer shall be placed around solid Copper bus (not customer wiring) to see both the stator and rotor current of the motor.

4.2 Secondary leads from the current transformer shall be terminated on an isolated screw terminal block for connection to customer differential/motor protection relays. The differential current transformer(s) shall have a xxx/5 ratio.

4. Current Transfomers *(This option can be deleted if not desired)*
4.1 Current transformers shall be supplied with the equipment to allow for over-current protection of the motor. The current transformer shall be placed around solid Copper bus and shall not interfere with customer wiring. The current transformer shall have a xxx/5 ratio.

4. Connections
4.1 The unit shall come fully assembled and ready for interconnection. Standoff insulators shall be provided for termination of customer phase conductors. Termination points shall accommodate a NEMA 2 hole compression lug.

5. Submittals
5.1 Upon issue of a purchase order, the supplier shall provide 3 copies of approval drawings. The submittals shall include:

- Installation Instructions
- Single Line and three line diagrams
- Pad and cable entry drawings
- Drawings showing component layout
- Data sheets for all internal components

6. Bid Requirements
6.1 Supplier must state all exceptions in the Bid. If no exceptions are taken, the supplier must state that there are no exceptions.

7. Acceptable Product & Suppliers
7.1 Suppliers must offer a minimum 2 year warranty and have available extended warranty programs.

7.2 Supplier must show that they are a regular supplier of medium voltage motor surge protection equipment.

7.3 Acceptable Manufacturer and Product:

Commercial Situation

A large conglomerate, historically known for quality motors were bidding against Baldor Electric for a new wood hog motor and a spare at in paper mill woodyard. On the next pages are what the end user asked for and what the competition supplied as a motor quote. In all instances Baldor Electric met or exceeded the customer specification requirements. The conglomerate's response was limited and did not meet the end user's requirements.

The purpose of this comparison is not to "pick apart" the competition, but to bring light to where Baldor Electric can and will meet and exceed customer specification requirements in order to tailor a motor to a customer's long term needs.

In addition, Baldor Electric has multiple layers of technical support:

- ☐ **Local sales engineers**
- ☐ **Regional Motor Managers**
- ☐ **Industry Engineers**
- ☐ **Factory Engineers specializing in electrical and mechanical designs**

The ability to serve the customer both locally through to the factory is an uncommon trait in most motor manufacturers and should be stressed as a differentiator. Also, do not underestimate the value of having a motor manufactured domestically. Many communication issues arise, or design changes can occur once the order has been entered, and it is much easier to be able to communicate directly with the factory.

Baldor Electric did not win this order on any major price differential but did win on the value as judged by the customer.

We engineered the motor to suit the application 100%; not by performing a series of tradeoffs on a standard motor to miss or barely meet customer minimum specification standards.

What the end user wanted

Hog Motor Requirements:
Revised Date 08-23-2006

1000 HP
900 RPM
Squirrel Cage Induction Motor
WP II Enclosure with Filters
(Filters shall be Stainless Steel media, include a air pressure differential switch)
1.15 Service Factor
200-250% Pull-Out Torque
180-220% Locked Rotor Torque
Copper Bar Rotor
Class H insulating materials, Vacuum Pressure Impregnation process--two cycles
"B" Temperature Rise
Code J inrush
NEMA "B"
2300/4160 Volts/ 3 phase /60 hertz
3% to 5% Slip Capability
Across the line starting
Acceleration time 5 – 10 sec
Current Imbalance Capability, 20% for 60 sec.
Stator Thermal Overloads (RTD's) Two per phase
Bearing RTD's One each Bearing
Surge Capacitors and Lightning Arrestors
Anti condensation winding space heaters
Thrust load from hog to motor, None
Two Starts Per Hour Maximum
Wastewood Hog Application
Dusty Environment
Hog Rotor, WK^2 23,822 $Lb\text{-}Ft^2$

Note: The end user changed the motor HP requirement to 1250 HP during Rev 1 of the proposal specification

Note: The end user changed the motor enclosure requirement to TEFC based on Industry recommendation

Note: Customer used the misnomer "Code J Inrush" This is typically a result and not specified. Believe the intent here in "not to exceed".

This is where our high number of start rotor design really separates us from many other motor manufacturers.

The Competitor's Quote

Proposal

Customer: Date: **3-Oct-2006**

Cust. Ref. Folder:

End User: MAC T:

Cust spec: Project:

Item 1 of 1 - HORIZONTAL 3-PHASE SQUIRREL CAGE INDUCTION MOTOR

Qty: **1** x **1250 HP**; **8** poles; **900** rpm; **2300** volts; **60 Hz**, **1.00** S.F., **TEFC**; estimated frame: **8011S**;

NET PRICE - each motor, including accessories and tests as listed on datasheet

DELIVERY - delivery time is subject to confirmation after receipt of order

COMMERCIAL TERMS

T & C's:	**Conditions of sale in apply.**
Price policy:	**Net cash 30 days from date of invoice.**
Proposal validity:	**Price clause 1Q applies. Price valid for 30 days.**
Delivery:	**FOB Norfolk VA. Freight collect to destination.**
Codes/Stds:	**ANSI/NEMA M.G.1; ANSI C50.41;IEEE 1/85/112/115.**

UNLESS SPECIFIED OTHERWISE, ALL VALUES ARE NOMINAL AT RATED VOLTAGE A

- DATA SHEET -

Customer: Proposal # Date: 1

Output Power	1250 HP	Type	
Number of Poles	8	Mounting	
Voltage	2300 V	Frame (estimated)	
Frequency	60 Hz	Enclosure	
Number of Phases	3	Service Factor	
Synchronous Speed	900	Insulation Class	
Rated Speed	885	Altitude (ft)	
Ambient Temperature (°C)	40		
Method of Temperature Measurement	Resistance	Efficiency (%) - Rated Load	
Temperature Rise at S.F. 1.00 (°C)	80	Efficiency (%) - 3/4 Load	96.4
Average Expected noise pressure level at 1m in no load	85	Efficiency (%) - 1/2 Load	
Starting Method	Across the line	Power Factor (%) - Rated Load	
Minimum Starting Voltage (%V)	90	Power Factor (%) - 3/4 Load	
Maximum Consecutive Starts (Cold/Hot)	2/1	Power Factor (%) - 1/2 Load	
Rated Current (Amps)	297		
Locked Rotor Current (% Rated Current)	650%	Safe Stall Time (100% Voltage) - Cold	20
Locked Rotor Torque (% Rated Torque)	80	Safe Stall Time (100% Voltage) - Hot	15
Breakdown Torque (% Rated Torque)	200		
Bearing Type	Antifriction	Rotation View from ODE	Dual
Lubrication	Self-cooled grease lubricated	Estimated Load WK2 (lb-ft²)	23822
Rotor Bar Construction	Aluminum	Rated Torque (lb-ft)	7415

Note: the motor is NOT manufactured in the USA. FOB Norfolk refers to Virginia International Terminals, a Port of Entry

Note: the quoted motor DID NOT meet minimum locked rotor torque requirements (180-220%) as stipulated by the end user… this competitor has eliminated historically strong regional application engineering support, thus all that is left for application engineering review are inexperienced

Note: the quoted motor barely met the minimum breakdown torque requirements (200-250%) as stipulated by the end user… personnel. This is a disregard for the needs of the end user.

Note: the quoted motor DID NOT meet the end users requirement for copper bar rotors

ACCESSORIES AND SPECIAL FEATURES

Bearing - Seals - Labyrinth seals on both DE and ODE
Bearing - Temperature Detector - Platinum BTD (100 ohm) - Qty: 2
Grounding Brush
Polyseal
Premium Efficiency
Space Heaters - Space Heaters - Standard Temperature
Stator - Temperature Detector - Stator Platinum RTD (100 Ohm) - Qty: 6
Surge Protection - Lightning Arresters
Surge Protection - Surge Capacitors
Terminal Box - Terminal Box oversized for up to three protective equipment

Note: the end user requested 1.15 SF

TESTS (Non witnessed)

Non-witnessed Routine
Efficiency

Note: the end user specifically asked for COPPER BAR ROTORS

EXCEPTIONS AND COMMENTS

Note: the end user asked for class H insulation

Specification16425:

1. Item 2.4 & 4.1: Compliance to OSHA is other's responsibility.
2. Item 9.5: The bearings life will be 130,000 for direct coupling only
3. Item 11.0: The conduit box will be of fabricated steel. It is not diagonally split. The conduit box is not rotatable.

Hog motor requirements:

1. Quoting motor for 1.0SF only.
2. The quoted motor will have torques values as specified above (suitable for load WK2 of 23,822 lb.ft2). These torque are of "Normal-toque design" as specified in spec 16425.
3. Quoting motor with Aluminum Rotor.
4. Quoted motor will have class 'F' insulation. Class H is not available.
5. Quoting motor for single voltage = 2300V as requested.
6. The motor will have Full load slip as 1.7% approx. Customer to advise if specific high slip motors are expected. The high slip motor will be of normal efficiency designs