ACS HELICOPTER MANEUVER SERIES · 19 OF 24

Vortex Ring State (VRS)

Area of Operation VIII — Emergency Operations

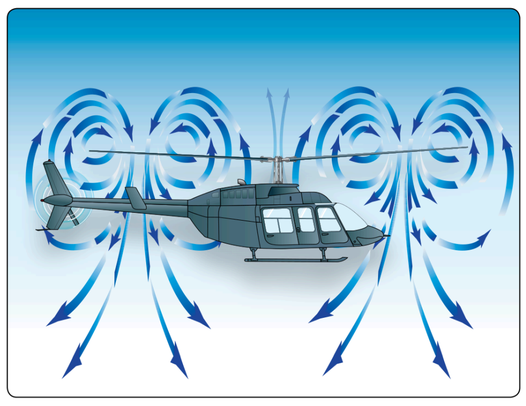
Private Pilot task PH.VIII.E **Commercial Pilot task** CH.VIII.E

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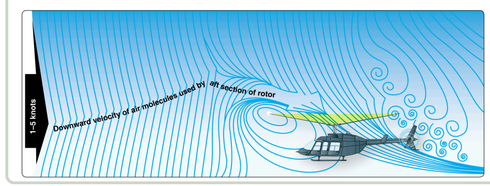
Objective. To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with main rotor Vortex Ring State (VRS).

HOW IT IS FLOWN

condensed from the FAA Helicopter Flying Handbook, Chapter 11 — Vortex Ring State



HFH Figure 11-3. *Vortex ring state.*



HFH Figure 2-39. *The airflow pattern for 1–5 knots of forward airspeed. Note how the downwind vortex is beginning to dissipate and induced flow down through the rear of the rotor disk is more horizontal.*

1. Formerly 'settling with power': a vertical descent with 20% up to full power applied and little or no climb performance — the rotor settles into its own downwash and the power goes into circulating a doughnut of air around the disk.
2. Conditions: (1) a vertical or nearly vertical descent of at least 300 fpm; (2) the rotor using 20–100% of engine power; (3) horizontal velocity slower than effective translational lift.
3. Typical setups: OGE hover without precise altitude control; approaches, especially steep approaches, with a tailwind; quick-stop type maneuvers; autorotation recoveries.
4. Recognition: shudder/turbulence, uncommanded pitch and roll oscillations, little or no collective authority, a sink rate that can approach 6,000 fpm if allowed to develop. Pulling collective only enlarges the stalled area and increases the descent.
5. Traditional recovery: forward cyclic to gain airspeed and/or partially lower collective to exit the vortex; complete when through ETL and a normal climb is established. Vuichard recovery: lateral cyclic thrust with an increase in power and lateral antitorque thrust — eliminates the descent rate rather than flying out of the vortex.
6. Training: recover no lower than 1,000 ft AGL or the manufacturer's altitude, whichever is higher. Recover at the first sign.

COMMON ERRORS — HFH LIST

- Too much lateral speed on entry (demonstration).
- Excessive decrease of collective (traditional).
- Excessive lateral cyclic; failure to maintain heading (Vuichard).
- Trying to arrest the descent with collective alone.

SKILLS — THE STANDARD

the applicant exhibits the skill to:

	PRIVATE · ACS-15	COMMERCIAL · ACS-16
S1	Complete the appropriate checklist(s).	
S2	Clear the area.	
S3	Select an altitude that allows recovery to be completed no lower than 1,000 feet AGL or as recommended by the manufacturer, whichever is higher.	
S4	Establish conditions leading to VRS entry.	
S5	Promptly recognize, announce, and recover at the first indication of VRS.	
S6	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.	

▢ Shaded rows are where the Commercial standard is tighter than Private. Unshaded rows apply to both certificates.

CHECKRIDE RULES — ACS APPENDIX 3

The evaluator must conduct a briefing with the applicant regarding the selection of a safe entry altitude, recognition of the onset of VRS, and recovery within the Task standards. The area must be free of obstructions should a landing become necessary.

KNOWLEDGE

PH.VIII.E.K1–K6 · the applicant demonstrates understanding of:

- Elements of vortex ring state.
- Effects of wind, weight, temperature, and density altitude.
- Requirements for the formation of VRS.
- Aerodynamics and indications of VRS.
- Flight scenarios under which VRS can occur.
- Effective recovery techniques.

RISK MANAGEMENT

PH.VIII.E.R1–R6 · identify, assess and mitigate risk associated with:

- Pilot recognition and response to VRS.
- Entering the maneuver at a lower altitude than planned.
- Application of power or exceeding powerplant limitations.
- Collision hazards.
- Distractions, task prioritization, loss of situational awareness, or disorientation.
- Loss of tail rotor effectiveness (LTE).

Standards: FAA-S-ACS-15 Private Pilot Helicopter and FAA-S-ACS-16 Commercial Pilot Helicopter (text reproduced from the current ACS). **References:** FAA-H-8083-2, FAA-H-8083-21, FAA-H-8083-25; POH/RFM.
Figures and technique: FAA Helicopter Flying Handbook, FAA-H-8083-21B — figures reproduced unmodified.
Always confirm tolerances against the ACS in force on your checkride date and procedures against the R44 POH/RFM.

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