THE DEVELOPMENT OF 'MODULAR' PROCESSING PLANTS FOR THE DIAMOND MINING INDUSTRY

R. Abate

BATEMAN MINERALS
THE DEVELOPMENT OF 'MODULAR' PROCESSING PLANTS FOR THE DIAMOND MINING INDUSTRY

THE 'IDEA'

The idea of designing and constructing process plants in 'boxes' or 'modules', was started some 40 years ago by a South African contracting company called Fraser and Chalmers. These units were namely small Dense Media Separating units, ranging in capacities from 1tph to 30tph. Up to some 40 of these units were sold up to the late 1960's. These units were used for concentrating ores and minerals such as Diamonds, Chrome Ores, Iron Ores, Lead, Zinc etc. These units were fully assembled and pre-tested in the workshop. (Refer fig.1)

After the demise of Fraser and Chalmers (MC International Projects) Van Eck and Lurie (Pty) Ltd, a local South African Mineral Processing company started to expand the range of these units and in 1967 supplied its first 'Modular' 10tph DMS unit to Brazil Diamante (later acquired by Trans Hex) for its West Coast operations in Namaqualand near Hondeklip Baai. All the 'modules' supplied up to that point in time did not have a capacity larger than 20tph. (Refer fig.2)

THE 'EXPANSION' OF THE CONCEPT

In 1978 Van Eck and Lurie (Pty) Ltd was acquired by E L Bateman Limited (ELB) as an enhancement to their existing activities in the mineral processing business. The 'Modular' plant business was set up as a strategic business unit within the Bateman organization, with a strategy to enhance and expand the 'Modular' plant business – not only in diamonds but also in other minerals such as coal, andalusite, iron ore and platinum which are often suitable for dense media separation. The 'Modular' business unit was staffed by a dedicated group of Process Engineers, Project Engineers, Draughtsmen, Buyers, Inspectors and Expeditors. During the next 25 years the range of available pre-designed DMS plants grew in capacity to cover throughputs from 1tph to 150tph. This range of plants proved successful up to the end of the century.

At the same time during that period it was decided to adopt the concept of 'modules' to the front end of the treatment plants (feed preparation) as well as to the final concentration in recovery of product (final recovery plant).

Numerous diamond plants were supplied which were completely 'Modular' with all the advantages of the pre-assembly and testing of the units undertaken in the workshop.

In providing the 'Modular Concept' to the total plant, a 3-tier containerised recovery plant 'module' was developed. This recovery plant was developed from proto-type plants that were supplied to the diamond mining companies in Brazil and Angola in 1989. The first 3-tier containerised recovery plant was supplied into the Yetwene Project in Angola where a complete plant with a ROM capacity of 120tph was supplied. The DMS unit was a 50tph DMS 'module'. (Refer Fig. 3 & Fig. 4)

As demand for the 'Modular' concept grew – the treatment plants capacities to treat larger tonnages at the request of the respective clients were designed and supplied. DMS units of 80, 100 and 150tph were designed and supplied to various diamond projects world wide.

For Transhex operations at Baken, two x 150tph DMS 'Modular' units were incorporated into the plant design to provide the New Baken Central Plant with a DMS capacity of 300tph. These pre-designed...
'modules' were incorporated into the unique design of the new plant – this is an example of how the 'Modular' units can be incorporated into a process plant design. The two DMS 'modules' were housed in a pre-designed portal framed structure, cutting down costs for the structural steel design and supply costs. Transhex's new plant has a run-of-mine capacity of 1200tph making it one of the largest alluvial treatment plants in the world. A similar installation was provided to De Beers Botswana where a 150tph DMS module was incorporated into a purpose designed plant. (Refer Fig. 5, Fig. 6 & Fig.7)

For the marine diamond mining industry, Bateman has undertaken some 13 installations on ocean going vessels utilizing a combination of 'Modular' and purpose designed plants. (Refer Fig.8 & Fig. 9)

THE CURRENT STATUS OF THE 'MODULAR' CONCEPT

To date, some 400 of these 'Modular' designed plants, mainly for Diamond Processing plants, have been supplied. These plants are operating in all the continents of the world. They form part of sampling plants, dump re-treatment plants, production plants, and are a combination of 'Modular' or purpose designed plants.

After the success of the 150tph DMS 'Modular' units, five of which have been supplied over the past five years, larger DMS 'Modular' units are being developed for respective clients.

Bateman is currently developing a 200tph DMS module for MIBA in the DRC. This unit forms part of a purpose design for the New NLK2 Kimberlite project. (Refer Fig.10)

On the 'containerisation' of the units, it was found that access and operational parameters were compromised in attempting to fit process plants into shipping containers – other than low capacity plants.

Development in Containerisation, especially for Recovery plant units, is based on the concept that the 'containerisation' should be custom designed to suit the plant space requirement. This concept is now being adopted to a new containerised grease recovery plant (Automated grease belt recovery unit).

On the 'infield' units for primary screening and crushing 'Modular' skid mounted units have been developed in combination with 'Modular' DMS units and containerised recovery plants.

The benefit of the supply of 'Modularisation' of process plants have been adopted by clients and other contracting companies who have seen the benefit of the 'idea'. Some companies have supplied various units on custom designed trailers, with a DMS plant of 100tph. Other companies have supplied 'Modular' units totally integrated into shipping containers.

For Bateman, the 'idea' of the 'Modular' plant has grown into a dedicated business unit of the group. As part of its service it provides a 24-hour consulting service back-up and manufacturers and supplies diamond density tracers. It has become a 'one stop shop' to the world wide diamond mining industry.

The high demand for these diamond 'Modular' DMS plants has encouraged Bateman to keep 'in stock' units of various capacities.

In Canada Bateman has supplied a complete 'Modular' diamond sampling plant for a Canadian client – Shore Gold. This plant will be operating as a lease plant into the Canadian diamond mining market. (Refer Fig. 11 & Fig. 12)

Water recovery is usually a problem for sites in arid areas. To minimize the use of water, modularized
high rate thickening units have been developed. In the case of a client in the permafrost areas of Russia, such a thickener was designed to fit inside a standard container, tilted upright and insulated against temperatures of -40°C.

Like water, electrical power is seldom freely available at remote diamond sites. Containerised, fully automatic diesel generating units are supplied and which are sized to cater for the plant electricity demands as well as for camp and infrastructure requirements. In most instances, electrical switchgear and MCC’s are also containerised and fully tested prior to dispatch to site.

A trend which appears to be developing, especially in the case of marginal deposits, is for the client to embark on a low CAPEX, small ‘Modular’ plant which is suitable for prospecting but, when the reserve is proved, this plant is incorporated into a larger production unit. This requires a special skill of projecting a design into the future – with short term economics and longer term adaptability for production. (Refer Fig. 13, Fig. 14 & Fig. 15)

ADVANTAGES OF THE ‘MODULAR’ CONCEPT:

- Most of the plant pre-assembled and tested in works. DMS and diamond recovery ‘modules’ fully erected and tested in works.
- Ease of erection on site – cutting down erection time on site.
- Cost effective due to pre-design of ‘modules’.
- Reliability of equipment selected in the ‘Modular’ units – low maintenance.
- Minimum concrete foundation – DMS module supplied with fabricated spillage sumps (optional)
- Short delivery times.
- Compact ‘Modular’ units. (Refer Fig. 16)
- Can easily be installed into existing plants – due to the flexibility of the 40 & 50tph DMS module (Feed preparation module flexible).
- ‘Modules’ can easily be moved to other sites.
- Good resale value due to demand by the Diamond Mining industry. (Refer Fig. 17)
- ‘Modular’ DMS units proven and tested in various operations.

CONCLUSION

The concept of providing diamond treatment plants in ‘modules’ has proven itself not only to Bateman, but also to similar contracting companies providing the same technology.
References:


Fig. 1 – Advert for Mk IV Fraser & Chalmers Heavy Media Separation

Fig. 2 – First 10 tph HMS Module supplied in 1967 by van Eck & Lurie to Brazil Diamante
Fig. 3 - A modular X-ray separation recovery plant which forms part of the modular process plant supplied to Koidu mine in Sierra Leone.

Fig. 4 - Diamond Work's containerised X-ray diamond recovery plant in Angola, in the left foreground of the picture.

Fig. 5 - Two x1500ph DMS modules for Transhox - fully assembled in the workshop.
Fig. 6 - Overall view of Transhex Baken plant with DMS housing in centre of picture.

Fig. 7 - 150tph modular DMS plant trial erected at workshop for the Damtshaa mine – De Beers Botswana

Fig. 8 - The MV Ivan Prinsep at sea off Cape Town undergoing sea trials – Supplied with a 50TPH DMS module.
Fig. 9 - Namco's MV Kovambo at sea equipped with Bateman Modular Plants.

Fig. 10 - MIBA's 400 tph Kimberlite process plant at Mbuji mayi, DRC

Fig. 11 - Pre-assembly in workshop of Shore Gold bulk sampling plant for Canada
Fig. 12 – Shore Gold’s diamond X-ray recovery plant pre-erected in workshop.

Fig. 13 – Plant installed at Central Mines Dump Sampling Facility at the Jagersfontein Mine.

Fig. 14 – The DMS module for Central Mines Dump Sampling facility – pre-erected in workshop.
Fig. 15 - Aquamator module pre-erected in workshop in which grass and vegetation are removed from the material to be fed to the DMS plant – Jagersfontein Mine – Dump Sampling facility.

Fig. 16 - 20tph DMS for El Hillal Tanzania during construction

Fig. 17 - 50tph modular DMS unit for Namib Resources on the Skeleton Coast complete with spillage sump (Refurbished)