§ 33.72 Hydraulic actuating systems.

Each hydraulic actuating system must function properly under all conditions in which the engine is expected to operate. Each filter or screen must be accessible for servicing and each tank must meet the design criteria of §33.71.

§ 33.73 Power or thrust response.

The design and construction of the engine must enable an increase—

(a) From minimum to rated takeoff power or thrust with the maximum bleed air and power extraction to be
permited in an aircraft, without overt-
temperature, surge, stall, or other det-
rimental factors occurring to the en-
gine whenever the power control lever
is moved from the minimum to the
maximum position in not more than 1
second, except that the Administrator
may allow additional time increments
for different regimes of control oper-
ation requiring control scheduling; and

(b) From the fixed minimum flight
idle power lever position when pro-
vided, or if not provided, from not more
than 15 percent of the rated takeoff
power or thrust available to 95 percent
rated takeoff power or thrust in not
over 5 seconds. The 5-second power or
thrust response must occur from a sta-
bilized static condition using only the
bleed air and accessories loads neces-
sary to run the engine. This takeoff
rating is specified by the applicant and
need not include thrust augmentation.

[Amdt. 33–1, 36 FR 5493, Mar. 24, 1971]

§ 33.74 Continued rotation.

If any of the engine main rotating
systems continue to rotate after the
engine is shutdown for any reason
while in flight, and if means to prevent
that continued rotation are not pro-
vided, then any continued rotation dur-
ing the maximum period of flight, and
in the flight conditions expected to
occur with that engine inoperative,
may not result in any condition de-
scribed in § 33.75(g)(2)(i) through (vi) of
this part.

[Amdt. 33–24, 72 FR 50867, Sept. 4, 2007]

§ 33.75 Safety analysis.

(a) (1) The applicant must analyze
the engine, including the control sys-
tem, to assess the likely consequences
of all failures that can reasonably be
expected to occur. This analysis will
take into account, if applicable:

(i) Aircraft-level devices and proce-
dures assumed to be associated with a
typical installation. Such assumptions
must be stated in the analysis.

(ii) Consequential secondary failures and latent failures.

(iii) Multiple failures referred to in
paragraph (d) of this section or that re-
sult in hazardous engine effects de-
defined in paragraph (g)(2) of this section.

(2) The applicant must summarize
those failures that could result in
major engine effects or hazardous en-
gine effects, as defined in paragraph (g)
of this section, and estimate the prob-
ability of occurrence of those effects.
Any engine part the failure of which
could reasonably result in a hazardous
engine effect must be clearly identified
in this summary.

(3) The applicant must show that
hazardous engine effects are predicted
to occur at a rate not in excess of that
defined as extremely remote (prob-
ability range of $10^{-7}$ to $10^{-9}$ per engine
flight hour). Since the estimated prob-
ability for individual failures may be
insufficiently precise to enable the ap-
plicant to assess the total rate for haz-
ardous engine effects, compliance may
be shown by demonstrating that the
probability of a hazardous engine effect
arising from an individual failure can
be predicted to be not greater than $10^{-8}$
per engine flight hour. In dealing with
probabilities of this low order of mag-
nitude, absolute proof is not possible,
and compliance may be shown by reli-
ance on engineering judgment and pre-
vious experience combined with sound
design and test philosophies.

(4) The applicant must show that
major engine effects are predicted to
occur at a rate not in excess of that de-
finied as remote (probability range of
$10^{-5}$ to $10^{-7}$ per engine flight hour).

(b) The FAA may require that any as-
sumption as to the effects of failures
and likely combination of failures be
verified by test.

(c) The primary failure of certain sin-
gle elements cannot be sensibly esti-
mated in numerical terms. If the fail-
ure of such elements is likely to result
in hazardous engine effects, then com-
pliance may be shown by reliance on
the prescribed integrity requirements of §§33.15, 33.27, and 33.70 as applicable.
These instances must be stated in the
safety analysis.

(d) If reliance is placed on a safety
system to prevent a failure from pro-
gressing to hazardous engine effects,
the possibility of a safety system fail-
ure in combination with a basic engine
failure must be included in the anal-
ysis. Such a safety system may include
safety devices, instrumentation, early
warning devices, maintenance checks,