

### **New Narrow Gauge Steam Locomotives of the Series 99.10xx (1'D1'h2t)**

(With a featured German Look)

Old steam locomotives are very popular with the public. They bring more prestige and a higher profile to the operating companies, as well as higher passenger numbers and hence more revenue. Yet because of their high operating costs and their substantial maintenance expenses, the economic success of steam engines is always hampered. Often railways seek the cheap way out and rationalize to diesel traction, which brings lower operating costs, but at the same time drastically less passenger frequency and significantly reduced income. As a result of this kind of a lose-lose situation, some railways even have to give up and end their operations altogether.

Modern steam technology, however, represents the best way out of this kind of dilemma. In the 1980s an innovative team of Swiss engineers, now associated with DLM AG, realized that the disadvantages attributed to steam traction were a matter of old age, not of the thermodynamic system. Modern steam hence eliminates the economic disadvantages without sacrificing the general attractiveness of steam.

DLM AG delivers modern, economically efficient and ecologically friendly steam locomotives for standard as well as narrow gauge lines. The concept and solution of modern steam has particularly proven itself successful on mountain rack railway lines, where the modern steam locomotives not only enjoy significantly higher popularity with the public, but also out-perform the existing diesel locomotives in both economic and ecological terms.

Modern steam locomotives feature the following advantages:

- One man operation (no fireman required)
- Short preparation time
- Clean combustion and excellent emission values thanks to oil firing with light heating oil (no smoke exhaust)
- Great fuel economy and low use of water
- Full insulation of the boiler, the cylinders and the steam piping
- No sparks, no danger of line side fires
- Mechanical lubrication, no need to lubricate during train operation
- Large operational radius and area of deployment
- Low stand-by losses
- Low maintenance costs

Compared to diesel traction, modern steam is superior in the following areas:

- Higher attractiveness for passengers, resulting in higher passenger numbers
- More revenues
- Better marketing opportunities for rail company sales department
- Higher profile for operating rail company
- Less pollution and cleaner exhaust
- Less noise and more pleasant sound from the locomotive and the steam whistle
- Better performance, higher durability and longer life

In general, a modern steam locomotive of 700 kW power is superior to a 1000 kW diesel locomotive (Diesel locomotive manufacturers state the power of the diesel engine on the test bed under ideal conditions, neglecting transmission losses and auxiliaries).

The steam locomotive series 99.10xx is designed for gauges between 750 and 1067mm. Thanks to a modular concept, the locomotives can be individually adapted to the specifications and needs of the customers. DLM also offers to equip the locomotives with the following, optional features:

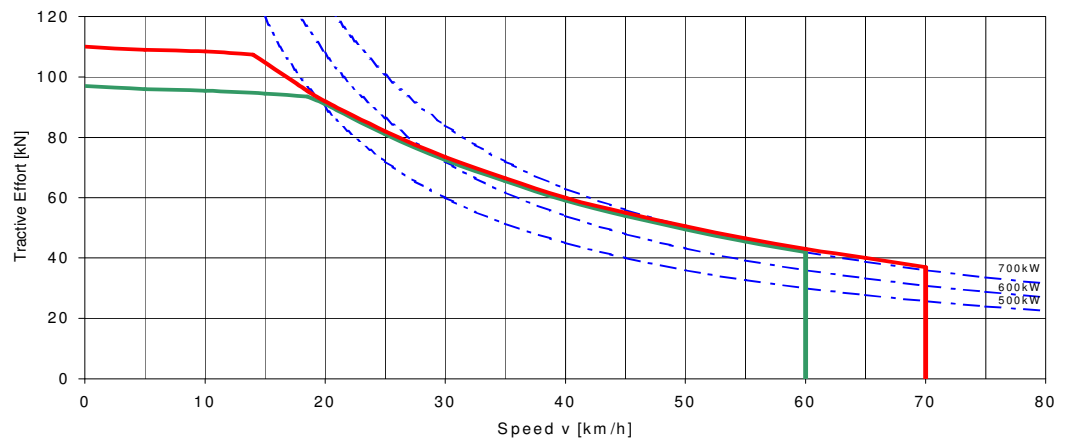
- Counter-pressure brake for wear-free braking on long and steep gradients
- Remote control of the locomotive from a driving trailer on push-pull trains

You may find additional locomotive types and steam engine designs on our website under [www.dlm-ag.ch](http://www.dlm-ag.ch) or through direct inquiry.

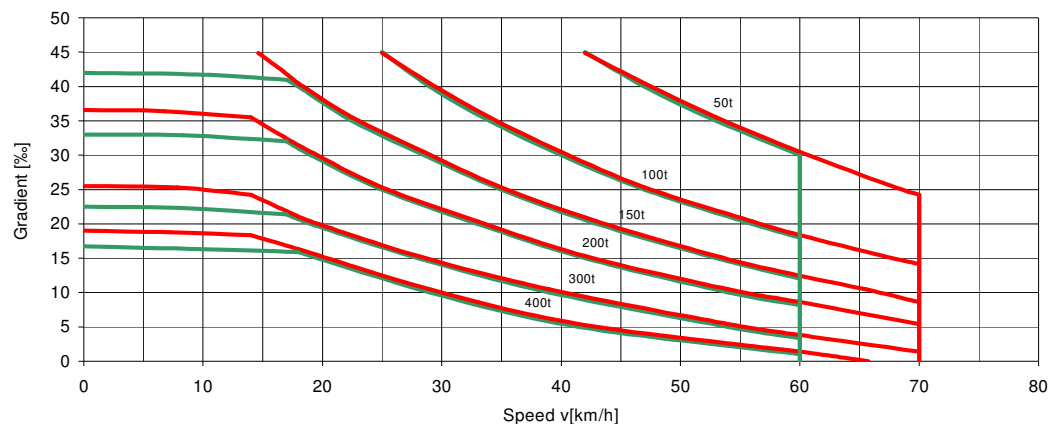
### Technical Data

|  |          |          |                |
|--|----------|----------|----------------|
| Gauge                                    | 750/760  | 900-1067 | mm             |
| Weight on driving wheels                 | 12.5     | 12.5     | t              |
| Classification                           | 1'D1'h2t | 1'D1'h2t |                |
| Maximum speed                            | 60       | 70       | km/h           |
| Maximum tractive effort at the wheel rim | 97       | 110      | kN             |
| Maximum power at the wheel rim           | 700      | 700      | kW             |
| Diameter of coupled wheels               | 1100     | 1100     | mm             |
| Boiler operating pressure                | 14       | 16       | bar ü          |
| Stroke                                   | 600      | 600      | mm             |
| Cylinder diameter                        | 410      | 410      | mm             |
| Piston valve diameter                    | 220      | 220      | mm             |
| Overall mass with 2/3 supplies:          |          |          |                |
| Adhesion                                 | 50       | 50       | t              |
| Overall                                  | 62       | 62       | t              |
| Supplies: Water                          | 9        | 9        | m <sup>3</sup> |
| Fuel                                     | 1.8      | 1.8      | m <sup>3</sup> |
| Sand                                     |          |          |                |
| Maximum gradient, forwards and backwards | 45       | 45       | 0/00           |
| Narrowest curve radius                   | 50       | 50       | m              |
| Overall wheelbase                        | 8300     | 8300     | mm             |
| Length over buffers                      | 11300    | 11300    | mm             |
| Largest height                           | 3570     | 3570     | mm             |
| Largest width                            | 2400     | 2600     | mm             |

### Tractive Effort versus Speed



### Load and Speed on Gradients



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