

Daimler AG

# Mercedes-Benz Unimog U400

Fuel consumption when mowing road grass verge

## DLG Test Report 5811 F



Figure 1:  
Unimog U 400  
during simulated  
mowing work



### Brief description

As a universal implement carrier, Unimog model U 400 is frequently used for mowing road verges along Federal highways and motorways with combined edge strip and embankment mowing implements.

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Figure 2:  
Unimog U 400 with edge strip and embankment mowing implement

## Content of the test

The fuel consumption during mowing work was simulated in the DLG Test Centre's Powermix process using the dynamometer car.

For comparison purposes, the same measurement drives were carried out with three agricultural tractors. In the result tables, the comparison

tractors are designated reference 1 to reference 3. In this case, references 1 and 3 are standard tractors with an output range from 110 to 120 kW and infinitely variable gearbox (emission level TIER II), whilst reference 2 is a system tractor in the output range of over 150 kW (emission level TIER III).

A U 400 with automated manual gearbox (electronic drive control) and hydrostatic auxiliary travel drive was used for the mowing work simulation.

## Evaluation – Short Version

| Tested criterion  | Test result  | Evaluation |
|---|--------------|------------|
| Specific fuel consumption during simulated mowing work with reference to the reference tractors |              |            |
| – In working range gear 6   | Very good    | ++         |
| – With hydrostatic gearbox in road gear 2, 100% pump slewing angle                              | Satisfactory | ○          |
| – With hydrostatic gearbox in road gear 3, 70% pump slewing angle                               | Good         | +          |

Evaluation scale: ++ / + / ○ / - / -- (○ = standard)

## Specifications

### Unimog U 400

|                                  |            |
|----------------------------------|------------|
| Rated engine power*              | 175 kW     |
| Rated speed*                     | 2200 1/min |
| Emission level                   | Euro4      |
| Kerb weight                      | 7090 kg    |
| Permissible gross vehicle weight | 12500 kg   |
| Permissible trailed load         | 27500 kg   |
| Wheel base                       | 3080 mm    |

\* Manufacturer specifications, measurement of pto power not possible due to technical test rig limitations

# Measuring Method

Both PTO output and hydraulic output were demanded from the Unimog and the reference tractors via the Powermix module for the fuel consumption measurements during simulated mowing work. The drawbar load was applied using the measuring vehicle. A cycle consisting of alternating loads, whose output requirements corresponded to those of a combined mowing implement (edge strip and embankment mower) with power take-off, was used for the measurement drives. In this case, the PTO output is usually transformed into hydraulic energy on the implement side to drive the mulching heads, whilst the vehicle's work hydraulics are used directly to control the boom movements.

The described cycle corresponds roughly to mowing work along an avenue or a Federal highway with guardrail (posts). In this case, the work hydraulics are pressurised at each obstacle (tree, post), when the booms are actuated to avoid the obstacles (grey curve). Whilst driving past the obstacle, the blade shaft output (PTO output) falls slightly (red curve). Whilst working on the flat, relatively low, constant drawbar load occurs due to the mulching heads' resistance in the vegetation (blue curve). The drawbar load only increases during the final third of the measurement

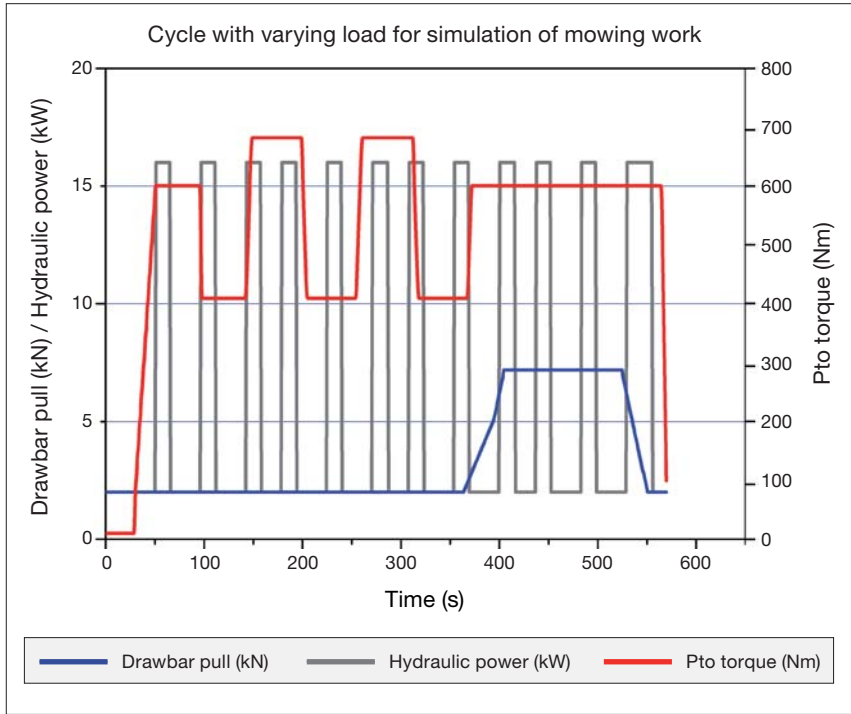


Figure 3: Cycle with varying load for simulation of mowing work

drive, falling back to the constant, basic load again at the end. This may, for example, be caused by a slight incline or decline (blue curve). The Powermix module was attached at the rear of the reference tractors, and at the front of the Unimog. The run-in phase in the cycle was not taken into consideration in evaluating and calculating the mean values. In practice, both the Unimog U 400 and tractors as of

approx. 110 kW can use this type of combination mower. The operational weights vary slightly in this case. To approximate the real operating conditions, both the Unimog and the tractors were ballasted up to their effective operational weight.

Table 1: Gross weight of the tractors for the mower simulation

|   | Reference 1 | Reference 2 | Reference 3 | Unimog U 400 |
|---|-------------|-------------|-------------|--------------|
| Gross weight with ballast and Powermix module | 10,330 kg   | 10,370 kg   | 9830 kg     | 10,325 kg    |

# Test results and individual evaluations

## Mowing work simulation

During the simulated mowing work, the Unimog was measured in 3 gearbox variants:

- Manual gearbox, working range gear 6
- Hydrostatic gearbox in road gear 2, 100% pump slewing angle
- Hydrostatic gearbox in road gear 3, 70% pump slewing angle

The engine speed was set to a practical PTO speed of approx. 700 rpm. The mean, resulting vehicle speed during the cycle was then approx. 5.3 km/h. In the case

of the reference tractors, the PTO speed was also set to approx. 700 rpm, the appropriate gearbox setting was selected for the corresponding vehicle speed.

Figure 4 shows that the specific consumption values achieved by the Unimog U 400 in all three gearbox settings are considerably lower than those of reference tractors 1 and 2. On average, they only differ insignificantly from the values of reference tractor 3.

Comparison of the absolute fuel consumptions shows that the Unimog's consumption does not deviate significantly from that of reference tractor 1, even in the most unfavourable gearbox setting,

"hydrostatic, 100% pump slewing angle", but lies significantly below the consumption achieved by reference tractor 2. Reference tractor 3 had the lowest rated output and therefore also the lowest fuel consumption. The different hourly consumptions in the case of the Unimog are attributable to the lower efficiency of the hydrostatic gearbox in comparison with the purely mechanical travel drive (gear L6).

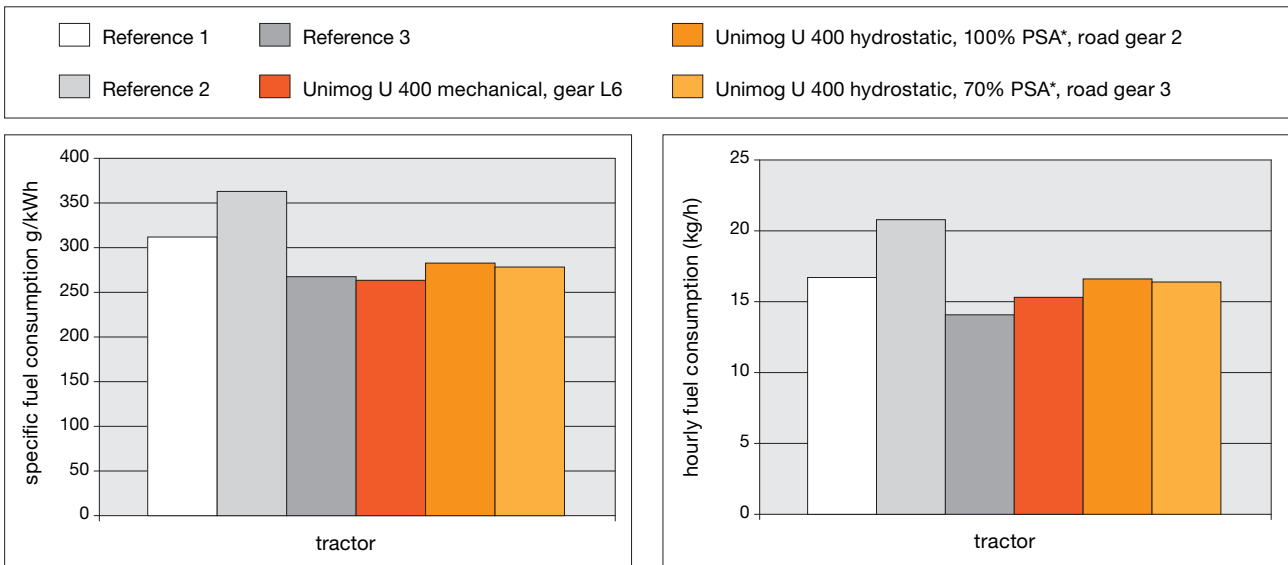


Figure 4: Mean specific fuel consumption over the cycle time during mowing work simulation\*\*

Figure 5: Mean hourly fuel consumption over the cycle time during mowing work simulation\*\*

\* PSA = pump slewing angle  
 \*\* Powermix-simulation, mean value of cycle



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## Summary and evaluation

In comparison with agricultural tractors measured under the same conditions, the mowing work simulation in the DLG-Powermix revealed fuel consumption for the Unimog U 400, which, depending on the gearbox setting, lay below

or just slightly above that of an economical tractor and significantly below that of a less economical tractor. These values are therefore evaluated as very good to satisfactory.

## Test

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