Duty

For duty which is less than continuous, a shunt need not be rated as high as a straight calculation based on resistance and voltage or current would indicate.

If, for instance the shunt is repeatedly energized for a short period (not to exceed 5 minutes)… a conservative rating may be obtained as follows:

$K1 = \sqrt{D}$
$P_{puls} = P_{max} / K1$
$P_{max} = P_{rated} \times 0.66$
P_{max} = maximum continuous power
P_{rated} = catalog rated power
P_{puls} = maximum pulsating power

where D is the ratio of ON time to the total period.

For surge and pulse service a different approach must be used. In these cases it is necessary to provide enough thermal mass to absorb the energy to be dissipated and be sure that the construction of the shunt is adequate to accommodate the peak power. Therefore, it is recommended that a complete description of the pulse/surge wave shape or circuit constants and operating conditions be submitted to the CSI Engineering Department for the selection of a suitable shunt.

Example: A 800 Amp 500mV shunt is energized for 15 seconds of each minute.
$D = 15 / 60 = 0.25$ and $K1 = \sqrt{0.25} = 0.5$ thus,
$P_{rated} = 800 \times 0.05 = 40$ watts
$P_{max} = P_{rated} \times 0.66 = 40 \times 0.66 = 26.4$ watts
$P_{puls} = P_{max} / K1 = 26.40 / 0.5 = 52.8$ watts
therefore this shunt can be loaded up to 910 Amps.

Ambient

If the ambient temperature of the area in which the shunt is to operate exceeds the ambient Reference Test Conditions, a de-rating factor must be applied to prevent the manganin temperature from going above the safe limit of 125°C. The following formula may be used to find the de-rating power.

$P_{out} = P_{max} \times (1-T/A)$
$P_{max} = P_{rated} \times 0.66$

where T is the difference between the rated and operating ambient temperatures, A is the rise allowed above the rated ambient and Pmax is the Pout at 25°C.

Example: If a 150 Amp 50 mV shunt is to operate in a 100°C ambient, what is the maximum load?
100°C is 75 degrees above the ambient, so T = 75°C, and the rated rise A is 100°C.
Therefore: $P_{out} = P_{max} \times (1-75 / 100) = P_{max} \times 0.25$ $P_{max} = 0.66 \times P_{rated} = 0.66 \times (150 \times 0.05) = 4.95$ watts
P_{out} for an ambient of 100°C is $P_{out} = 4.95 \times 0.25 = 1.23$ watts,
60 Amps will be the maximum load.