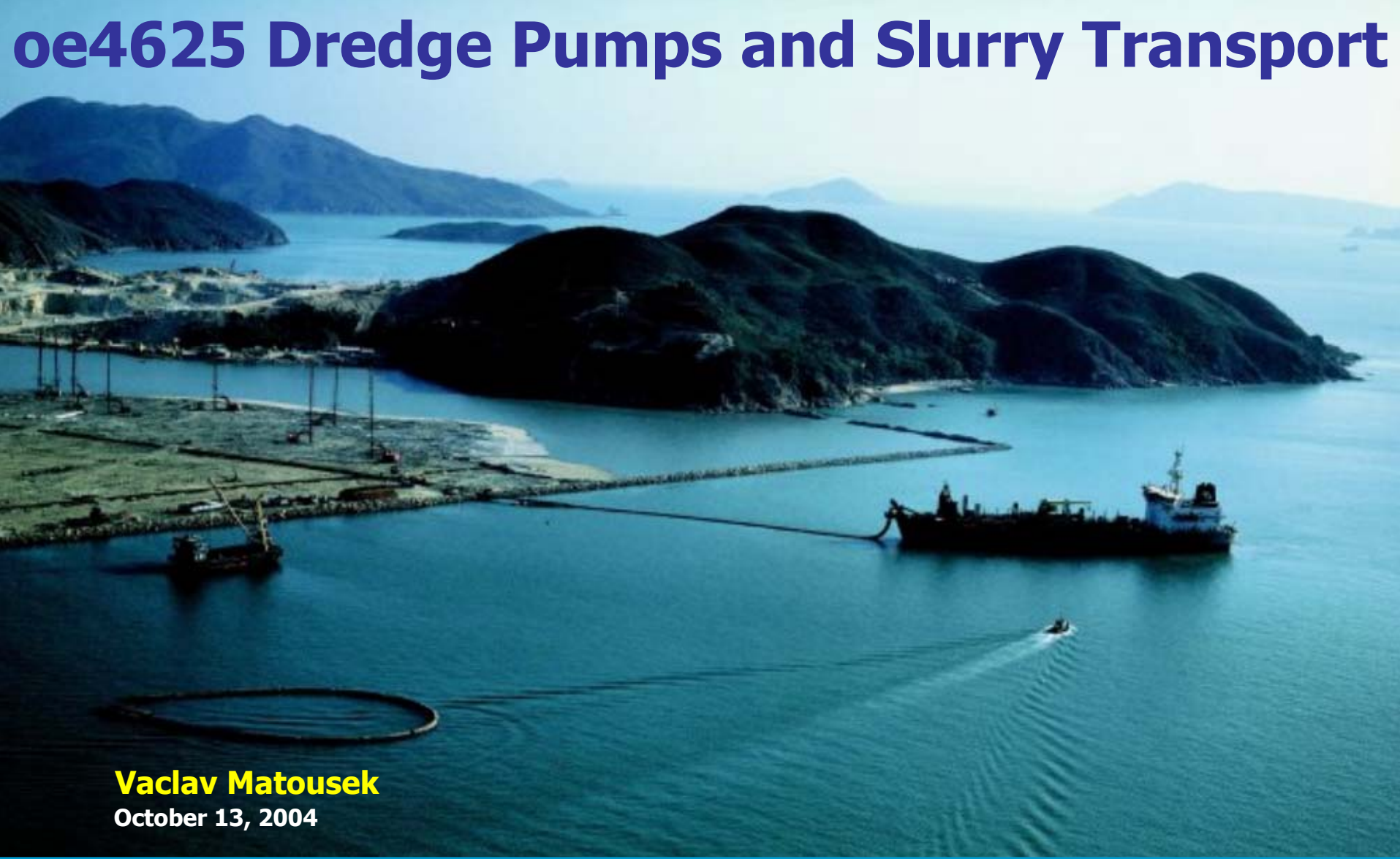
oe4625 Dredge Pumps and Slurry Transport



Vaclav Matousek

October 13, 2004

10. SYSTEMS WITH PUMPS IN SERIES

OPERATIONAL RULES

CHARACTERISTICS OF SET OF PUMPS

LOCATION OF BOOSTERS ALONG PIPELINE

OPERATIONAL RULES

In a set of pumps in series the first pump serves usually as "*the suction pump*" (Dutch: zuigpomp) and the pumps behind the suction pump as "*the delivery pumps*" (Dutch: perspompen).

A suction pump is supposed to handle low suction pressure at its inlet (the pump must have a high decisive vacuum) and provides only a low delivery pressure.

Delivery pumps operate at higher suction pressure values and provide higher manometric head than a suction pump.

OPERATIONAL RULES

A typical example of a set of pumps:

- an installation with a submerged pump on a dredge ladder and one or two on-board dredge pumps.

The submerged pump acts as a suction pump and the on-board dredge pump(s) as delivery pump(s) for a long delivery pipeline.

CHARACTERISTICS OF SET OF PUMPS

Pumps operating in series should be **compatible**, i.e.:

- to be designed for the same working range of flow rates
- to have similar shape of the Q-H curve
- to have virtually identical position of the nominal full-torque
- to have passages and connections of similar dimensions (passages of boosters should be at least of the same size as that of a first pump).

CHARACTERISTICS OF SET OF PUMPS

For certain flow rate Q_m through the system:

The manometric head of all pumps (of the set of pumps)

$$H_{man,total} = \sum_{i=1}^{n} H_{man,i}$$

The manometric pressure

$$P_{man,total} = \sum_{i=1}^{n} P_{man,i}$$

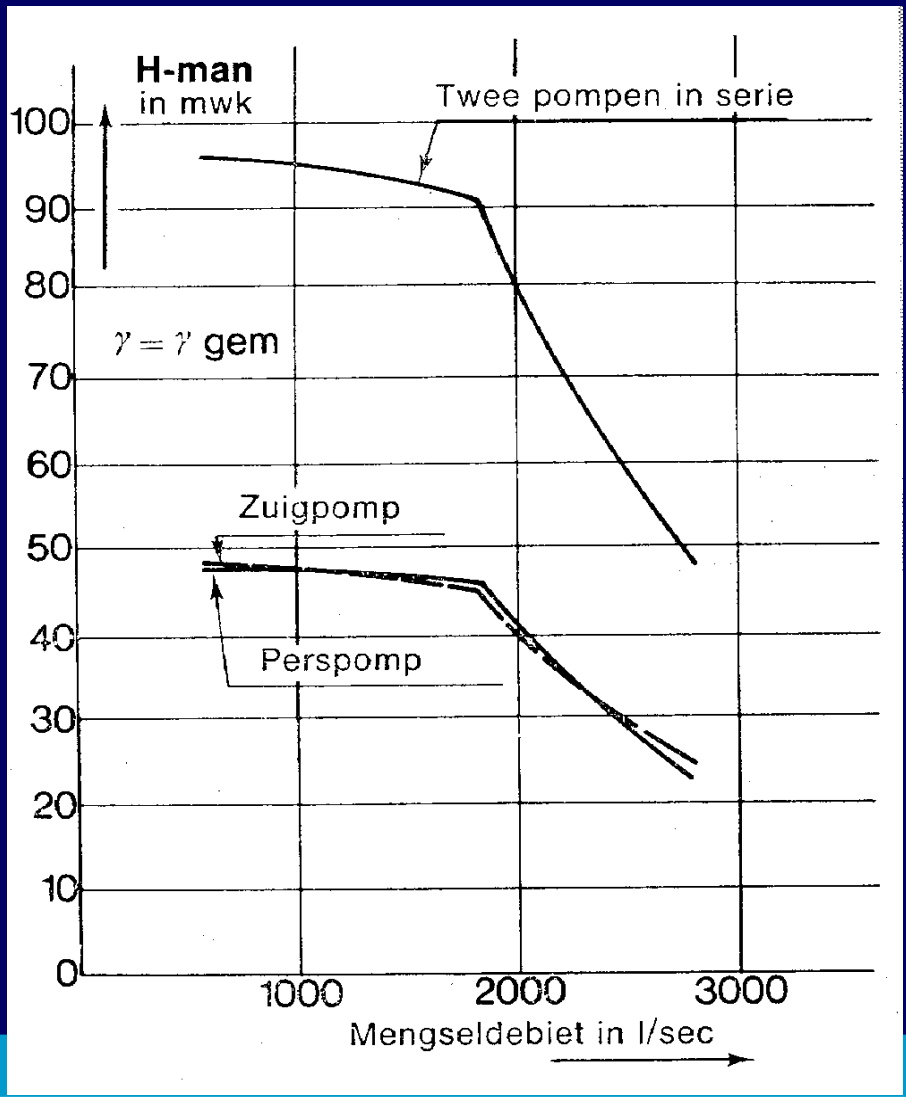
The input power

$$W_{in,total} = \sum_{i=1}^{n} W_{in,i}$$

The efficiency of the set of pumps

$$\eta_{total} = \frac{Q_m \sum_{i=1}^{n} P_{man,i}}{\sum_{i=1}^{n} W_{in,i}}$$

CHARACTERISTICS OF SET OF PUMPS



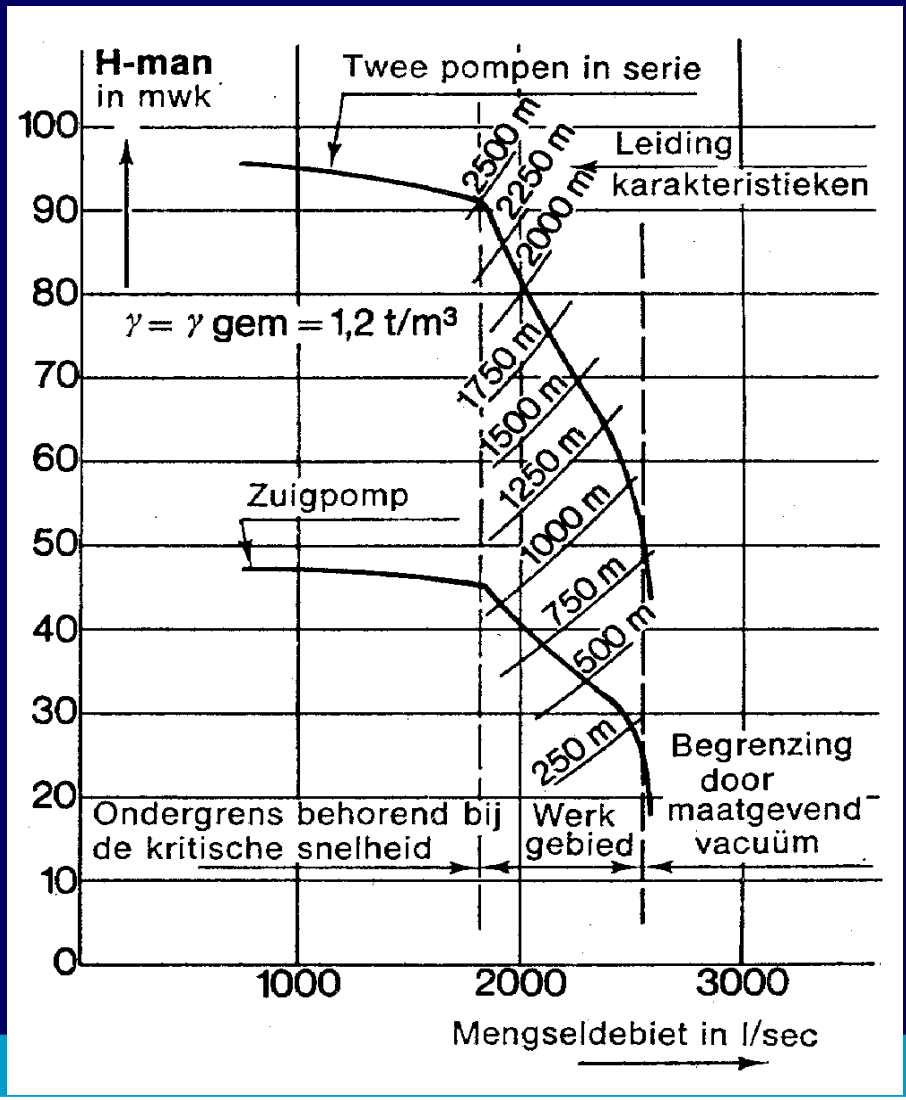
The total manometric head provided by a set of pumps in series

is equal to

the sum of manometric heads of particular pumps for a given flow rate.

Figure. H – Q characteristic for two pumps in series.

CHARACTERISTICS OF SET OF PUMPS

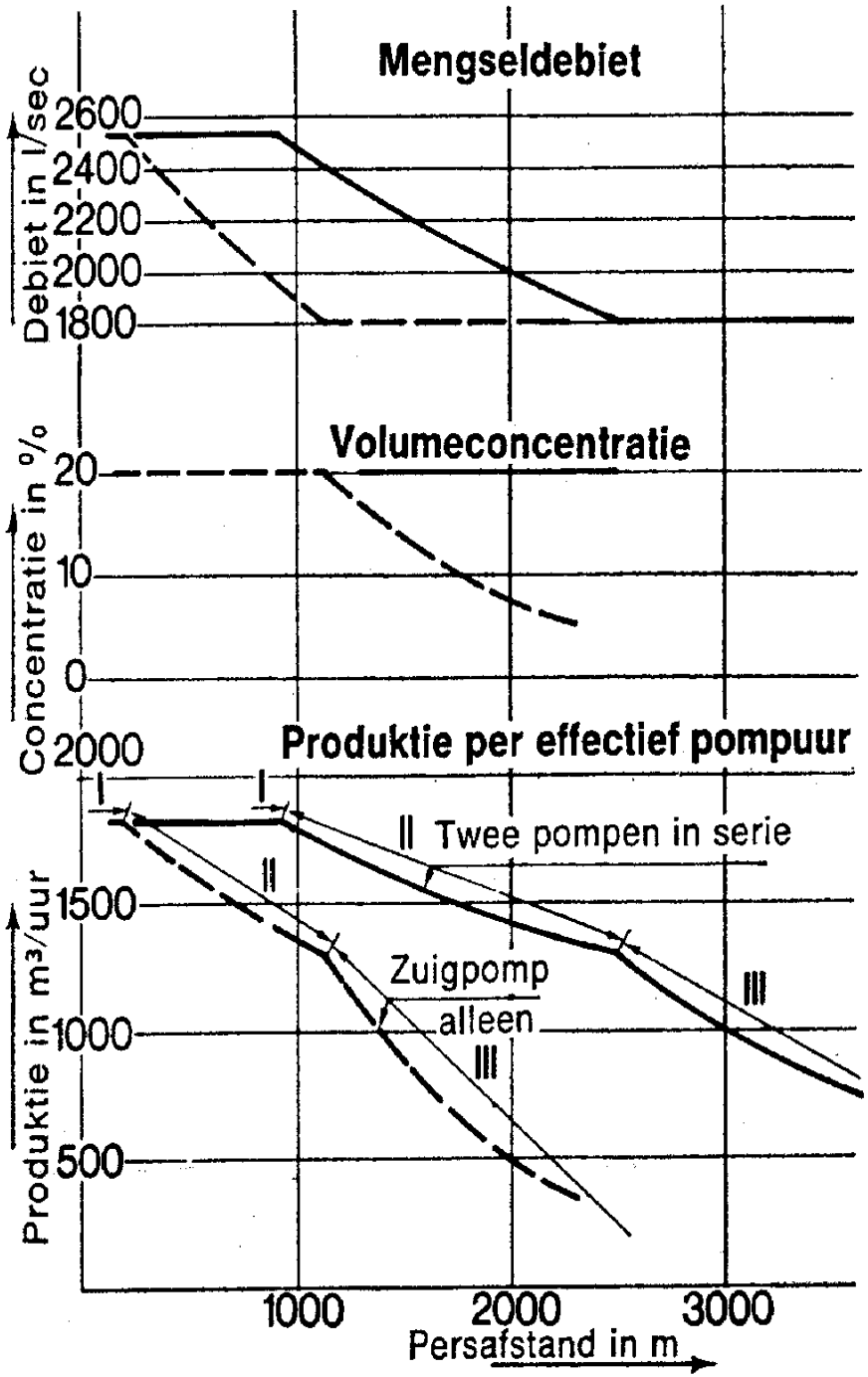


The working point of a twin-pump - pipeline installation

is given by

a point of intersection between the twin-pump characteristic and the pipeline characteristic.

Figure. Working points for different pump-pipe installations.



CHARACTERISTICS

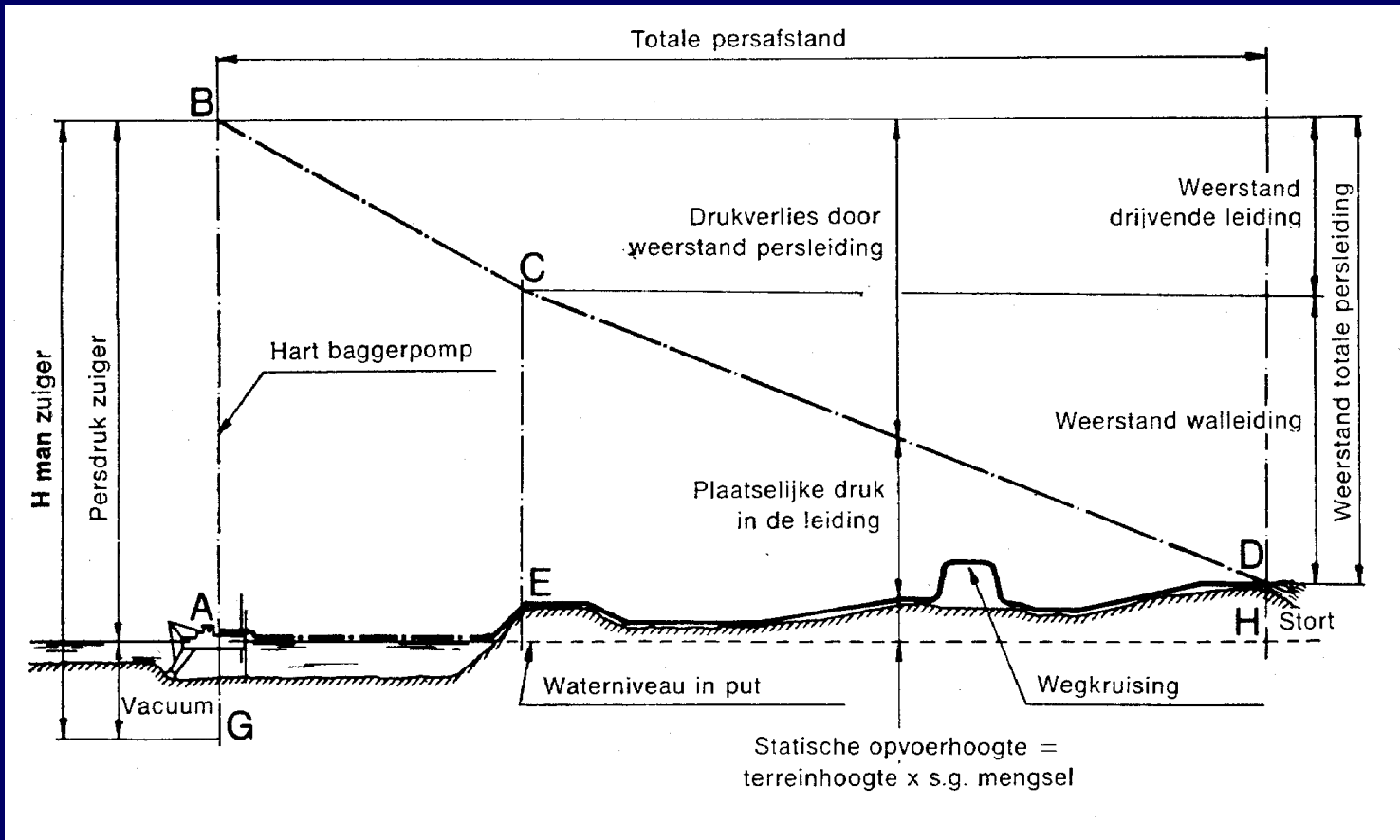
If a second pump is installed, both the production of the system and the potential delivery distance increase significantly.

Figure. Production as a function of a pipeline length for installations with a single pump, a set of two pumps respectively.

TU Delft

LOCATION OF BOOSTERS ALONG PIPELINE

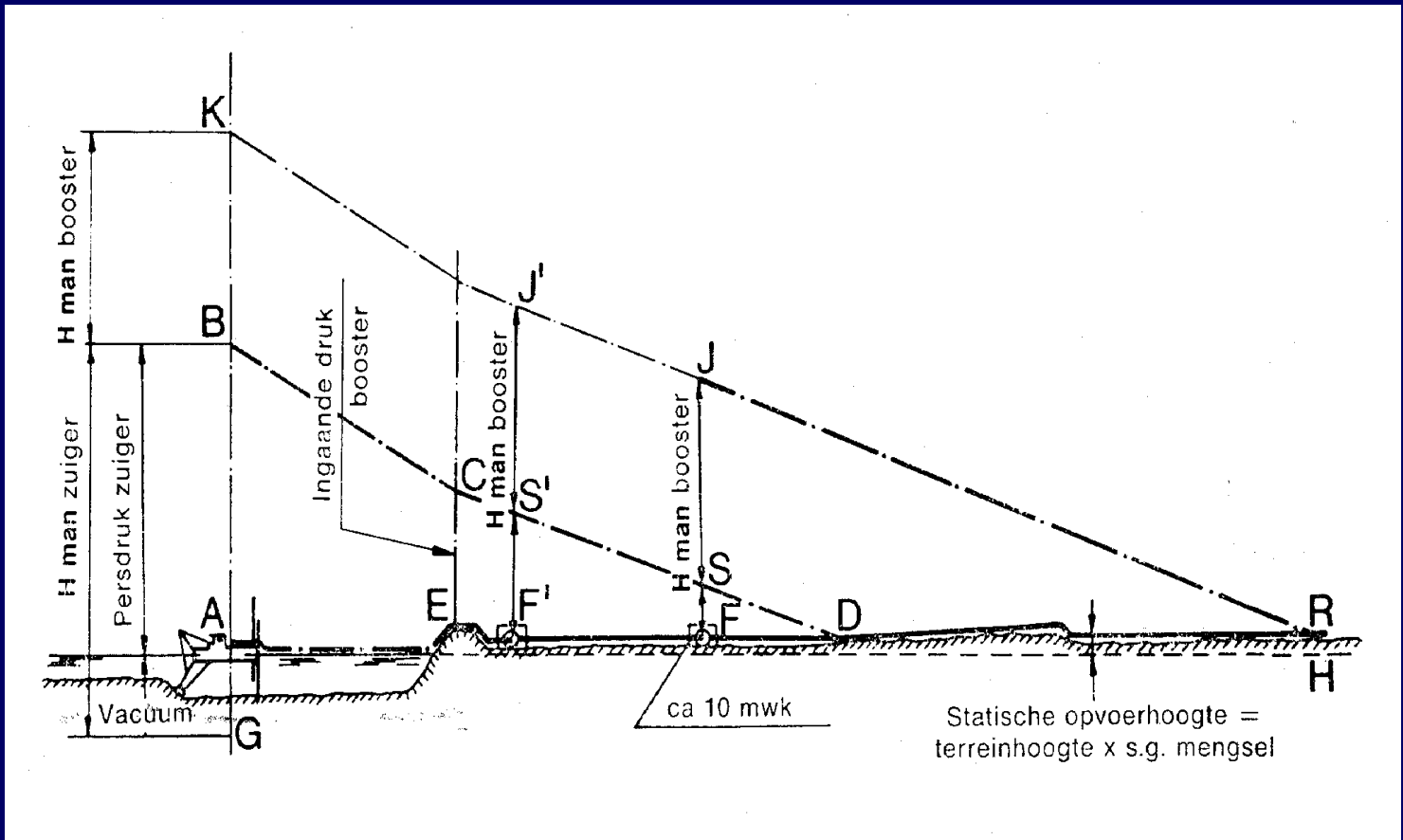
SYSTEM WITH NO BOOSTERS



October 13, 2004 **Pressure head distribution along a pipeline without a booster.** 10

LOCATION OF BOOSTERS ALONG PIPELINE

SYSTEM WITH TWO BOOSTERS



October 13, 2004 **Pressure head distribution along a pipeline with two boosters.** 11