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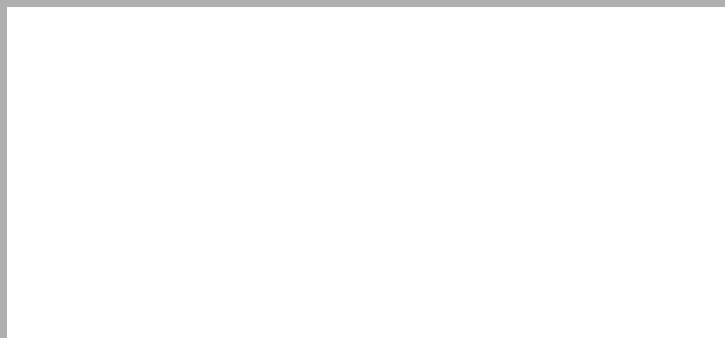
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A Macawber Group Company

ADVANCED PNEUMATIC CONVEYING SYSTEMS  
 CONTROLLED RATE INJECTION SYSTEMS  
 INFLATABLE SEAT VALVES

**Your Local Distributor:****ISO 9001**

Company Management  
 Quality Certification  
 (parent company)



Pressure Vessel  
 Quality Assurance Certification



Product Safety requirements satisfy the  
 Directives of the European Commission.



# Ash Conveying Systems

Pneumatic Dense-Phase Ash Conveying Systems

**Macawber**

- Multiple pick-up (feed) points on a single pipeline
- Low profile equipment – excellent for retrofitting
- Low power cost per ton transferred
- Maintenance free equipment – no continuously moving parts
- Very low material transfer velocity-schedule 40 pipeline
- Worldwide experience since 1974
- Worldwide technical support
- ISO 9001

# Macawber Engineering

Macawber Engineering



### Low velocity fly ash handling

1. A well-proven method of transferring ash through standard pipelines at low velocity using small equipment that is virtually maintenance free. Continuous development since 1974 with concentrated specialisation ensures highest efficiency and operating reliability.
2. Experience in this specialised field is vital to success. Every ash type and combustion type has been handled by the **Macawber** dense-phase technology.
3. The **Ashveyor®** operating sequence is very simple and relaxed. The small cast iron vessels do not require a vent valve, a level probe or a discharge valve. Each cycle clears away deposited ash from the feed hopper leaving them normally empty.
4. Each line of **Ashveyors®** on each ESP field, economiser or bag house cycle simultaneously to transfer the ash through a common pipeline. Diverter valves for each feed point are not required and system controls are equally simple.
5. Typically, a major coal fired utility of 2 x 300 Mwatt units using low quality coal with high ash content requires 46 tons/hour design rate over 350 metres from ESP units and handling high temperature ash at 350C from the economiser.



### How does Macawber Technology Compare with Old Technology?

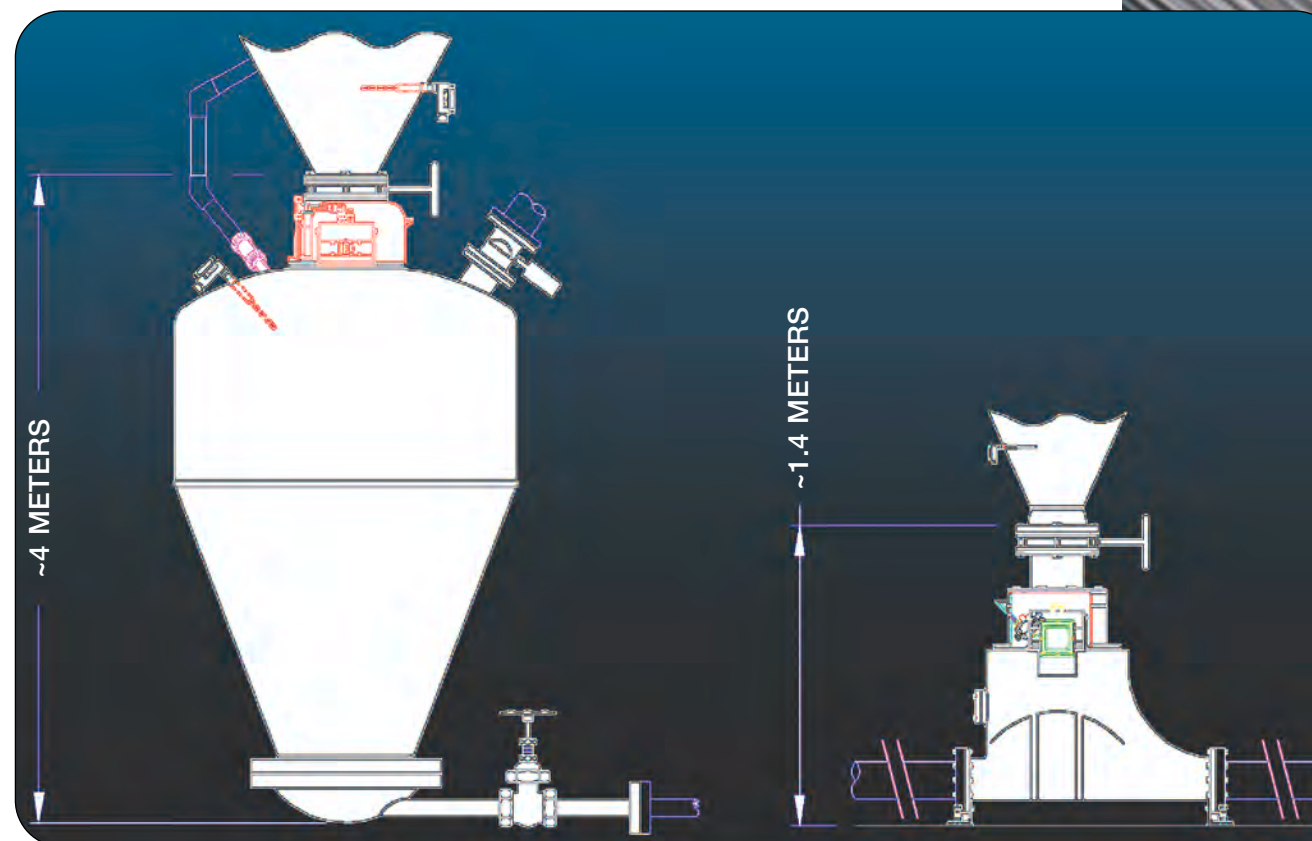
The following table compares Macawber's low-velocity, dense-phase **Ashveyor®** technology with the traditional (old) technologies of positive pressure, dilute-phase conveying and vacuum dilute-phase conveying. The example is for a typical conveying distance of 100 m (330 ft.).

#### Dimensions

Characteristic	Positive Pressure Dilute Phase	Vacuum Dilute Phase Dense	ASHVEYOR® Phase
Material-to-air Ratio	13	8	90
Average Material Velocity	78 m/s (60 f/s)	20 m/s (65 f/s)	4 m/s (13 f/s)
Energy Consumption kw per ton conveyed	110 kw	135 kw	75 kw
Pipewear	High	High	Low
ESP Hoppers Always Empty	No	No	Yes
Pipeline Material	Schedule 80 carbon steel or chrome cast iron	Chrome cast iron	Schedule 40 carbon steel

### How does Macawber Compare with other Dense-phase Systems?

The typical old style dense-phase systems comprise large vessels with complex pipline arrangements involving tee connections and discharge valves. The Macawber Ashveyor® system is compact, easy to install, and uses a single in-line pipline arrangement that eliminates tee connections and discharge valves. In addition, the Ashveyor® system does not require level probes, vent valves or air inlet valves to each vessel. The following comparison is a scaled size view.





### 1. Dry Bottom Ash Handling

This is a proven development of the Ashveyor® working in conjunction with an ash crusher at each outlet. Crushed bottom ash is conveyed away through schedule 40 pipeline to storage.

### 2. From Wet to Dry

The elimination of water from bottom ash handling has many economic benefits. Additionally the problems of lagoon water quality control, space requirements and general maintenance requirements are avoided.

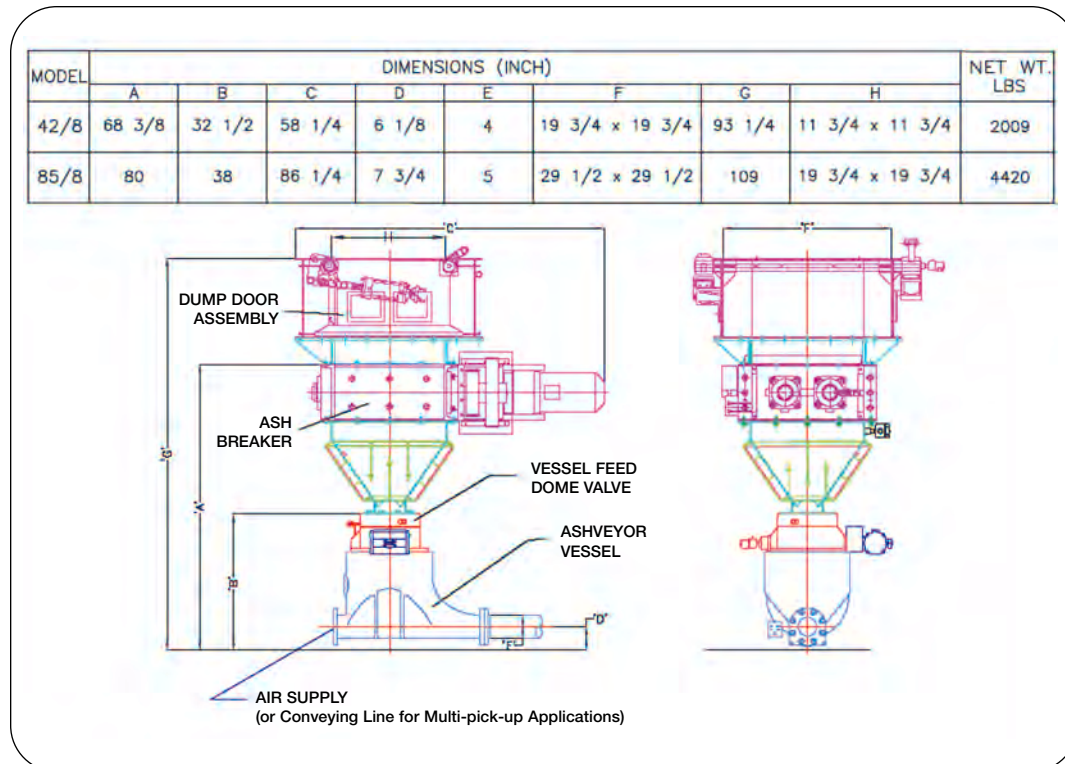
### 3. Operating Sequence

Each bottom ash outlet operates independently but conveys the ash through a common pipeline. The ash level inside the base of the boiler is signalled by a high temperature lazer probe to release accumulated bottom ash through special cooling dump doors. The clinker enters the ash crusher to be reduced in size for the Ashveyor® to convey the particles to storage.

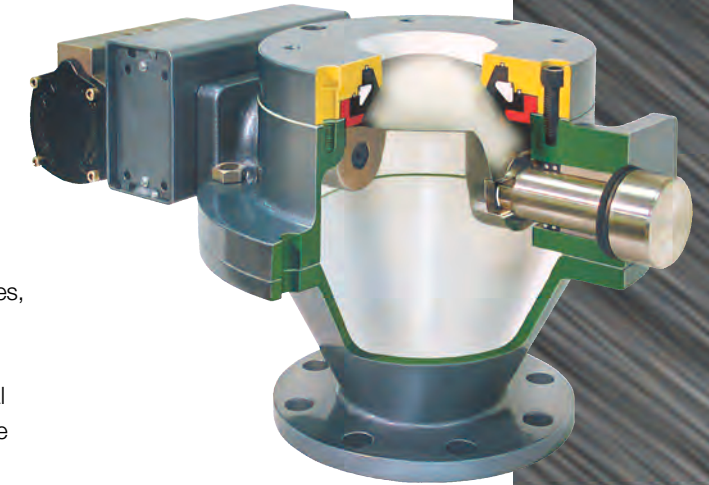
The accumulated clinker ash is cooled continuously by part of the total combustion air passing through the porous deck of the ash dump doors. Heat gain to this part of the combustion air assists boiler efficiency.

The ash crusher control incorporates an auto reversing drive automatically applied in the event of crusher overload due to foreign material entering the clinker crusher. This function is displayed at central control with visual and audio alarms.

The ash conveying sequence control arrangement includes a fault diagnostic facility. An audio alarm and visual display describes a fault condition, which may be easily remedied with operator friendly intervention at the system control facia.



## The Dome® Valve

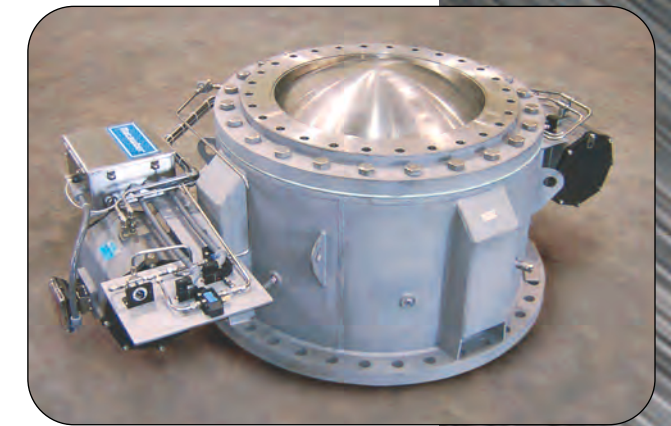


1. The Dome Valve® was introduced and patented in 1978 for the sole purpose of providing long life and reliability when handling hot and abrasive materials. The unique inflatable seal traps abrasive particles on closing preventing their movement under the effect of the pressure differential. This action ensures wear resistance from particles, operating reliability and valve performance.

2. Continuous development over the years with additional patents and innovations has developed the market for the valve to many applications. In addition the valve is widely used to retrofit ash valves requiring high maintenance or frequent replacement.

3. The operating sequence of the Dome® valve is very simple and effective; The spherical component rotates 90 to pass through a static or moving column of abrasive ash to the closed position where an inflatable seal is pressurised to entrap particles and prevent their movement. The inflatable seal reliably achieves a pressure differential of 7barg at a high temperature.

4. The standard size range is 2 inches to 16 inches and 600°F with inline configuration for pipeline service or bulkhead configuration for pressure vessel inlet. Special Dome® Valves are available to 30 inches and 43 barg with a range of materials of construction.



Dome® Valve Closure and Seal comparison with other valve types

Function:	Knife Gate Valve	Butterfly Valve	Ball Valve	Dome® Valve
Closing member away from material flow	YES	NO	YES	YES
Close without jamming on column of material	NO	NO	NO	YES
Close and seal on column of material	NO	NO	NO	YES

Dome® Valve Pressure Comparison with other valve types

Seal Bubble Tight to:	Knife Gate Valve	Butterfly Valve	Ball Valve	Dome® Valve
14.5 psi (1 barg)	NO	NO	Maybe	YES
100 psi (7 barg)	NO	NO	NO	YES
623.5 psi (43 barg)	NO	NO	NO	YES
Combined Pressure and Vacuum	NO	NO	Maybe	YES

# Specialised Applications

## Specialised Applications

In addition to ash conveying systems, Macawber has a range of equipment for special applications such as FBC bed drains, pressure let down systems, long distance conveying and ash re-injection.

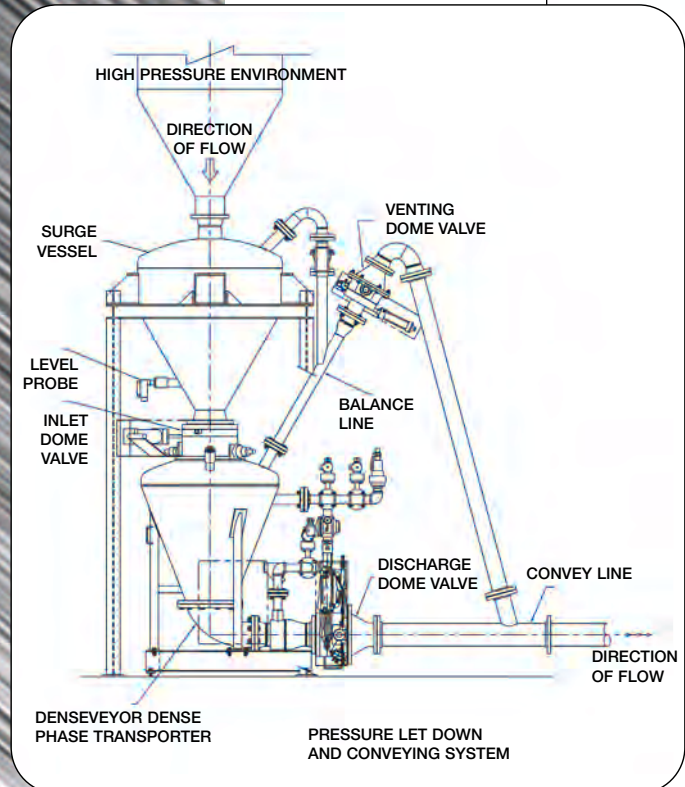
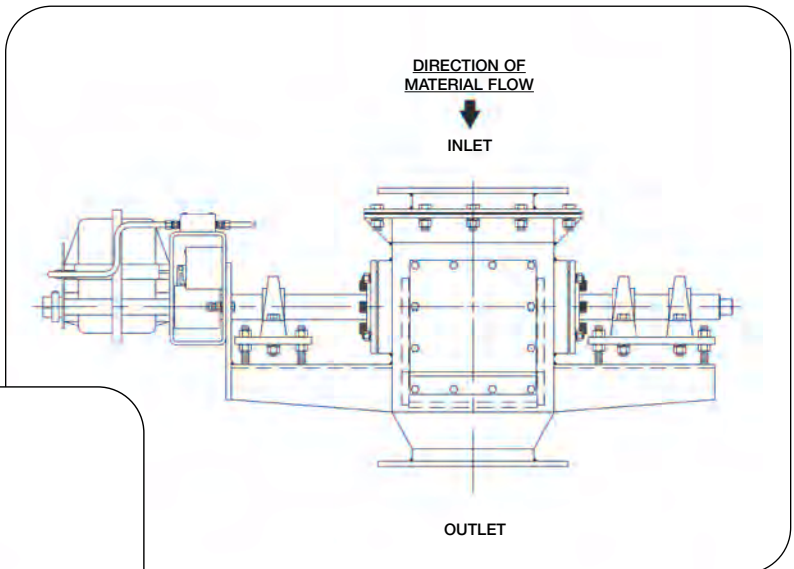
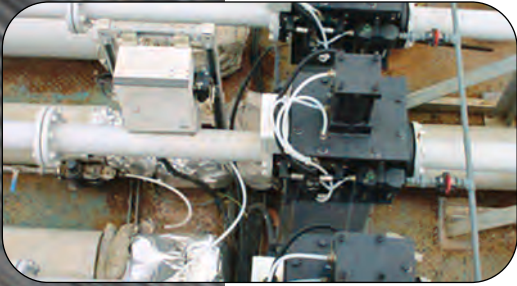
## Ash Re-injection System

Macawber can provide a range of ash re-injection systems. The MiniDenseveyor® is ideal for returning carbon-rich ash back into the combustion process.

## Long Distance Ash Conveying

Macawber provides a range of technologies for conveying ash over distances up to 2000 m (6500 ft). These technologies include the Denseveyor®, Variflow® and Macpump® dense-phase systems.

The Macpump® can convey at rates as high as 300 tph.



## Fluid Bed Combuster Bed Drain Valves

A high-temperature, dust tight clam shell type cut-off valve capable of up to 1500°F operation.

## Pressure Let-down Systems

Many combustion systems such as gasifiers, circulating fluid bed combustors and combined cycle systems operate at high pressures – often as high as 600 psi.

Macawber Dome® Valve technology can provide means of transferring hot materials from high to low pressure environments.

Combined systems for pressure reduction and conveying are also available.

# Application Examples

## Application Examples

Examples of the Ashveyor® ash handling process are well known throughout the world. They are used with all types of coal fired boiler and alternative fuels such as biomass, sewage sludge, garbage and medical waste.

**1. Cottam Power Station UK.** 4 x 500 Mwatt first fields ESP fly ash systems each comprising 9 x fly ash feed points on a single pipeline handling 28 tons/hour for 280 to 350 metres.

**2. London Waste UK.** 5 x 50 Mwatt ESP units handling domestic waste biomass fuel ash. Retrofit of dilute-phase ash handling system. handling 8 tons/hour for each system for 260 metres.

**3. South Carolina Electric and Gas. USA.** Retrofit of all ash handling and storage systems for 2 x 130 Mwatt boilers including bottom ash, fly ash, pyrites, back pass and air heater ash positions.

**4. Liaoning Power Plant, China.** Two new 300 Mwatt coal fired boilers for ESP fly ash and economiser fly ash. Design rate 46 tons/hour 360 metres.

**5. Montenay Waste-to-Energy Plant, Panama City, Florida. USA.** Handling lime-rich ash from garbage incineration with FGD treatment. Two streams, each stream conveying 2.5 tons/hour from Air Heater, FGD and Baghouse over 80m.

**6. Shanghai Coke and Chemical Plant. China.** High temperature ash from 8 gasifiers at 30 psig. Continuous pressure let down and dense-phase conveying at 350°C to storage. A total of 32 high temperature and high pressure let down/conveying systems.

**7. Fibrothetford. UK.** A comprehensive set of systems to handle ash from chicken litter biomass fuel. Bag house ash is heavily lime rich providing important variations to fly ash characteristics.

**8. Koblitz Energy, Brazil.** A waste to energy plant handling rice hulls fly ash. Four Ashveyors® transferring fly ash from a baghouse to a silo at 10 tons/hour over 250 metres.

**9. City of Paulo Alto, USA.** Sludge incineration plant handling sewage sludge ash at 18 tons/hour 180 metres in a 100mm pipeline with Ashveyors® conveying the ash to a storage silo and from there to a load out bin.

**10. Alabama Power, Birmingham USA.** Coal fired utility handling bottom ash and fly ash. Fifteen Model 1.5/8 Ashveyors® and seven with ash crushers. All ash is being transferred to a storage silo.

**11. Agrilectric, Lake Charles, USA.** Waste to energy plant handling rice hulls ash. Ten x 1.5/8 ashveyors® operating on a 100mm pipeline conveying fly ash from baghouses and mechanical collectors to a silo.

**12. Mitsubishi, Japan.** Fly Ash transfer through a 250mm pipeline over 250 metres at 30 tons/hour.

**13. Fiddlers Ferry Power Station, UK.** Fly Ash transfer through a 300mm pipeline over 170 metres at 120 tons/hour.

