CHAPTER FIVE

5.0 CONCLUTION AND RECOMMENDATION

5.1 CONCLUSION

In conclusion, sandcrete block making machines are essential for producing affordable building materials, but achieving quality and efficiency requires careful attention to mix design, machine maintenance, and operational practices. Addressing issues like mould bulging through proper techniques ensures durable and structurally sound blocks, contributing to safer and more sustainable construction.

5.2 RECOMMENDATION

* Mix Design: Stick to the right proportions of cement, sand, and aggregates. Less water is better to avoid weak blocks.
* Machine Maintenance: Keep the machine clean and well-lubricated. Regularly check for wear and tear on the mould and vibrating parts.
* Compaction: Make sure the machine compacts the mix evenly and thoroughly.
* Curing: Properly cure the blocks by keeping them moist for at least 7 days to gain strength.
* Quality Control: Regularly check the dimensions, strength, and density of the blocks to meet standards.
* Training: Properly train machine operators to follow best practices and spot potential issues.

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APPENDIX

POWER REQUIREMENT

1. Electric Motors

* Mixing Unit: The motor for the mixer needs to be powerful enough to handle the heavy load of sand, cement, and water. Power can range from 5 HP to 20 HP (3.7 kW to 15 kW) depending on the mixer's capacity.

* Vibrating System: Vibrator motors are essential for compacting the concrete. Each vibrator motor might range from 1 HP to 3 HP (0.75 kW to 2.2 kW), and the machine may have multiple vibrators.

* Hydraulic System: The hydraulic pump is driven by an electric motor, which can range from 3 HP to 10 HP (2.2 kW to 7.5 kW) depending on the size and pressure requirements of the hydraulic system.

* Material Feeding System: If the machine has a conveyor belt or screw feeder, the motor for this system might range from 1 HP to 5 HP (0.75 kW to 3.7 kW).

2. Hydraulic System:

* The hydraulic pump's motor is a significant power draw. The power requirement depends on the system's pressure and flow rate. A typical range is 3 HP to 10 HP (2.2 kW to 7.5 kW).

3. Control System and Auxiliary Components:

* The control panel and any auxiliary components (e.g., sensors, lights) will have a smaller power requirement, typically less than 1 HP (0.75 kW).

4. Total Power Requirement:

* Small-Scale Machines: Total power might range from 10 HP to 25 HP (7.5 kW to 18.5 kW).

* Medium-Scale Machines: Total power might range from 25 HP to 40 HP (18.5 kW to 30 kW).

* Large-Scale Machines: Total power might exceed 40 HP (30 kW).

5. Voltage and Phase:

* Most industrial sandcrete block making machines operate on three-phase power, typically 380V to 415V at 50 Hz or 440V to 480V at 60 Hz. Smaller machines may operate on single-phase power (220V to 240V).

6. Power Factor Correction:

* To improve energy efficiency, power factor correction (PFC) may be employed. This involves using capacitors to reduce reactive power and improve the power factor closer to 1.

Keep in mind that these are general ranges, and the specific power requirements can vary based on the machine's design, capacity, and features.

MOULDING FORCE REQUIRED

1. Hydraulic Pressure:

* Typical hydraulic pressure in sandcrete block machines ranges from 1500 PSI to 3000 PSI (10 MPa to 20 MPa). The exact pressure depends on the block size, density, and machine design.

2. Cylinder Specifications:

* Cylinder Diameter: The diameter of the hydraulic cylinder(s) directly affects the force applied. Common cylinder diameters range from 4 inches to 8 inches (100 mm to 200 mm).
* Number of Cylinders: Some machines use multiple cylinders to distribute force evenly across the mould.

3. Force Calculation:

* The force exerted by a hydraulic cylinder is calculated using the formula:
* $F = P \times A$
* Where:
* F is the force in pounds or newtons.
* P is the pressure in PSI or Pascals.

* A is the area of the cylinder piston in square inches or square meters.

4. Example Calculation:

* Let's assume a machine uses a hydraulic cylinder with a diameter of 6 inches (radius = 3 inches) and operates at a pressure of 2000 PSI.
* Area $A = \pi r^2 = \pi \times (3 \text{ inches})^2 \approx 28.27 \text{ square inches}$
* Force $F = 2000 \text{ PSI} \times 28.27 \text{ square inches} \approx 56{,}540 \text{ pounds}$
* So, a single cylinder can exert approximately 56,540 pounds of force.

5. Total Moulding Force:

* Small-Scale Machines: Total moulding force might range from 20,000 lbs to 50,000 lbs (90 kN to 220 kN).
* Medium-Scale Machines: Total moulding force might range from 50,000 lbs to 100,000 lbs (220 kN to 440 kN).
* Large-Scale Machines: Total moulding force might exceed 100,000 lbs (440 kN).

6. Vibration Force:

* In addition to static hydraulic force, vibration plays a crucial role in compacting the sandcrete mixture. Vibration force is typically generated by vibrator motors attached to the mould.

7. Vibrator Motor Specifications:

* Frequency: Vibration frequency typically ranges from 3000 to 6000 vibrations per minute (50 Hz to 100 Hz).
* Amplitude: Vibration amplitude is usually between 0.5 mm to 2 mm.
* Force: The dynamic force exerted by each vibrator motor can range from 1 kN to 5 kN.

8. Combined Effect:

* The combined effect of static hydraulic force and dynamic vibration ensures proper compaction and density of the sandcrete blocks.

MOULD BULGING PROCESS

1. Excessive Mix Water: Too much water in the concrete mix increases the hydrostatic pressure against the mould walls.
2. Improper Mix Proportioning: An incorrect ratio of cement, sand, and aggregates can lead to a mix that doesn't compact well, increasing pressure.
3. Insufficient Compaction: If the mix isn't adequately compacted, air pockets remain, and the material exerts more outward force.
4. Worn or Weak Moulds: Over time, moulds can weaken due to repeated use and stress, making them more susceptible to bulging.
5. Overfilling: Putting too much concrete mix into the mould at once can overload it.
6. Machine Vibration Issues: If the machine's vibration system isn't working correctly, it can lead to uneven compaction and pressure distribution.
7. Inadequate Curing: Improper curing can weaken the blocks, but it's more of a consequence than a direct cause of bulging during moulding.

To prevent mould bulging:

* Use the correct water-cement ratio.
* Ensure proper mix proportions.
* Maintain the moulding machine and moulds in good condition.
* Avoid overfilling the moulds.
* Ensure effective compaction during the moulding process.

FABRICATION DETAILS

A concrete block making machine's fabrication details involve designing and constructing various components to efficiently produce concrete blocks. Key aspects include the frame structure, vibration system, mold design, material feeding mechanism, and control system. The specific fabrication details vary depending on the type and automation level of the machine.

1. Frame Structure:

The frame is typically made of steel, often Q345 steel, known for its strength and durability.

The frame dimensions and weight depend on the machine's size and capacity.

The frame provides structural support for all other components and ensures stability during operation.

2. Vibration System:

Block machines use vibration to compact the concrete mix within the mold.

The vibration system usually consists of vibrators (electric or hydraulic) attached to the mold and/or the machine's frame.

The vibration frequency and amplitude are crucial parameters that can be adjusted to achieve optimal block density and strength.

3. Mold Design:

Molds are designed to create specific block shapes and sizes, such as hollow blocks, solid blocks, or paving stones.

The mold material is often steel, and it may undergo heat treatment (like carburizing) to enhance its wear resistance and lifespan.

Molds are designed to be easily removable and replaceable, allowing for production of different block types.

4. Material Feeding System:

A hopper is used to store the concrete mix, which is then fed into the mold.

The feeding system can be manual or automated, depending on the machine's design.

Some machines use a conveyor system to transport the concrete mix to the hopper.

5. Control System:

Modern block machines often feature a PLC (Programmable Logic Controller) for automated control.

The control system manages various aspects of the production process, including vibration, feeding, and mold movements.

Full automation can significantly improve production efficiency and reduce manual errors.

6. Other Considerations:

Some machines are designed to be mobile (e.g., diesel-powered) for use in locations without reliable power supply.

Pallets are often used to support the blocks during curing, but some machines are designed to produce blocks directly on the ground (egg-laying type).

The specific fabrication details, such as the type of steel used, the vibration system's design, and the level of automation, will vary based on the machine's intended use and production capacity.