

## 14.1 Aviation Fuel (AVGAS)

- Piston engine aircraft use a gasoline fuel known as AVGAS<sup>52</sup>.
- ☐ Grades and Colors: AVGAS is graded by its octane rating and is color-coded for identification.
- AVGAS 100LL (Low Lead): Blue, 100/130 rating.
- AVGAS 100 (High Lead): Green, 100/130 rating.
- ☐ Volatility: This is the fuel's ability to vaporize. High volatility is needed for starting, but too much can lead to vapor lock (fuel boiling in the lines) or carburetor icing<sup>53</sup>. As altitude increases, atmospheric pressure decreases, and the fuel's boiling point lowers<sup>54</sup>.
- ☐ Octane Rating: This is a measure of the fuel's resistance to detonation (knocking)<sup>55</sup>. It is not a measure of the fuel's energy content<sup>56</sup>. A higher octane rating allows for higher compression ratios and more power without detonation<sup>57</sup>. The rating is based on a comparison with reference fuels: Iso-Octane (rated 100) and Normal Heptane (rated 0)<sup>58</sup>.

## 14.2 Abnormal Combustion

- ☐ Detonation: This is a violent, uncontrolled explosion of the remaining unburnt fuel/air mixture ('end gas') in the cylinder after normal ignition<sup>59</sup>. It is caused by excessive heat and pressure. The flame front can accelerate to over 1,000 feet per second<sup>60</sup>.
- Effects: Detonation causes a sharp rise in cylinder pressure and temperature, leading to a metallic knocking sound ('pinking'), power loss, and can cause severe engine damage like burnt pistons and valves<sup>61</sup>.
- Causes: High charge temperature, incorrect (too advanced) ignition timing, poor cooling, and using a fuel with too low an octane rating<sup>62</sup>.
- ☐ Pre-Ignition: This is the ignition of the fuel/air mixture before the spark plug fires<sup>63</sup>. It is usually caused by a local hot spot in the combustion chamber, such as an incandescent carbon

- deposit or an overheated spark plug electrode<sup>64</sup>. It leads to rough running and significant
- power loss.
- ☐ Fuel Additives: Tetra Ethyl-Lead (T.E.L.) is added to fuel to increase its octane rating and
- prevent detonation<sup>65</sup>.

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