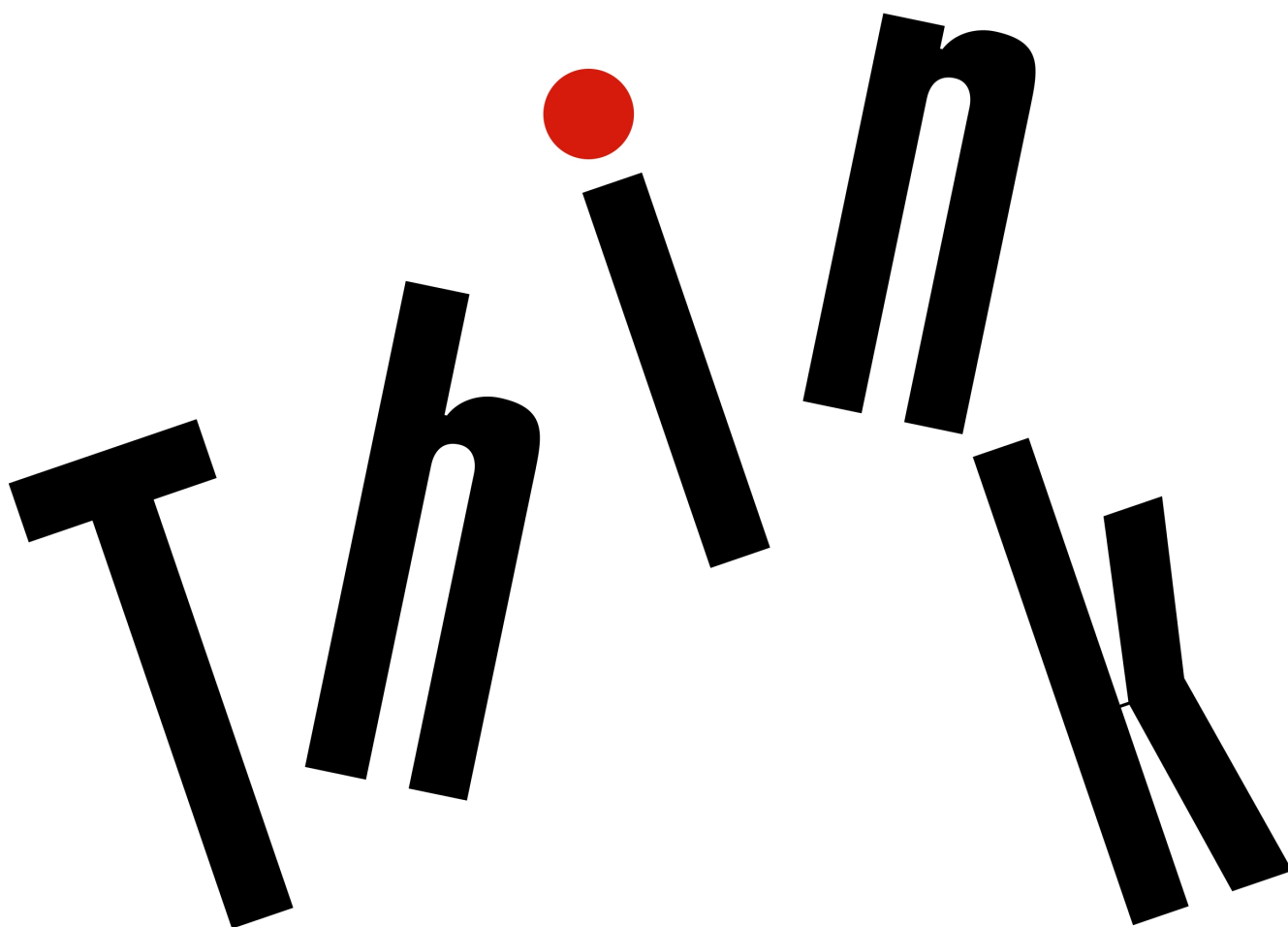# ThinkPad®

L560 Hardware Maintenance Manual

Note: Before using this information and the product it supports, be sure to read the general information under Appendix A "Notices" on page 109.

Contents

About this manual

This manual contains service and reference information for the following ThinkPad® notebook computer.

ThinkPad L560   Machine Type (MT): 20F1 and 20F2

Use this manual along with the advanced diagnostic tests to troubleshoot problems.

Important:

This manual is intended only for trained service technicians who are familiar with ThinkPad products. Use this manual along with the advanced diagnostic tests to troubleshoot problems effectively.
Before servicing a ThinkPad product, be sure to read all the information under Chapter 1 "Safety information" on page 1 and Chapter 2 "Important service information" on page 27.

Chapter 1. Safety information

This chapter presents following safety information that you need to be familiar with before you service a ThinkPad notebook computer.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.

- When lifting any heavy object:

    1. Ensure that you stand safely without slipping.

    2. Distribute the weight of the object equally between your feet.

    3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.

    4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any object that weighs more than 16 kg (35 lb) or that you think is too heavy for you.*

- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.

- Before you start the machine, ensure that other service technicians and the customer's personnel are not in a hazardous position.

- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.

- Keep your toolcase away from walk areas so that other people will not trip over it.

- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.

- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, about 8 centimeters (3 inches) from the end.

- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

    Attention: Metal objects are good electrical conductors.

- Wear safety glasses when you are hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.

- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.

- Reinstall all covers correctly before returning the machine to the customer.

- Fan louvers on the machine help to prevent overheating of internal components. Do not obstruct fan louvers or cover them with labels or stickers.

Electrical safety

Observe the following rules when working on electrical equipment.

Important:

Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.
Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.

- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.

- Disconnect all power before:
    - Performing a mechanical inspection
    - Working near power supplies
    - Removing or installing main units

- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine, and to lock the wall box in the off position.

- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
    - Ensure that another person, familiar with the power-off controls, is near you to switch off the power, if necessary.
    - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

        Attention: An electrical shock can occur only when there is a complete circuit. By observing the above rule, you can prevent a current from passing through your body.
    - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
    - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

    Observe the special safety precautions when you work with very high voltages; Instructions for these precautions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.

- Do not use worn or broken tools and testers.

- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered off.

- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.

- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.

- Do not service the following parts *with the power on* when they are removed from their normal operating places in a machine:
    - Power supply units
    - Pumps
    - Blowers and fans
    - Motor generators
    - Similar units to listed above

    This practice ensures correct grounding of the units.

- If an electrical accident occurs:

- Use caution; do not become a victim yourself.
- Switch off power.
- Send another person to get medical aid.

Safety inspection guide

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-ThinkPad features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock)
- Explosive hazards, such as a damaged CRT face or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

To determine whether there are any potentially unsafe conditions, use the following checklist at the beginning of every service task. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power off the computer. Disconnect the power cord.
3. Check the power cord for:
    a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
    b. The power cord should be the authorized type specified for your computer. Go to: http://www.lenovo.com/serviceparts-lookup.
    c. Insulation must not be frayed or worn.
4. Check for cracked or bulging batteries.
5. Remove the cover.
6. Check for any obvious non-ThinkPad alterations. Use good judgment as to the safety of any non-ThinkPad alterations.
7. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
8. Check for worn, frayed, or pinched cables.
9. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Handling devices that are sensitive to electrostatic discharge

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD.) ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Ensure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

  Note: The use of a grounding system to guard against ESD damage is desirable but not necessary.

  - Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
  - When working on a double-insulated or battery-operated system, use an ESD common ground or reference point. You can use coax or connector-outside shells on these systems.
  - Use the round ground prong of the ac plug on ac-operated computers.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Safety notices (multilingual translations)

The safety notices in this section are provided in the following languages:
- English
- Arabic
- Brazilian Portuguese
- French
- German
- Hebrew
- Japanese
- Korean
- Spanish
- Traditional Chinese

DANGER

Before the computer is powered on after FRU replacement, make sure that all screws, springs, and other small parts are in place and are not left loose inside the computer. Verify this by shaking the computer and listening for rattling sounds. Metallic parts or metal flakes can cause electrical short circuits.

DANGER

Some standby batteries contain a small amount of nickel and cadmium. Do not disassemble a standby battery, recharge it, throw it into fire or water, or short-circuit it. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

DANGER

The battery pack contains small amounts of nickel. Do not disassemble it, throw it into fire or water, or short-circuit it. Dispose of the battery pack as required by local ordinances or regulations. Use only the battery in the appropriate parts listing when replacing the battery pack. Use of an incorrect battery can result in ignition or explosion of the battery.

DANGER

The lithium battery can cause a fire, an explosion, or a severe burn. Do not recharge it, remove its polarized connector, disassemble it, heat it above 100°C (212°F), incinerate it, or expose its cell contents to water. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

DANGER

If the LCD breaks and the fluid from inside the LCD gets into your eyes or on your hands, immediately wash the affected areas with water for at least 15 minutes. Seek medical care if any symptoms from the fluid are present after washing.

DANGER

To avoid shock, do not remove the plastic cover that protects the lower part of the inverter card.

⚠

DANGER

Though the main batteries have low voltage, a short-circuited or grounded battery can produce enough current to burn personnel or combustible materials.

⚠

DANGER

Unless hot swap is allowed for the FRU being replaced, do as follows before removing it: power off the computer, unplug all power cords from electrical outlets, remove the battery pack, and disconnect any interconnecting cables.

⚠ خطر

قبل اعادة تشغيل الحاسب بعد الانتهاء من استبدال FRU، تأكد من أنه قد تم اعادة كل من المسامير و السوست وكل الأجزاء الصغيرة الأخرى في أماكنهم ولم يتم فقدهم داخل الحاسب.

ويمكن التحقق من ذلك عن طريق هز الحاسب والاستماع لأي صوت صاخب يصدر منه.

قد تؤدي الأجزاء أو الرقائق المعدنية الى حدوث دائرة قصر.

⚠ خطر

تحتوي بعض البطاريات الاحتياطية على كمية صغيرة من مادتي النيكل والكادميوم. لا تقم بفك أو اعادة شحن البطارية الاحتياطية ولا تقم أيضا بالقاءها في النار أو الماء ولا تتسبب في احداث دائرة قصر بها. قم بالتخلص من البطارية كما هو موضح في القوانين المحلية.

استخدم نوع البطارية المحدد والذي يوصى باستخدامه. حيث أنه قد يؤدي استخدام نوع بطارية غير صحيح الى اشتعالها أو انفجارها.

⚠ خطر

تحتوي حزمة البطارية على كمية صغيرة من مادة النيكل. لا تقم بفكها أو القاءها في النار
أو الماء ولا تتسبب في احداث دائرة قصر بها. تخلص من حزمة البطارية وفقا لما هو
موضح في القوانين المحلية. قم، عند استبدال حزمة البطارية، باستخدام الأنواع المحددة فقط
والتي يوصى باستخدامها. حيث أنه قد يؤدي استخدام نوع بطارية غير صحيح الى اشتعالها
أو انفجارها.

⚠️
خطر

قد تتسبب بطارية الليثيوم في حدوث حريق أو انفجار أو حدوث حروق شديدة. لا تقم
باعادة شحن البطارية أو ازالة موصل الاستقطاب الخاص بها ولا تحاول أيضا فكها
أو تسخينها لأكثر من ١٠٠ درجة منوية (٢١٢١ فهرنهايت) أو حرقها أو تعريض
محتويات الخانة الخاصة بها للماء. قم بالتخلص من البطارية وفقا لما هو موضح في
القوانين المحلية. استخدم نوع البطارية المحدد والذي يوصى باستخدامه. حيث أنه
قد يؤدي استخدام نوع بطارية غير صحيح الى اشتعالها أو انفجارها.

⚠️
خطر

اذا ما انكسرت شاشة LCD ولامس السائل الداخلي عينيك أو يديك، قم في الحال بغسلهما
بالماء لمدة لا تقل عن ١٥ دقيقة. اذا ما وجدت أي أعراض بعد الغسل اطلب عندئذ المساعدة
الطبية.

⚠️
خطر

لتجنب التعرض لأي صدمات، لا تقم بازالة الغطاء البلاستيكي الذي يحمي الجزء الأسفل
من بطاقة العاكس.

⚠️
خطر

على الرغم من أن البطاريات الرئيسية يكون لها جهد منخفض، الا أنه قد تقوم البطاريات
التي حدث قصور بها أو التي تم توصيلها أرضيا باصدار تيار يكفي لحدوث حروق للأفراد
أو تعرض المواد القابلة للاشتعال للحريق.

⚠️ خطر

ما لم يتم السماح بالتبديل الفوري لأي **FRU** الجاري استبداله بدون ضرورة اغلاق النظام، قم
بتنفيذ ما يلي قبل ازالته، قم بايقاف تشغيل الحاسب ونزع كل أسلاك الطاقة من المخارج الكهربائية
وقم أيضا بازالة حزمة البطارية ثم قم بفصل أي كابلات متصلة.

⚠️

PERIGO

Antes de ligar o computador após a substituição da FRU, certifique-se de que todos os parafusos, molas e outras peças pequenas estejam no lugar e não estejam soltos dentro do computador. Verifique isso sacudindo o computador e procurando ouvir sons de peças soltas. Peças metálicas ou lascas de metal podem causar curto-circuito.

⚠️

PERIGO

Algumas baterias reserva contêm uma pequena quantidade de níquel e cádmio. Não desmonte uma bateria reserva, recarregue-a, jogue-a no fogo ou na água, ou deixe-a entrar em curto-circuito. Descarte a bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

⚠️

PERIGO

O pacote da bateria contém uma pequena quantidade de níquel. Não o desmonte, jogue-o no fogo ou na água, ou deixe-o entrar em curto-circuito. Descarte o pacote da bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas ao substituir o pacote da bateria. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

⚠️

PERIGO

A bateria de lítio pode causar incêndio, explosão ou graves queimaduras. Não a recarregue, remova seu conector polarizado, desmonte-a, aqueça-a acima de 100°C (212°F), incinere-a, ou exponha o conteúdo de sua célula à água. Descarte a bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

PERIGO

Se o LCD quebrar e o fluido de dentro dele entrar em contato com seus olhos ou com suas mãos, lave as áreas afetadas imediatamente com água durante pelo menos 15 minutos. Procure cuidados médicos se algum sintoma causado pelo fluido surgir após a lavagem.

PERIGO

Para evitar choque elétrico, não remova a capa plástica que protege a parte inferior da placa inversora.

PERIGO

Embora as principais baterias possuam baixa voltagem, uma bateria em curto-circuito ou aterrada pode produzir corrente o bastante para queimar materiais de pessoal ou inflamáveis.

PERIGO

A menos que uma hot swap seja permitida para a FRU que está sendo substituída, faça o seguinte antes de removê-la: desligue o computador, desconecte todos os cabos de energia das tomadas, remova o pacote de baterias e desconecte quaisquer cabos de interconexão.

DANGER

Avant de remettre l'ordinateur sous tension après remplacement d'une unité en clientèle, vérifiez que tous les ressorts, vis et autres pièces sont bien en place et bien fixées. Pour ce faire, secouez l'unité et assurez-vous qu'aucun bruit suspect ne se produit. Des pièces métalliques ou des copeaux de métal pourraient causer un court-circuit.

DANGER

Certaines batteries de secours contiennent du nickel et du cadmium. Ne les démontez pas, ne les rechargez pas, ne les exposez ni au feu ni à l'eau. Ne les mettez pas en court-circuit. Pour les mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la pile de sauvegarde ou celle de l'horloge temps réel, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. Une batterie ou une pile inappropriée risque de prendre feu ou d'exploser.

DANGER

La batterie contient du nickel. Ne la démontez pas, ne l'exposez ni au feu ni à l'eau. Ne la mettez pas en court-circuit. Pour la mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la batterie, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. En effet, une batterie inappropriée risque de prendre feu ou d'exploser.

DANGER

La pile de sauvegarde contient du lithium. Elle présente des risques d'incendie, d'explosion ou de brûlures graves. Ne la rechargez pas, ne retirez pas son connecteur polarisé et ne la démontez pas. Ne l'exposez pas à une temperature supérieure à 100°C, ne la faites pas brûler et n'en exposez pas le contenu à l'eau. Mettez la pile au rebut conformément à la réglementation en vigueur. Une pile inappropriée risque de prendre feu ou d'exploser.

DANGER

Si le panneau d'affichage à cristaux liquides se brise et que vous recevez dans les yeux ou sur les mains une partie du fluide, rincez-les abondamment pendant au moins quinze minutes. Consultez un médecin si des symptômes persistent après le lavage.

DANGER

Afin d'éviter tout risque de choc électrique, ne retirez pas le cache en plastique protégeant la partie inférieure de la carte d'alimentation.

DANGER

Bien que le voltage des batteries principales soit peu élevé, le court-circuit ou la mise à la masse d'une batterie peut produire suffisamment de courant pour brûler des matériaux combustibles ou causer des brûlures corporelles graves.

DANGER

Si le remplacement à chaud n'est pas autorisé pour l'unité remplaçable sur site que vous remplacez, procédez comme suit avant de retirer l'unité : mettez l'ordinateur hors tension, débranchez tous les cordons d'alimentation des prises de courant, retirez le bloc de batterie et déconnectez tous les câbles d'interconnexion.

VORSICHT

Bevor nach einem FRU-Austausch der Computer wieder angeschlossen wird, muß sichergestellt werden, daß keine Schrauben, Federn oder andere Kleinteile fehlen oder im Gehäuse vergessen wurden. Der Computer muß geschüttelt und auf Klappergeräusche geprüft werden. Metallteile oder-splitter können Kurzschlüsse erzeugen.

VORSICHT

Die Bereitschaftsbatterie, die sich unter dem Diskettenlaufwerk befindet, kann geringe Mengen Nickel und Cadmium enthalten. Sie darf nur durch die Verkaufsstelle oder den IBM Kundendienst ausgetauscht werden. Sie darf nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Die Batterie kann schwere Verbrennungen oder Verätzungen verursachen. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Bereitschafts-oder Systembatterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

VORSICHT

Akkus enthalten geringe Mengen von Nickel. Sie dürfen nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

VORSICHT

Die Systembatterie ist eine Lithiumbatterie. Sie kann sich entzünden, explodieren oder schwere Verbrennungen hervorrufen. Batterien dieses Typs dürfen nicht aufgeladen, zerlegt, über 100°C erhitzt oder verbrannt werden. Auch darf ihr Inhalt nicht mit Wasser in Verbindung gebracht oder der zur richtigen Polung angebrachte Verbindungsstecker entfernt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

VORSICHT

Die Leuchtstoffröhre im LCD-Bildschirm enthält Quecksilber. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Der LCD-Bildschirm besteht aus Glas und kann zerbrechen, wenn er unsachgemäß behandelt wird oder der Computer auf den Boden fällt. Wenn der Bildschirm beschädigt ist und die darin befindliche Flüssigkeit in Kontakt mit Haut und Augen gerät, sollten die betroffenen Stellen mindestens 15 Minuten mit Wasser abgespült und bei Beschwerden anschließend ein Arzt aufgesucht werden.

VORSICHT

Aus Sicherheitsgründen die Kunststoffabdeckung, die den unteren Teil der Spannungswandlerplatine umgibt, nicht entfernen.

⚠️

VORSICHT

Obwohl Hauptbatterien eine niedrige Spannung haben, können sie doch bei Kurzschluß oder Erdung genug Strom abgeben, um brennbare Materialien zu entzünden oder Verletzungen bei Personen hervorzurufen.

⚠️

VORSICHT

Wenn ein Austausch der FRU bei laufendem Betrieb nicht erlaubt ist, gehen Sie beim Austausch der FRU wie folgt vor: Schalten Sie den Computer aus, ziehen Sie alle Netzkabel von den Netzsteckdosen ab, entfernen Sie den Akku und ziehen Sie alle miteinander verbundenen Kabel ab.

⚠️ סכנה

לפני הפעלת המחשב לאחר החלפת FRU יש לוודא שכל הברגים, הקפיצים, וחלקים קטנים אחרים נמצאים במקומם ואינם חופשיים לזוז בתוך המחשב. כדי לוודא זאת, יש לטלטל את המחשב ולהקשיב לגילוי קולות שקשוק. חלקי או שבבי מתכת עלולים לגרום לקצרים חשמליים.

⚠️ סכנה

סוללות המתנה מסוימות מכילות כמות קטנה של ניקל וקדמיום. אין לפרק סוללת המתנה, לטעון אותה מחדש, להשליך אותה לאש או למים או לקצר אותה. יש לסלק את הסוללה כנדרש על ידי התקנות והחוקים המקומיים. יש להשתמש רק בסוללה המופיעה ברשימת החלקים המתאימה. שימוש בסוללה לא מתאימה עלול לגרום להצתה או התפוצצות של הסוללה.

⚠️ סכנה

מארז הסוללה מכיל כמות קטנה של ניקל וקדמיום. אין לפרק את מארז הסוללה, להשליך אותו לאש או למים או לקצר אותו. יש לסלק את מארז הסוללה הסוללה כנדרש על ידי התקנות והחוקים המקומיים. יש להשתמש רק בסוללה המופיעה ברשימת החלקים המתאימה בזמן החלפת מארז הסוללה. שימוש בסוללה לא מתאימה עלול לגרום להצתה או התפוצצות של הסוללה.

סכנה

סוללת הליתיום עלולה לגרום לשריפה, להתפוצצות או לכוויות קשות. אין לטעון אותה מחדש,
לסלק את המחבר המקוטב שלה, לפרק אותה או לחמם אותה לטמפרטורה העולה על 100 מעלות
צלזיוס. אין לשרוף את הסוללה ואין לחשוף את תוכן התא למים. יש לסלק את הסוללה כנדרש
בתקנות ובחוקים המקומיים. יש להשתמש רק בסוללה המופיעה ברשימת החלקים המתאימים.
שימוש בסוללה אחרת עלול לגרום לסכנת שריפה או התפוצצות.

סכנה

אם מסך תצגיש תוזלי (LCD) נשבר והתוזל מתוך חמסך בא במגע עם עיניכם או ידיכם, שטפו את
האזורים הנגועים מיד במים במשך 15 דקות לפחות. פנו לקבלת עזרה רפואית אם תסמינים הנובעים
מהמגע עם הנוזל נמשכים לאחר חשטיפה.

סכנה

כדי למנוע התחשמלות, אין להסיר את מכסה הפלסטיק המגן על חלקו התחתון של הכרטיס
ההפוך.

סכנה

אף שהסוללות הראשיות הן בעלות מתח נמוך, סוללה מקוצרת או מוארקת עלולה להפיק זרם
מספיק לגרימת כוויות או להצתת חומרים דליקים.

סכנה

אלא אם כן מותרת יחחלפה חמחי של ה-FRU המוחלף, פעלו כדלהלן לפני חסרתו :
כבו את המחשב, נתקו את כל כבלי החשמל מהשקעים, הוציאו את מארז הסוללות ונתקו את כל הכבלים
המחוברים.

危険

FRU の交換後、 ThinkPad の電源を入れる前に、ねじ、バネ、その他の小さな部
品がすべて正しい位置にあり、また ThinkPad の内部で緩んでいないことを確認し
てください。
これを確認するには、 ThinkPad を振って、カチャカチャと音がしないか確かめま
す。金属部品や金属破片はショートの原因になることがあります。

⚠️

危険

予備バッテリーの中には少量のニッケルとカドミウムが含まれているものがあります。したがって、予備バッテリーの分解、再充電、火または水の中への投棄、またはショートさせることは決して行わないでください。バッテリーを廃棄する場合は地方自治体の条例に従ってください。適切なパーツ・リストにあるバッテリーだけを使用してください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

⚠️

危険

バッテリー・パックには少量のニッケルが含まれています。バッテリー・パックを分解したり、火または水の中に投げ込んだり、ショートさせないでください。バッテリー・パックの廃棄にあたっては、地方自治体の条例または規則に従ってください。バッテリー・パックを交換するときは、適切なパーツ・リストにあるバッテリーだけを使用してください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

⚠️

危険

リチウム・バッテリーは、火災、爆発、または重症のやけどを引き起こすことがあります。バックアップ・バッテリーの充電、その極性コネクターの取り外し、バッテリー本体の分解、
100℃ (212°F) 以上への加熱、焼却、電池の中身を水に浸すことはしないでください。バッテリーを廃棄する場合は地方自治体の条例に従ってください。適切なパーツ・リストにあるバッテリーだけを使用してください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

⚠️

危険

LCD が破損し、 LCD の中の液体が目に入ったり、手に触れたりした場合は、液体が触れた部分を少なくとも 15 分間洗い流してください。洗い流した後に、液体によって何らかの症状が現れた場合は、医師の治療を受けてください。

⚠️

危険

感電を防ぐため、インバーター・カードの下部を保護しているプラスチック・カバーを外さないでください。

⚠️

危険

メイン・バッテリーの電圧は低くても、ショートしたり、接地したバッテ
リーが、作業者にやけどを負わせたり、可燃物を燃やすだけの電流を発生さ
せる場合があります。

⚠️

危険

交換しようとしている FRU がホット・スワップに対応していない場合、それを
取り外す前に、コンピューターの電源をオフにし、すべての電源コードを
コンセントから抜き、バッテリー・パックを取り外して、相互接続している
ケーブルをすべて切り離してください。

⚠️

위험

FRU를 교체하고 나서 컴퓨터 전원을 켜기 전에 모든 나사, 스프링 및 기타
작은 부품들이 올바른 위치에 있는지, 컴퓨터 내부에 단단하게 연결되어 있
는지 확인하십시오. 컴퓨터를 흔들어 달깍거리는 소리가 나지 않는지 확인하
십시오. 금속 부품 또는 금속 조각은 누전을 일으킬 수 있습니다.

⚠️

위험

일부 보조 배터리에는 소량의 니켈 및 카트뮴이 포함되어 있습니다. 보조 배
터리를 분해하거나, 다시 충전하거나, 불 또는 물에 던지거나, 단락시키지 마
십시오. 배터리 팩을 폐기할 때에는 해당 지역의 법률 규정을 따르십시오. 배
터리 팩을 교체할 때에는 올바른 배터리만 사용하십시오. 올바르지 않은 배터
리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다.

⚠️

위험

배터리 팩에는 소량의 니켈이 포함되어 있습니다. 배터리 팩을 분해하거나,
불 또는 물에 던지거나, 단락시키지 마십시오. 배터리 팩을 폐기할 때에는 해
당 지역의 법률 규정을 따르십시오. 배터리 팩을 교체할 때에는 올바른 배터
리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나
폭발할 수 있습니다.

⚠️

위험

리튬 배터리는 화재, 폭발 또는 심각한 화상을 일으킬 수 있습니다. 리튬 배터리를 다시 충전하거나, 극성 커넥터를 제거하거나, 분해하거나, 100C(212F) 이상으로 가열하거나, 소각하거나, 전지 내용물을 물에 노출시키지 마십시오. 배터리를 폐기할 때에는 해당 지역을 법률 규정을 따르십시오. 올바른 배터리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다.

위험

LCD가 파손되어 LCD 내부의 액체가 눈에 들어가거나 손에 묻으면 즉시 깨끗한 물로 15분 이상 닦아 내십시오. 씻은 후에 조금이라도 이상을 느끼면 즉시 병원에 가서 의사의 진찰을 받아야 합니다.

위험

전기적 위험을 방지하려면 인버터 카드의 아래 부분을 보호하는 플라스틱 덮개를 제거하지 마십시오.

위험

기본 배터리의 전압은 낮지만, 단락되거나 접지된 배터리는 화상을 입히기에 충분한 전류와 가연성 물질을 발생시킬 수 있습니다.

위험

FRU 교체 시 Hot Swap이 지원되지 않는 경우, FRU를 제거하기 전에 컴퓨터의 전원을 끄고, 전기 콘센트에서 전원 코드를 분리하고, 배터리를 제거한 후, 연결된 모든 케이블을 분리하십시오.

PELIGRO

Antes de encender el sistema despues de sustituir una FRU, compruebe que todos los tornillos, muelles y demás piezas pequeñas se encuentran en su sitio y no se encuentran sueltas dentro del sistema. Compruébelo agitando el sistema y escuchando los posibles ruidos que provocarían. Las piezas metálicas pueden causar cortocircuitos eléctricos.

PELIGRO

> Algunas baterías de reserva contienen una pequeña cantidad de níquel y cadmio. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

PELIGRO

> Las baterías contienen pequeñas cantidades de níquel. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas al sustituir la batería. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

PELIGRO

> La batería de repuesto es una batería de litio y puede provocar incendios, explosiones o quemaduras graves. No la recargue, ni quite el conector polarizado, ni la desmonte, ni caliente por encima de los 100°C (212°F), ni la incinere ni exponga el contenido de sus celdas al agua. Deséchela tal como dispone la normativa local.

PELIGRO

> Si la LCD se rompe y el fluido de su interior entra en contacto con sus ojos o sus manos, lave inmediatamente las áreas afectadas con agua durante 15 minutos como mínimo. Obtenga atención medica si se presenta algún síntoma del fluido despues de lavarse.

PELIGRO

> Para evitar descargas, no quite la cubierta de plástico que rodea la parte baja de la tarjeta invertida.

PELIGRO

Aunque las baterías principales tienen un voltaje bajo, una batería cortocircuitada o con contacto a tierra puede producir la corriente suficiente como para quemar material combustible o provocar quemaduras en el personal.

PELIGRO

Salvo que se permita el intercambio en caliente para la unidad sustituible localmente, realice lo siguiente antes de extraerla: apague el sistema, desconecte todos los cables de alimentación de las tomas de alimentación eléctrica, extraiga la batería y desconecte los cables de interconexión.

危險

完成 FRU 更換之後，在開啟電腦的電源之前，請確定所有螺絲、彈簧及其他小零件都已歸位，沒有遺留在電腦內部。
若要確認這一點，請搖晃電腦，聽聽看是否有卡嗒的聲響。
金屬零件或儀錶的火花會造成電線短路。

危險

部分備用電池含有微量的鎳和鎘。請勿拆開備用電池、再充電、丟入火或水中，或使其形成短路。請按照當地法令或規定來棄置電池。

僅限使用零件清單中的電池。使用不適當的電池會導致電池起火或爆炸。

危險

電池套件含有微量的鎳。請勿拆開電池套件、丟入火或水中，或使其形成短路。
請按照當地法令或規定來棄置電池套件。

更換電池套件時，僅限使用零件清單中的電池。使用不適當的電池會導致電池起火或爆炸。

危險

鋰電池會導致起火、爆炸或嚴重燒傷。請勿再充電、拔除其電極接頭、拆開、
加熱超過 100°C (212°F) 、焚燒，或讓電池組成物浸到水。請按照當地法
令或規定來棄置電池。
僅限使用零件清單中的電池。使用不適當的電池會導致電池起火或爆炸。

⚠️
危險

如果 LCD 破裂導致 LCD 流出的液體沾到您的眼睛或手，請立即以清水沖洗沾
染部位至少 15 分鐘。如果在清洗後出現該液體所造成的任何症狀，請就醫治
療。

⚠️
危險

為避免電擊，請勿拆下轉換卡下面的塑膠護蓋。

⚠️
危險

雖然主電池的電壓很低，但短路或接地電池所產生的電流，仍足以使人燒傷或
使可燃物質起火。

⚠️
危險

除非 FRU 允許以熱抽換來替換，否則請依下列方式將其移除：將電腦關機，拔除插
座上所有電源線，移除電池包，並拔開任何交互連接的線材。

Laser compliance statement (multilingual translations)

The laser compliance statements in this section are provided in the following languages:
- English
- Arabic
- Brazilian Portuguese
- French
- German
- Hebrew
- Japanese
- Korean
- Spanish
- Traditional Chinese

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.

- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

تحذير:
عند تثبيت منتجات الليزر (مثل أقراص CD-ROM أو محركات تشغيل أقراص DVD أو أجهزة الألياف البصرية أو النواقل)، لاحظ ما يلي:

- لا تقم بنزع الغطاء. قد ينتج عن نزع غطاء منتج ليزر التعرض لأشعة ليزر في منتهى الخطورة. لا توجد أجزاء يمكن صيانتها داخل الجهاز.

- قد ينتج عن استخدام مفاتيح أو تنفيذ عمليات ضبط أو اجراءات بطريقة مختلفة عما هو محدد هنا التعرض لأشعة ليزر في منتهى الخطورة.

خطر

تحتوي بعض منتجات الليزر على صمام ثنائي ليزري مضمن من Class 3A أو Class 3B. لاحظ ما يلي.
توجد أشعة ليزر عند الفتح. لا تنظر للشعاع ولا تنظر بطريقة مباشرة باستخدام أدوات ضوئية وتجنب التعرض المباشر للشعاع.

CUIDADO:
Quando produtos a laser (como CD-ROMs, unidades de DVD, dispositivos de fibra ótica ou transmissores) estão instalados, observe o seguinte:

- Não remova as tampas. A remoção das tampas do produto a laser pode resultar em exposição prejudicial à radiação de laser. Não há peças que permitam manutenção no interior do dispositivo.
- A utilização de controles ou ajustes ou a execução de procedimentos diferentes daqueles especificados aqui pode resultar em exposição perigosa à radiação.

PERIGO

> Algumas produtos a laser contêm um diodo de laser Classe 3A ou Classe 3B integrado. Observe o seguinte:
>
> Radiação a laser quando aberta. Não olhe diretamente para o feixe a olho nu ou com instrumentos óticos e evite exposição direta ao feixe.

ATTENTION :
Si des produits laser (tels que des unités de CD, DVD, à fibre optique ou des émetteurs) sont installés, lisez les informations suivantes :

- Ne retirez pas les carters. En ouvrant le produit laser, vous vous exposez au rayonnement dangereux du laser. Aucune pièce de l'unité n'est réparable.
- Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites dans le présent manuel.

DANGER

> Certains produits à laser contiennent une diode à laser intégrée de classe 3A ou 3B. Prenez connaissance des informations suivantes.
>
> Rayonnement laser lorsque le carter est ouvert. Evitez toute exposition directe au rayon laser. Evitez de regarder fixement le faisceau ou de l'observer à l'aide d'instruments optiques.

Vorsicht:
Bei der Installation von Lasergeräten (wie CD-ROM-Laufwerken,
DVD-Laufwerken, Einheiten mit Lichtwellenleitertechnik oder Sendern)
Folgendes beachten:

- Die Abdeckungen nicht entfernen. Durch Entfernen der Abdeckungen des
  Lasergeräts können gefährliche Laserstrahlungen freigesetzt werden.
  Das Gerät enthält keine zu wartenden Teile.
- Werden Steuerelemente, Einstellungen oder Durchführungen von
  Prozeduren anders als hier angegeben verwendet, kann gefährliche
  Laserstrahlung auftreten.

Gefahr

> Einige Lasergeräte enthalten eine Laserdiode der Klasse 3A oder 3B.
> Beachten Sie Folgendes:
>
> Laserstrahlung bei geöffneter Verkleidung. Nicht in den Strahl blicken.
> Keine Lupen oder Spiegel verwenden. Strahlungsbereich meiden.

‫זהירות:‬
‫כאשר מוצרי לייזר (כגון תקליטורים, כונני DVD, התקני סיבים אופטיים או משדרים) מותקנים, שימו לב להנחיות‬
‫הבאות:‬

- ‫אל תסירו את הכיסויים. הסרת הכיסויים של מוצר הלייזר עלולה לגרום לחשיפה מסוכנת לקרינת לייזר. ההתקן‬
  ‫אינם כוללים רכיבים להחלפה עצמית.‬
- ‫שימוש בבקרות ובהתאמות שלא צוינו או ביצוע תהליכים שלא צוינו, יכולים לגרום לחשיפה מסוכנת לקרינה.‬

 ‫סכנה‬

> ‫כמה ממוצרי הלייזר מכילים דיודת לייזר מובנית Class 3A או Class 3B. שימו לב לדברים שלהלן.‬
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 위험

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- La utilización de controles, ajustes o la realización de procedimientos diferentes a los especificados puede dar como resultado una exposición peligrosa a radiaciones.

PELIGRO

> Algunos productos láser contienen un diodo láser de Clase 3A o Clase 3B incorporado. Tenga en cuenta lo siguiente.
>
> Emite radiación láser cuando está abierto. No fije la vista en el rayo, no lo mire directamente con instrumentos ópticos y evite la exposición directa al rayo.

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- 若不遵守本文規定的控制、調整或操作程序，可能會導致危險的輻射外洩。

危險

> 某些雷射產品包含內嵌式 3A 類或 3B 類雷射二極體。這類光碟機的使用者應注意下列聲明。
>
> 在開啟光碟機時，會有雷射輻射。請勿直視光束或以光學儀器直接觀看光束，並避免直接暴露在光束中。

Chapter 2. Important service information

This chapter presents following important service information that applies to all machine types supported by this manual:
- "Strategy for replacing FRUs" on page 27
- "Strategy for replacing FRUs for CTO, special-bid, and standard models" on page 28

Important:
- If the computer is equipped with both a hard disk drive and an M.2 solid-state drive, do not use the M.2 solid-state drive as a bootable device. The M.2 solid-state drive is used for "cache" function only.
- Advise customers to contact the Lenovo® Customer Support Center if they need any assistance in obtaining or installing any software fixes, drivers, and UEFI BIOS downloads. Telephone numbers for Lenovo Support are available at:
  http://www.lenovo.com/support/phone
- System Disassembly/Reassembly videos that show the FRU removals or replacements for the Lenovo® authorized service technicians are available in the following support site:
  http://www.lenovoservicetraining.com/ion/

Strategy for replacing FRUs

Before replacing parts:

Ensure that all software fixes, drivers, and UEFI BIOS downloads are installed before replacing any FRUs listed in this manual.

After a system board is replaced, ensure that the latest UEFI BIOS is loaded to the system board before completing the service action.

To download software fixes, drivers, and UEFI BIOS, go to http://www.lenovo.com/ThinkPadDrivers and follow the instructions on the screen.

Use the following strategy to prevent unnecessary expense for replacing and servicing FRUs:

- **If you are instructed to replace a FRU but the replacement does not correct the problem, reinstall the original FRU before you continue**.

- Some computers have both a processor board and a system board. If you are instructed to replace either the processor board or the system board, and replacing one of them does not correct the problem, reinstall that board, and then replace the other one.

- If an adapter or a device consists of more than one FRU, any of the FRUs might be the cause of the error. Before replacing the adapter or device, remove the FRUs, one by one, to see if the symptoms change. Replace only the FRU that changed the symptoms.

Attention: The setup configuration on the computer you are servicing might have been customized. Running Automatic Configuration might alter the settings. Note the current configuration settings (using the View Configuration option); then, when service has been completed, verify that those settings remain in effect.

Strategy for replacing a hard disk drive, a solid-state drive, or an M.2 solid-state drive

Always try to run a low-level format operation before replacing a hard disk drive or a solid-state drive. This will cause all customer data on the drive to be lost. Be sure that the customer has a current backup of the data before you perform this task.

Attention: The drive startup sequence in the computer you are servicing might have been changed. Be extremely careful during write operations such as copying, saving, or formatting. If you select an incorrect drive, data or programs can be overwritten.

If the computer is shipped with both an M.2 solid-state drive and a hard disk drive, the M.2 solid-state drive is used for the "cache" function and to support the Intel® Rapid Start Technology. We recommend that users do not replace the M.2 solid-state drive by themselves. Otherwise, the "cache" function will not work and the Intel Rapid Start Technology cannot be used any more.

Attention: Ensure that you partition the M.2 solid-state drive after installing it on the computer you are servicing. Otherwise, the M.2 solid-state drive will not function correctly. For instructions on how to partition an M.2 solid-state drive, go to http://www.lenovo.com/support/msata-fru.

Important notice for replacing a system board

Some components mounted on a system board are very sensitive. Improper handling of a system board can cause damage to those components, and might cause a system malfunction.

Attention: When handling a system board:

- Do not drop a system board or apply any excessive force to it.
- Avoid rough handling of any kind.
- Avoid bending a system board and pushing it hard to prevent cracking at each Ball Grid Array (BGA) chipset.

How to use error message

Use the error codes displayed on the screen to diagnose failures. If more than one error code is displayed, begin the diagnosis with the first error code. Whatever causes the first error code might also cause false error codes. If no error code is displayed, see whether the error symptom is listed in the Symptom-to-FRU Index for the computer you are servicing.

Strategy for replacing FRUs for CTO, special-bid, and standard models

This topic provides information about the model types and FRU identification.

Product definition

This topic introduces different model types and how to identify each type.

Dynamic Configure To Order (CTO) model

This model provides the ability for a customer to configure a Lenovo solution from a Web site, and have this configuration sent to fulfillment, where it is built and shipped directly to the customer. The machine label and eSupport will load these products as the 4-character MT, 4-character model, and 2-character country code. The model is "CTO1" and the default country code is "WW" (example: 20AACTO1WW).

Special-bid model

This model is a unique configuration that has been negotiated between Lenovo and the customer. A unique MTM consists of a 4-character MT, a 4-character model, and a numeric 2-character country code is provided to the customer to place orders (example: 20AA000955). The country code assigned is numeric and does not designate a specific country or region. The custom model factsheet for the MTM indicates which country the special-bid MTM is set up for. Special-bid offering is not generally announced.

Standard model

Standard models (fixed configuration) are announced and offered to all customers. The MTM portion of the machine label consists of a 4-character MT, a 4-character model, and an alphabetic 2-character country code. The country code assigned is alphabetic and represents a designated country or region (example: 20AA0009UK).

FRU identification

Use Lenovo eSupport to identify major FRUs, FRU part numbers, and FRU descriptions for a product at an MT - serial number level. Examples of major FRUs are hard disk drive, system board, liquid crystal display (LCD), and memory module.

To identify the major FRUs for a product, do the following:
1. Go to:
   http://www.lenovo.com/support
2. Click **Warranty & Services**.
3. Click **Check Warranty Status**.
4. On the Warranty Status Lookup page, click **Parts Lookup**.
5. Type your machine type and serial number, and then click **Submit**.

eSupport also can be used to view the general FRU list for a product.

To get the general FRU list for a product, do the following:
1. Go to:
   http://www.lenovo.com/support
2. Click **Parts & Accessories**.
3. Follow the instructions on the screen to select product.
4. Click **Products and Parts Detail**.
5. On the PRODUCT AND PARTS DETAIL page, click the **Parts Detail** tab to view the FRU list.

   Note: The FRU list is a general list of components and does not contain specific model information.

Chapter 3. General checkout

This chapter presents following information:
- "What to do first" on page 31
- "Checkout guide" on page 32
    - "Lenovo Solution Center" on page 32
    - "Quick test programs" on page 32
    - "UEFI diagnostic program" on page 33
    - "Bootable diagnostic programs" on page 33
- "Power system checkout" on page 34

Some descriptions in this chapter might not apply to your particular computer.

Before you go to the checkout guide, be sure to read the following important notes.

Important notes:
- **Only certified trained personnel should service the computer.**
- **Before replacing any FRU, read the entire page on removing and replacing FRUs.**
- **When you replace FRUs, it is recommended to use new nylon-coated screws.**
- **Be extremely careful during such write operations as copying, saving, or formatting.** The sequence of the drives in the computer that you are servicing might have been altered. If you select an incorrect drive, data or programs might be overwritten.
- **Replace a FRU only with another FRU of the correct model.** When you replace a FRU, ensure that the model of the machine and the FRU part number are correct.
- **A FRU should not be replaced because of a single, unreproducible failure.** Single failures can occur for a variety of reasons that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. Consider replacing a FRU only when a problem recurs. If you suspect that a FRU is defective, clear the error log and run the test again. If the error does not recur, do not replace the FRU.
- **Be careful not to replace a nondefective FRU.**

What to do first

When you do return a FRU, you must include the following information in the parts exchange form or parts return form that you attach to it:
1. Name and phone number of service technician
2. Date of service
3. Date on which the machine failed
4. Date of purchase
5. Failure symptoms, error codes appearing on the display, and beep symptoms
6. Procedure index and page number in which the failing FRU was detected
7. Failing FRU name and part number
8. Machine type, model number, and serial number
9. Customer's name and address

Note: During the warranty period, the customer is responsible for repair costs if the computer damage was caused by misuse, accident, modification, unsuitable physical or operating environment, or improper maintenance by the customer. Following is a list of some common items that are not covered under warranty and some symptoms indicate that the system has been subjected to stress beyond normal use.

Before checking problems with the computer, determine whether the damage is covered under the warranty by referring to the following list:

The following are not covered under warranty:
- LCD panel cracked from the application of excessive force or from being dropped

- Scratched (cosmetic) parts
- Distortion, deformation, or discoloration of the cosmetic parts
- Plastic parts, latches, pins, or connectors that have been cracked or broken by excessive force
- Damage caused by liquid spilled into the system
- Damage caused by the improper insertion of a PC Card or the installation of an incompatible card
- Improper disc insertion or use of an optical drive
- Fuses blown by attachment of a nonsupported device
- Forgotten computer password (making the computer unusable)
- Sticky keys caused by spilling a liquid onto the keyboard
- Use of an incorrect ac power adapter on laptop products

The following symptoms might indicate damage caused by nonwarranted activities:
- Missing parts might be a symptom of unauthorized service or modification.
- Check for obvious damage to a hard disk drive. If the spindle of a hard disk drive becomes noisy, the hard disk drive might have been dropped or subject to excessive force.

Checkout guide

Use the following procedures as a guide to identify and correct problems with the ThinkPad notebook computers.

Note: The diagnostic tests are intended to test only ThinkPad products. The use of non-ThinkPad products, prototype cards, or modified options can lead to false indications of errors and invalid system responses.

1. Identify the failing symptoms in as much detail as possible.
2. Verify the symptoms. Try to re-create the failure by running the diagnostic test or by repeating the operation.

Lenovo Solution Center

The Lenovo Solution Center program enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for maximum system performance.

The Lenovo Solution Center program is available for download at http://www.lenovo.com/diags.

To run the Lenovo Solution Center program, go to Control Panel and click **System and Security ➙ Lenovo - System Health and Diagnostics**, and then follow the instructions on the screen.

For more information about the Lenovo Solution Center program, refer to the help information system of the program.

Quick test programs

You can run quick test programs to troubleshoot and resolve computer problems, especially when the computer does not have the Lenovo Solution Center program installed.

To download and install a quick test program, go to http://www.lenovo.com/diags and follow the instructions on the Web site.

To run a test using a quick test program, do the following:

1. Go to the C:\SWTOOLS\ldiag directory.
2. Double-click the gui_lsc_lite.exe file.
3. When the **User Account Control** window opens, click **Yes**.

4. Select the device class to be tested.

5. Select the devices to be tested.

6. Select the test to be performed.

7. Follow the instructions on the screen to start the test. When a problem is detected, information messages are displayed. Refer to the messages to troubleshoot the problem.

UEFI diagnostic program

A UEFI diagnostic program is preinstalled on the computer. It enables you to test memory modules and internal storage devices, view system information, and check and recover bad sectors on internal storage devices.

To run the UEFI diagnostic program, do the following:

1. Turn on the computer. If the computer cannot be turned on, go to "Power system checkout" on page 34, and check the power sources. If an error code is displayed, go to "Symptom-to-FRU index" on page 42 for error code descriptions and troubleshooting hints.

2. When the ThinkPad logo is displayed, repeatedly press and release the F10 key. The main screen of the UEFI diagnostic program is displayed.

3. Follow the instructions on the screen to use the diagnostic program.

The options on the main screen are as follows:

Table 1. Items on the main screen of the UEFI diagnostic program

Tests	Tools
• Quick Memory Test • Quick Storage Device Test • LCD test • PCI-e test • Exit Application	• System Information • Generate configuration file • Execute from configuration file • Recover Bad Sectors Tool*

* Recover Bad Sectors Tool is only available on computers that have hard disk drives installed.

Bootable diagnostic programs

If the computer you are servicing is not installed with the UEFI diagnostic program, you can download a bootable diagnostic program from the Lenovo Support Web site. The bootable diagnostic programs enable you to test computer memory and internal storage devices, view system information, and check and recover the internal storage devices. To use the bootable diagnostic programs, you can create a bootable diagnostic medium on a USB device or CD.

To create a bootable diagnostic medium, do the following:

1. Go to http://www.lenovo.com/diagnose.

2. Click **Lenovo Bootable Diagnostics**.

3. Follow the instructions on the Web site to create a bootable diagnostic medium on a USB device or CD.

To use the diagnostic medium you have created, do one of the following:

• If you have created the bootable diagnostic medium on a USB device, do the following:

1. Attach the USB device to the computer.

2. Turn on the computer. If the computer cannot be turned on, go to "Power system checkout" on page 34, and check the power sources. If an error code is displayed, go to "Symptom-to-FRU index" on page 42 for error code descriptions and troubleshooting hints.

3. When the ThinkPad logo is displayed, repeatedly press and release the F12 key. When the Boot Menu window opens, release the F12 key.

4. Use the arrow keys to select **USB HDD** and then press Enter. The diagnostic program will be launched automatically.

5. Follow the instructions on the screen to use the diagnostic program.

- If you have created the bootable diagnostic medium on a CD, do the following:

    1. Turn on the computer. If the computer cannot be turned on, go to "Power system checkout" on page 34, and check the power sources. If an error code is displayed, go to "Symptom-to-FRU index" on page 42 for error code descriptions and troubleshooting hints.

    2. Insert the CD into the optical drive.

    3. Restart the computer.

    4. When the ThinkPad logo is displayed, repeatedly press and release the F12 key. When the Boot Menu window opens, release the F12 key.

    5. Use the arrow keys to select **ATAPI CDx** (x: 0, 1, ...) and then press Enter. The diagnostic program will be launched automatically.

    6. Follow the instructions on the screen to use the diagnostic program.

Power system checkout

To verify a symptom, do the following:
1. Turn off the computer.
2. Remove the battery pack.
3. Connect the ac power adapter.
4. Check that power is supplied when you turn on the computer.
5. Turn off the computer.
6. Disconnect the ac power adapter and install the charged battery pack.
7. Check that the battery pack supplies power when you turn on the computer.

If you suspect a power problem, see the appropriate one of the following power supply checkouts:
- "Checking the ac power adapter" on page 34
- "Checking operational charging" on page 35
- "Checking the battery pack" on page 35
- "Checking the coin-cell battery" on page 36

Checking the ac power adapter

You are here because the computer fails only when the ac power adapter is used.

- If the power problem occurs only when the docking station or the port replicator is used, replace the docking station or the port replicator.

- If the power-on indicator does not turn on, check the power cord of the ac power adapter for correct continuity and installation.

- If the computer does not charge during operation, go to "Checking operational charging" on page 35.

To check the ac power adapter, do the following:
1. Unplug the ac power adapter cable from the computer.
2. Measure the output voltage at the plug of the ac power adapter cable. See the following figure:
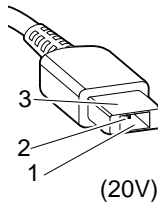
Pin	Voltage (V dc)
1	+20
2	0
3	Ground

(20V)

Note: Output voltage across pin 2 of the ac power adapter might differ from the one you are servicing.
3. If the voltage is not correct, replace the ac power adapter.
4. If the voltage is acceptable, replace the system board.

Note: Noise from the ac power adapter does not always indicate a defect.

Checking operational charging

To check whether the battery charges properly during operation, do the following:

Note: Before you begin, install a discharged battery pack or a battery pack that has less than 50% of the total power remaining in the computer.
1. Discharge the battery until the remained battery power is less than 50%.
2. Connect the computer to ac power to charge the battery. If the battery status icon in the Windows® notification area indicates that the battery is not charging, remove the battery and let it return to room temperature.
3. Reinstall the battery. If the battery is still not charging, replace the battery pack and refer to "Checking the battery pack" on page 35 to check the original battery pack.
4. Check the battery status icon again. If the same error still exists, replace the system board.

Checking the battery pack

The battery status icon in the Windows notification area displays the percentage of battery power remaining.

Move your pointer to the battery-status icon in the Windows notification area to check the battery status. The battery-status icon displays the percentage of battery power remaining and how long you can use your computer before you must charge the battery.

Note: If the battery pack becomes hot, it may not be able to charge. Remove it from the computer and leave it at room temperature for a while. After it cools down, reinstall and recharge it.

To check the battery pack, do the following:
1. Turn off the computer and disconnect the ac power adapter.
2. Remove the battery pack and measure the voltage between battery terminals 1 (+) and 7 (-). The correct voltages are shown in the following table.
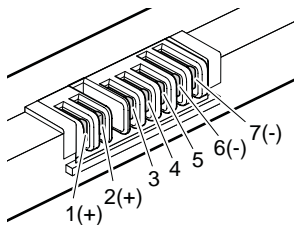
Terminal	Voltage (V dc)
1	+ 0 to + 16.8
7	Ground (-)

3. Measure the resistance between battery terminal 5 and 7 (-). The resistance should be 4 to 30 KΩ. If the resistance is not correct, replace the battery pack.
4. Depending on the voltage that you measure, do one of the following:

   - If the voltage is less than +11.0 V dc, recharge the battery. If the voltage is still less than +11.0 V dc after recharging, replace the battery pack.
   - If the voltage is more than +11.0 V dc, discharge the battery pack until the voltage becomes less than +11.0 V dc. Then recharge the battery pack. If the voltage is still less than +11.0 V dc, replace the battery pack.

   Note: Recharging will take at least three hours, even if the battery status indicator does not turn on.
5. Replace the system board if the new battery pack is not charged.

Checking the coin-cell battery

To check the coin-cell battery, do the following:

1. Turn off the computer, and unplug the ac power adapter from it.
2. Turn the computer upside down.
3. Remove the battery pack (see "1010 Battery pack" on page 70).
4. Remove the coin-cell battery (see "1080 Coin-cell battery" on page 76).
5. Measure the voltage of the coin-cell battery. See the following figure.
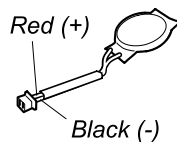
Wire	Voltage (V dc)
Red	+2.5 to +3.2
Black	Ground

- If the voltage is correct, replace the system board.
- If the voltage is not correct, replace the coin-cell battery.
- If the coin-cell battery discharges quickly after replacement, replace the system board.

Chapter 4. Related service information

This chapter presents following information:
- "Restoring the factory contents by using the Recovery Disc Set" on page 37
- "Recovery overview for the Windows 10 operating system" on page 38
- "Passwords" on page 39
- "Power management" on page 41
- "Symptom-to-FRU index" on page 42

Service Web site:
When the latest maintenance diskette and the system program service diskette become available, they will be posted on http://www.lenovo.com/support.

Restoring the factory contents by using the Recovery Disc Set

When the main storage drive is replaced because of a failure, no product recovery program ison the new drive. In this case, the customer must use the Recovery Disc Set to recover the computer. Order the Recovery Disc Set and the drive at the same time so that the customer can restore the computer to the factory default settings by using the Recovery Disc Set after the new drive is installed. For information about which discs to order, go to:
http://www.lenovo.com/serviceparts-lookup

Depending on the model, the number of recovery discs included in the Recovery Disc Set differs. To restore the factory contents by using the product Recovery Disc Set, do the following:

Notes:
- During the recovery process, all data on the drive will be deleted. If possible, copy any important data or personal files that you want to keep onto removable media or a network drive before you start the recovery process.
- The recovery process takes one to two hours to complete. The length of time depends on the method you use. If you use product Recovery Disc Set, the recovery process takes about two hours.
  1. Make the CD/DVD drive the first startup device in the startup sequence using the following procedure:
     a. Open the ThinkPad Setup program and select **Startup ➜ Boot**.
     b. Select the CD/DVD drive as the **1st Boot Device**.
  2. Insert the bootable recovery disc into the CD/DVD drive.
  3. Start the computer from the CD/DVD drive.
  4. When promoted, select your language and click **Next**.
  5. Read the license and accept the terms and conditions. Then follow the instructions on the screen.
  6. If the Recovery Disc Set contains a Supplemental Recovery Disc, insert it when prompted and click **Yes**.

     Note: Not all Recovery Disc Sets come with a Supplemental Recovery Disc. If there is a Supplemental Recovery Disc, it will be clearly marked as such.
  7. When all of the data has been copied from the last disc in the set and has been processed, remove the recovery disc and restart the computer. Follow the instructions on the screen to finish the recovery.

     Note: The rest of the recovery process is fully automated and no action from you is required. The computer will restart into the Microsoft® Windows desktop several times and you might experience periods when no activity is apparent on the screen for several minutes at a time. This is normal.
  8. When the recovery process completes, the Welcome to Microsoft Windows screen is displayed. Follow the instructions on the screen to complete the Windows setup.

9. After you have completed the Windows setup, you might want to restore the original startup sequence. Start the ThinkPad Setup program and then press F9 to restore the default settings. Press F10 to save changes and exit the ThinkPad Setup program.

Note: After restoring a drive to the factory default settings, you might need to reinstall some device drivers.

Recovery overview for the Windows 10 operating system

The Windows recovery programs enable you to reset your computer or use advanced startup options.

It is recommended that you create a recovery USB drive as early as possible. Store the recovery USB drive as a backup or replacement for the Windows recovery programs.

For more information, see "Creating and using a recovery USB drive" on page 39.

Resetting your computer

If your computer does not perform well, you might consider resetting your computer. In the resetting process, you can choose to keep your files or remove them, and then reinstall the Windows operating system.

To reset your computer, do the following:

Note: The graphical user interface (GUI) items of the operating system might change without notice.

1. Open the Start menu and then click **Settings**. If **Settings** is not displayed, click **All apps** to display all programs, and then click **Settings** ➙ **Update & security** ➙ **Recovery**.
2. In the **Reset this PC** section, click **Get started**.
3. Follow the instructions on the screen to reset your computer.

Using advanced startup options

With advanced startup options, you can change the firmware settings of the computer, change the startup settings of the Windows operating system, start the computer from an external device, or restore the Windows operating system from a system image.

To use advanced startup options, do the following:

Note: The GUI items of the operating system might change without notice.

1. Open the Start menu and then click **Settings**. If **Settings** is not displayed, click **All apps** to display all programs, and then click **Settings** ➙ **Update & security** ➙ **Recovery**.
2. In the **Advanced startup** section, click **Restart now** ➙ **Troubleshoot** ➙ **Advanced options**.
3. Select a desired startup option, then follow the instructions on the screen.

Recovering your operating system if Windows 10 fails to start

The Windows recovery environment on your computer is capable of operating independently from the Windows 10 operating system. This enables you to recover or repair the operating system even if the Windows 10 operating system fails to start.

After two consecutive failed boot attempts, the Windows recovery environment starts automatically. Then you can choose repair and recovery options by following the instructions on the screen.

Note: Ensure that your computer is connected to ac power during the recovery process.

Creating and using a recovery USB drive

You can create a recovery USB drive as a backup for the Windows recovery programs. With the recovery USB drive, you can troubleshoot and fix the problems even if the preinstalled Windows recovery programs are damaged.

Creating a recovery USB drive

The USB drive that you use to create the recovery USB drive must be at least 16 GB of storage. The actual USB capacity that is required depends on the size of the recovery image.

Attention: The creation process deletes anything stored on the USB drive. To avoid data loss, make a backup copy of all the data that you want to keep.

To create a recovery USB drive, do the following:

Note: Ensure that your computer is connected to ac power during the following process.

1. Connect a proper USB drive (at least 16 GB of storage).
2. Type `recovery` in the search box on the taskbar. Then click **Create a recovery drive**.
3. Click **Yes** in the User Account Control window to allow the Recovery Media Creator program to start.
4. In the Recovery Drive window, follow the on-screen instructions to create a recovery USB drive.

Using the recovery USB drive

If you cannot start your computer, use the recovery USB drive to recover your computer.

To use a recovery USB drive, do the following:

Note: Ensure that your computer is connected to ac power.

1. Connect the recovery USB drive to the computer.
2. Turn on or restart the computer. Before the Windows operating system starts, repeatedly press the F12 key. The Boot Menu window opens.
3. Select the recovery USB drive as the boot device.
4. Select a preferred keyboard layout.
5. Click **Troubleshoot** to display the optional recovery solutions.
6. Select a corresponding recovery solution according to your situation. Then follow the instructions on the screen to complete the process.

Passwords

As many as three passwords might be needed for any ThinkPad notebook computer: the power-on password, the hard disk password, and the supervisor password.

If any of these passwords has been set, a prompt for it appears on the screen whenever the computer is turned on. The computer does not start until the password is entered.

Note: If only an supervisor password is installed, the password prompt does not appear when the operating system is booted.

Power-on password

A power-on password protects the system from being powered on by an unauthorized person. The password must be entered before an operating system can be booted. For how to remove the power-on password, see "How to remove the power-on password" on page 40.

Hard-disk password

There are two hard-disk passwords:

- User hard disk password—for the user
- Master hard disk password—for the system administrator, who can use it to get access to the hard disk even if the user has changed the user hard disk password

Note: There are two modes for the hard disk password: **User only** and **Master + User**. The **Master + User** mode requires two hard disk passwords; the system administrator enters both in the same operation. The system administrator then provides the user hard disk password to the system user.

Attention: If the user hard disk password has been forgotten, check whether a master hard disk password has been set. If it has, it can be used for access to the hard disk drive. If no master hard disk password is available, neither Lenovo nor Lenovo authorized service technicians provide any services to reset either the user or the master hard disk password, or to recover data from the hard disk drive. To put the system back to operational status, the only Lenovo and Lenovo-authorized service solution would be to replace the hard disk drive or solid-state drive with a scheduled fee.

For how to remove the power-on password, see "How to remove the hard-disk password" on page 41.

Supervisor password

The supervisor password protects the system information stored in the ThinkPad Setup program. It provides the following security features:

- If only a supervisor password is set, a password prompt is displayed when you try to start the ThinkPad Setup program. Unauthorized users cannot change most of the system configuration options in the ThinkPad Setup program without the password.
- The system administrator can use the supervisor password to access a computer even if the user of that computer has set a power-on password. The supervisor password overrides the power-on password.
- The system administrator can set the same supervisor password on many ThinkPad notebook computers to make administration easier.

Attention: If the supervisor password has been forgotten and cannot be made available to the service technician, there is no service procedure to reset the password. The system board must be replaced for a scheduled fee.

How to remove the power-on password

To remove a power-on password that you have forgotten, do the following:

(A) If no supervisor password has been set:
1. Turn off the computer and disconnect the ac power adapter.
2. Remove the battery pack. For how to remove the battery pack, see "1010 Battery pack" on page 70.
3. Remove the coin-cell battery. For how to remove the coin-cell battery, see "1080 Coin-cell battery" on page 76.
4. Connect the ac power adapter. Turn on the computer and wait until the POST ends. After the POST ends, the password prompt does not appear. The power-on password has been removed.
5. Reinstall the coin-cell battery and the battery pack.

(B) If an supervisor password has been set and is known by the service technician:
1. Turn on the computer.
2. When the ThinkPad logo comes up, immediately press F1.

3. Type the supervisor password to enter the ThinkPad Setup program.

4. Select **Security**, using the cursor keys to move down the menu.

5. Select **Password**.

6. Select **Power-On Password**.

7. Type the current supervisor password in the **Enter Current Password** field. Then leave the **Enter New Password** field blank, and press Enter twice.

8. In the Changes have been saved window, press Enter.

9. Press F10; then, in the Setup confirmation window, select **Yes**.

How to remove the hard-disk password

Attention: If **User only** mode is selected and the user hard disk password has been forgotten and cannot be made available to the service technician, neither Lenovo nor Lenovo authorized service technicians provide any services to reset the user hard disk password, or to recover data from the hard disk drive. To put the system back to operational status, the only Lenovo and Lenovo-authorized service solution would be to replace the hard disk drive or solid-state drive with a scheduled fee.

To remove a user hard disk password that has been forgotten, when the supervisor password and the master hard disk password are known, do the following:

1. Turn on the computer.

2. When the ThinkPad logo comes up, immediately press F1 to enter ThinkPad Setup.

3. Select **Security**, using the cursor keys to move down the menu.

4. Select **Password**.

5. Select **Hard-disk *x* password**, where *x* is the letter of the hard disk drive. A pop-up window opens.

6. Select **Master HDP**.

7. Type the current master hard disk password in the **Enter Current Password** field. Then leave the **Enter New Password** field blank, and press Enter twice.

8. Press F10.

9. Select **Yes** in the Setup confirmation window. Both user hard disk password and master hard disk password will have been removed.

Power management

To reduce power consumption, the computer has three power management modes: screen blank, sleep, and hibernation.

Screen blank mode (for the Windows 7 operating system only)

If the time set on the "Turn off monitor" timer in the operating system expires, the LCD backlight turns off.

To put the computer into screen blank mode, do the following:

1. Right-click the battery gauge in the task bar.

2. Select **Power off display**.

To end screen blank mode and resume normal operation, press any key.

Sleep mode

When the computer enters sleep mode, the following events occur in addition to what occurs in screen blank mode:
• The LCD is powered off.

- The hard disk drive is powered off.
- The microprocessor stops.

To enter sleep mode, do the following:

- **For Windows 7**: Open the Start menu, then click the arrow next to the **Shut down** button. Click **Sleep** from the menu displayed.
- **For Windows 10:** Open the Start menu, click ⏻ **Power,** and then click **Sleep**.

In certain circumstances, the computer goes into sleep mode automatically:

- After a period of inactivity specified in power plan settings
- When the battery indicator blinks orange, indicating that the battery power is low

To cause the computer to return from sleep mode and resume operation, do one of the following:
- Press the Fn key.
- Open the LCD cover.
- Turn on the power button.

Also, in either of the following events, the computer automatically returns from sleep mode and resumes operation:

- The ring indicator (RI) is signaled by a serial device or a PC Card device.
- The time set on the resume timer elapses.

  Note: The computer does not accept any input immediately after it enters sleep mode. Wait a few seconds before taking any action to reenter operation mode.

Hibernation mode

In hibernation mode, the following occurs:

- The system status, RAM, VRAM, and setup data are stored on the hard disk.
- The system is powered off.

Note: If the computer enters the hibernation mode while it is docked to the docking station, do not undock it before resuming normal operation. If you do undock it and then try to resume normal operation, you will get an error message, and you will have to restart the system.

If you have defined one of the following actions as the event that causes the system to go into hibernation mode, perform that action.
- Closing the lid.
- Pressing the power button.

Also, the computer goes into hibernation mode automatically after a period of inactivity specified in power plan settings.

When the power is turned on, the computer returns from hibernation mode and resumes operation. The hibernation file in the boot record on the hard disk drive is read, and system status is restored from the hard disk drive.

Symptom-to-FRU index

This section contains following information:

- "LCD-related symptoms" on page 45
- "Intermittent problems" on page 46
- "Undetermined problems" on page 46

The symptom-to-FRU index in this section lists symptoms and errors and their possible causes. The most likely cause is listed first, in boldface type.

Note: Do the FRU replacement or other actions in the sequence shown in the column headed "FRU or action, in sequence." If replacing a FRU does not solve the problem, put the original part back in the computer. Do not replace a nondefective FRU.

This index can also help you determine, during regular servicing, what FRUs are likely to need to be replaced next.

A numeric error is displayed for each error detected in POST or system operation. In the displays, **n** can be any number.

If no numeric code is displayed, check the narrative descriptions of symptoms. If the symptom is not described there, go to "Intermittent problems" on page 46.

Note: For a device not supported by diagnostic codes in the ThinkPad notebook computers, see the manual for that device.

Numeric error codes

Table 2. Numeric error codes

Symptom or error (beeps, if any)	FRU or action, in sequence
0177 Bad SVP data, stop POST task.	**Replace the system board.**
0183 Bad CRC of Security Settings in EFI Variable. Enter ThinkPad Setup.	1. **Run ThinkPad Setup to check the security settings, and then save the settings by pressing F10.** 2. System board.
0187 EAIA data access error.	1. **Run ThinkPad Setup to check the security settings, and then save the settings by pressing F10.** 2. System board.
0188 Invalid RFID Serialization Information Area	1. **Run ThinkPad Setup to reset the S/N or UUID.** 2. System board.
0189 Invalid RFID Configuration information area	1. **Run ThinkPad Setup to reset the S/N or UUID.** 2. System board.
0190 Critical low-battery error	1. **Charge the battery pack.** 2. Battery pack.
0191 System Security - Invalid Remote Change requested.	1. **Run ThinkPad Setup, and then save current setting by pressing F10.** 2. System board.
0199 System Security - Security password retry count exceeded.	1. **Run ThinkPad Setup and check the supervisor password.** 2. System board.
0251 System CMOS checksum bad - Default configuration used	1. **Run ThinkPad Setup and reset the settings.** 2. coin-cell battery

Table 2. Numeric error codes (continued)

Symptom or error (beeps, if any)	FRU or action, in sequence
0253 EFI Variable Block Data was destroyed.	**The system EFI Variable Block Data might have been corrupted.**
0271 Real Time Clock Error - Check Date and Time settings.	**Run ThinkPad Setup and reset the date and time.**
1802 Unauthorized network card is plugged in - Power off and remove the network card.	1. **Remove the network card.** 2. System board.
1820 More than one external fingerprint readers are attached. Power off and remove all but the reader that you set up within your main operating system.	**Power off and remove all but the reader that you set up within your main operating system.**
2100 Detection error on HDD0 (Main HDD)	1. **Reseat the hard disk drive.** 2. Replace the main hard disk drive. 3. Replace the system board.
2102 Detection error on SSD (M.2)	1. **Reseat the M.2 solid state drive.** 2. Replace the M.2 solid state drive. 3. Replace the system board.
2110 Read error on HDD0 (Main HDD)	1. **Reseat the hard disk drive.** 2. Replace the main hard disk drive. 3. Replace the system board.
2112 Read error on SSD (M.2)	1. **Reseat the M.2 solid state drive.** 2. Replace the M.2 solid state drive. 3. Replace the system board.
2200 Machine Type and Serial Number are invalid.	**System board.**
2201 Machine UUID is invalid.	**System board.**

Error messages

Table 3. Error messages

Symptom or error (beeps, if any)	FRU or action, in sequence
Fan error	1. **Thermal-fan assembly**. 2. Thermal grease. 3. System board.
Thermal sensing error	**The thermal sensor has problem. Shut down the computer immediately and have the computer serviced.**
The connected AC adapter has a lower wattage than the recommended model which was shipped with the system. To boot with the AC adapter, please connect the AC adapter which was shipped with the system. Press Esc to continue.	**Use the ac adapter shipped with the computer.**
The connected AC adapter has a lower wattage than the recommended model which was shipped with the system. System is going to shutdown...	**Use the ac adapter shipped with the computer.**

Table 3. Error messages (continued)

Symptom or error (beeps, if any)	FRU or action, in sequence
Unknown adapter is connected system. To boot with the AC adapter, please connect correct AC adapter with the system. Press Esc to continue.	**Use the ac adapter shipped with the computer.**
Unknown adapter is connected the system. Please connect correct AC adapter with the system. System is going to shutdown....	**Use the ac adapter shipped with the computer.**
The battery installed is not supported by this system and will not charge. Please replace the battery with the correct Lenovo battery for this system. Press the ESC key to continue.	**Replace the battery with the correct Lenovo battery for this system**.
This system does not support batteries that are not genuine Lenovo-made or authorized. The system will continue to boot, but may not charge unauthorized batteries. **Attention:** Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.	**Replace the battery with the correct Lenovo battery for this system**.

Beep errors

Table 4. Beep errors

Problem	Solution
One short beep, pause, three short beeps, pause, three more short beeps, pause, and one short beep	Shut down the computer immediately. Ensure that memory modules are installed correctly. If they are, and you still hear the beeps, have the computer serviced.
One long and two short beeps	The video function has a problem. Have the computer serviced.
Four cycles of four short beeps	Shut down the computer immediately and have the computer serviced.
Five short beeps, pause, five more short beeps, pause	Continue to boot immediately when the error is detected
Five short beeps	Shut down the computer immediately and have the computer serviced.
Three short beeps, pause, one short beep, pause, one more short beep, pause, and three short beeps	Shut down the computer immediately. Ensure that wireless cards are installed correctly. If they are, and you still hear the beeps, have the computer serviced.

LCD-related symptoms

Important: The TFT LCD for the notebook computer contains many thin-film transistors (TFTs). The presence of a small number of dots that are missing, discolored, or always lighted is characteristic of TFT LCD technology, but excessive pixel problems can cause viewing concerns.

If the LCD you are servicing has two or less visible defective pixels, it should not be considered faulty. However, if the LCD has three or more visible defective pixels, it will be deemed as defective by Lenovo and it should be replaced.

Notes:

- This policy applies to all ThinkPad notebook computers purchased on 1 January, 2008 or later.
- Lenovo will not provide warranty replacement if the LCD is within specifications because we cannot guarantee that any replacement LCD will have zero pixel defects.
- One pixel consists of R, G, B sub-pixels.

Table 5. LCD-related symptoms

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, and a blank LCD during POST.	**System board**.
• LCD backlight not working. • LCD too dark. • LCD brightness cannot be adjusted. • LCD contrast cannot be adjusted.	1. **Reseat the LCD connectors**. 2. LCD assembly. 3. System board.
• LCD screen unreadable. • Characters missing pixels. • Screen abnormal. • Wrong color displayed.	1. **See important note for "LCD-related symptoms."** 2. Reseat all LCD connectors. 3. LCD assembly. 4. System board.
Horizontal or vertical lines displayed on LCD.	**LCD assembly**.

Intermittent problems

Intermittent system hang problems can be due to a variety of causes that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. FRU replacement should be considered only when a problem recurs.

Undetermined problems

If the diagnostic tests did not identify the device that has failed, if wrong devices are installed, or if the system simply is not operating, follow these procedures to isolate the failing FRU (do not isolate FRUs that have no defects).

Verify that all attached devices are supported by the computer.

Verify that the power supply being used at the time of the failure is operating correctly. (See "Power system checkout" on page 34.)

1. Turn off the computer.
2. Visually check each FRU for damage. Replace any damaged FRU.
3. Remove or disconnect all of the following devices:
   a. Non-ThinkPad devices
   b. Devices attached to the docking station or the port replicator
   c. Printer, mouse, and other external devices
   d. Battery pack
   e. Hard disk drive
   f. Optical drive
   g. Memory module under the bottom cover (if there is one)
   h. PC cards
4. Turn on the computer.
5. Determine whether the problem has been solved.
6. If the problem does not recur, reconnect the removed devices one at a time until you find the failing FRU.
7. If the problem remains, replace the following FRUs one at a time (do not replace a non-defective FRU):
   a. System board

b. LCD assembly

Chapter 5. Status indicators

This chapter presents the system status indicators that show the status of the computer.
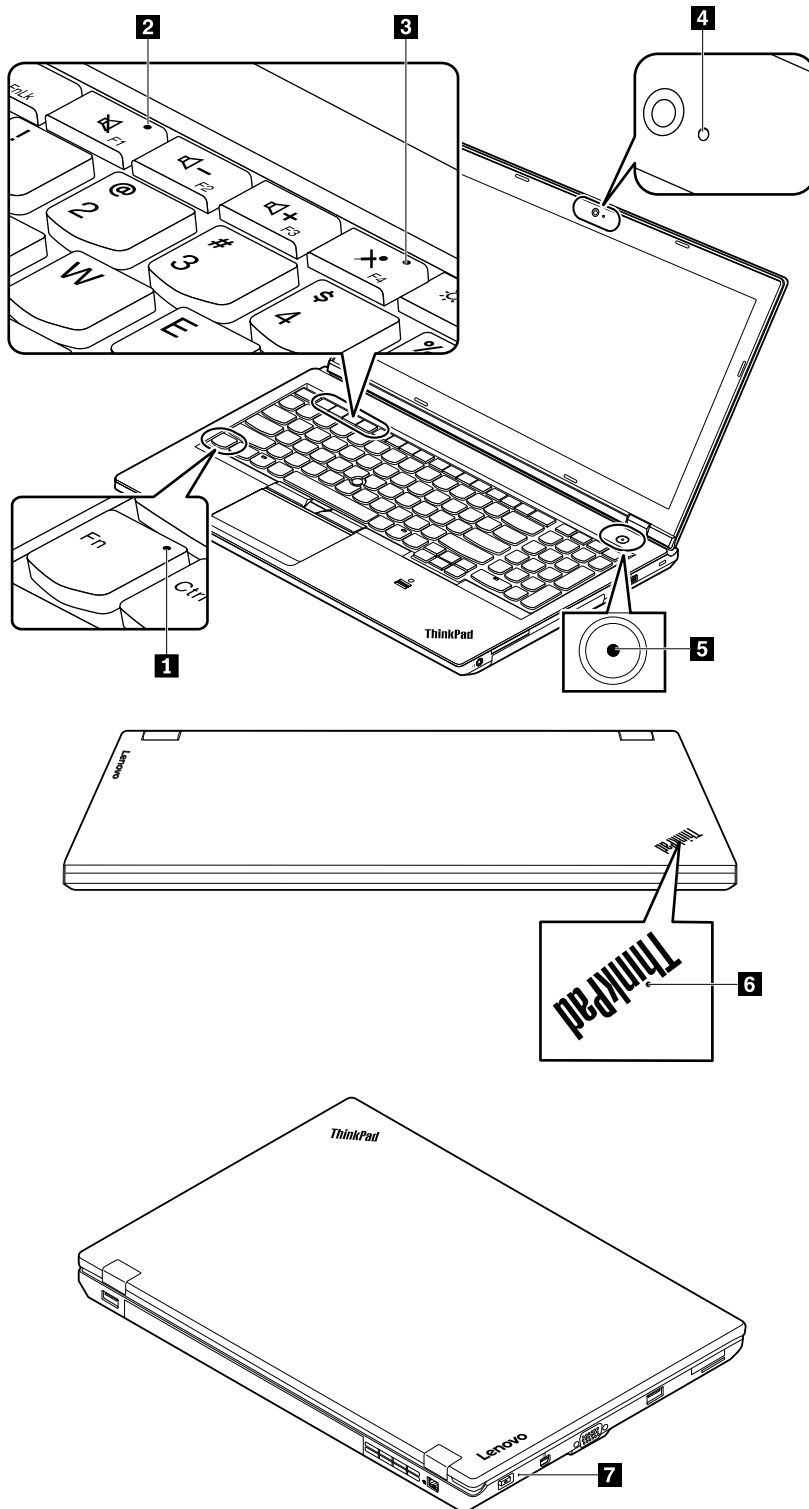
Table 6. Status indicators

Indicator	Indicator behavior and description
1 Fn Lock indicator	**Off** (default mode): The Fn Lock function is disabled. To initiate the special function of each key, press the function key directly. To input F1 - F12, press the Fn key and the corresponding function key. **On** (legacy mode): The Fn Lock function is enabled. To input F1 - F12, press the corresponding function key directly. To initiate the special function of each function key, press the Fn key and the corresponding function key.
2 Speaker-mute indicator	When the speaker-mute indicator is on, the speakers are muted.
3 Microphone-mute indicator	When the microphone-mute indicator is on, the microphones are muted.
4 Camera status indicator	When the camera status indicator is on, the camera is in use.
5 6 System status indicator	**Blinks for three times**: The computer is initially connected to power. **On**: The computer is on (in normal mode). **Blinks fast**: The computer is entering sleep or hibernation mode. **Blinks slowly**: The computer is in sleep mode. **Off**: The computer is off or in hibernation mode.
7 ac power status indicator	This indicator shows the ac power charging status of the computer. **Green**: The computer is connected to ac power and the charging status is 80%–100%. **Amber**: The computer is connected to ac power and the charging status is 1%–80%. **Off**: The computer is not connected to ac power.

Chapter 6.   Fn key combinations

The following table describes the functions of Fn key combinations.

Table 7. Function keys and key combinations

Function keys and key combinations	Description
Fn+Esc	You can configure the Fn key and function keys in the Keyboard Properties window by doing the following: 1. Go to Control Panel. Change the view of Control Panel from Category to Large icons or Small icons. 2. Click **Keyboard**. In the Keyboard Properties window, click the **Fn and function keys** or **ThinkPad F1–F12 keys** tab. 3. Select the options of your preference. Press Fn+Esc to enable or disable the Fn Lock function. • **When the Fn Lock function is disabled**: The Fn Lock indicator is off. To initiate the special function printed as an icon on each function key, press the corresponding function key directly. To input F1- F12, press the Fn key and the corresponding function key. • **When the Fn Lock function is enabled**: The Fn Lock indicator turns on. To input F1- F12, press the corresponding function key directly. To initiate the special function printed as an icon on each function key, press the Fn key and the corresponding function key.
F1	Speaker mute
F2	Speaker volume down
F3	Speaker volume up
F4	Microphone mute
F5	Brightness down
F6	Brightness up
F7	Switches a display output location.
F8	Enables or disables wireless features.
F9	For Windows 10: Opens the Settings window. For Windows 7: Opens **Control Panel**.
F10	For Windows 10: Opens the Cortana® search box. For Windows 7: Opens **Windows Search**.
F11	Views all applications that are currently open.
F12	For Windows 10: Views all the programs. For Windows 7: Opens **Computer**.
Fn+Spacebar	Controls the keyboard backlight. There are three modes for the keyboard backlight: **Off**, **Low**, and **High**. Press Fn+Spacebar to change the modes of the keyboard backlight.
Fn+B	Has the same function as the Break key on a conventional keyboard.
Fn+P	Has the same function as the Pause key on a conventional keyboard.
Fn+S	Has the same function as the SysRq key on a conventional keyboard.

Table 7. Function keys and key combinations (continued)

Function keys and key combinations	Description
Fn+K	Has the same function as the ScrLK key on a conventional keyboard.
Fn+End	Has the same function as the Insert key on a conventional keyboard.
Fn+4	Puts your computer into sleep mode. To return to normal operation, press the Fn key only.

Chapter 7. Locations

This chapter introduces the locations of some computer hardware components.

Locating computer controls, connectors, and indicators

This section introduces the locations of the computer controls, connectors, and indicators.

Front view
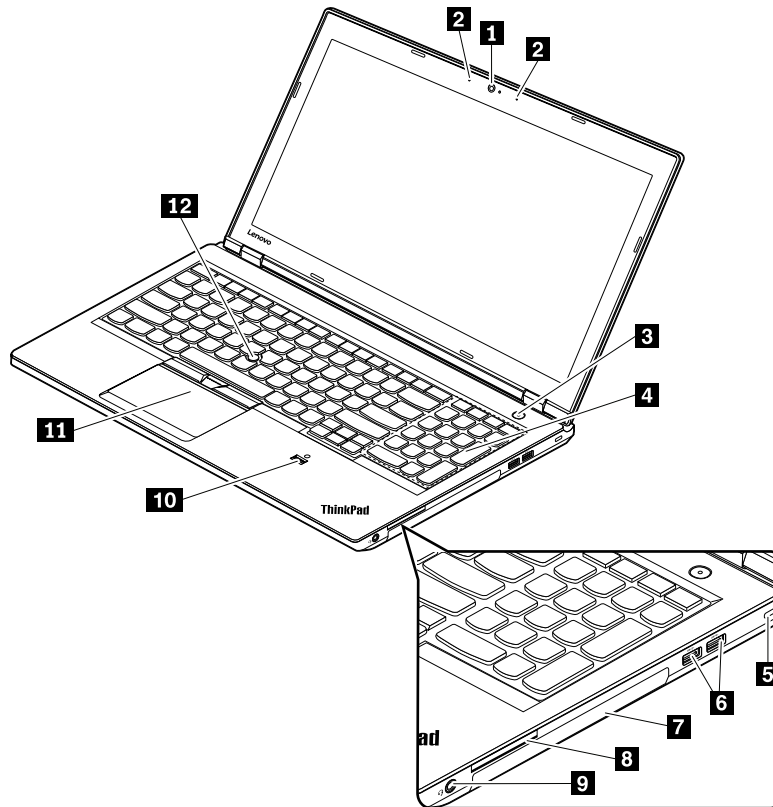
1 Camera (available on some models)		**7** Optical drive (available on some models)	
2 Microphones (available on some models)		**8** Smart-card-reader slot (available on some models)	
3 Power button		**9** Audio connector	
4 Numeric keypad		**10** Fingerprint reader (available on some models)	
5 Security-lock slot		**11** Trackpad	
6 USB 3.0 connectors		**12** TrackPoint® pointing stick	

Rear view
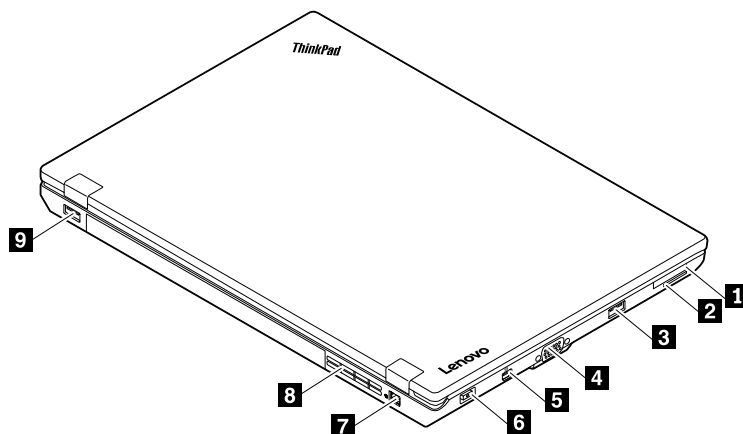
1 ExpressCard slot (available on some models)

2 Media-card slot

3 Always On USB connector

4 Video graphics array (VGA) connector

5 Mini DisplayPort® connector

6 Power connector

7 Ethernet connector

8 Fan louvers

9 USB 3.0 connector

Bottom view
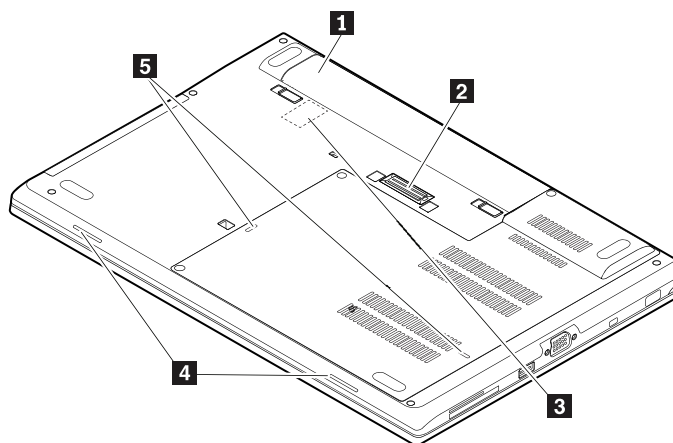
1 Battery pack

2 Docking station connector

3 Micro-SIM-card slot

4 Speakers

5 Keyboard drainage holes

Locating FRUs and CRUs

This topic introduces the following service parts:
- "Major FRUs and CRUs" on page 56
- "LCD FRUs and CRUs" on page 58

Notes:
- Each FRU is available for all types or models, unless otherwise specified.
- **CRU statement for customers:**
  You can resolve some problems with your product with a replacement part you can install yourself, called a "Customer Replaceable Unit" or "CRU." Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. *Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product.* If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this *Hardware Maintenance Manual*. An electronic version of this manual can be found at http://www.lenovo.com/support. Click **User Guides & Manuals** and then follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

  ThinkPad computers contain the following types of CRUs and FRU:
  - **Self-service CRUs:** Refer to parts that can be installed or replaced easily by customer themselves or by trained service technicians at an additional cost.
  - **Optional-service CRUs:** Refer to parts that can be installed or replaced by customers with a greater skill level. Trained service technicians can also provide service to install or replace the parts under the type of warranty designated for the customer's machine.
  - **FRUs:** Refer to parts that must be installed or replaced only by trained service technicians. If customers choose to replace the FRUs by themselves, the product warranty might be affected.

Major FRUs and CRUs
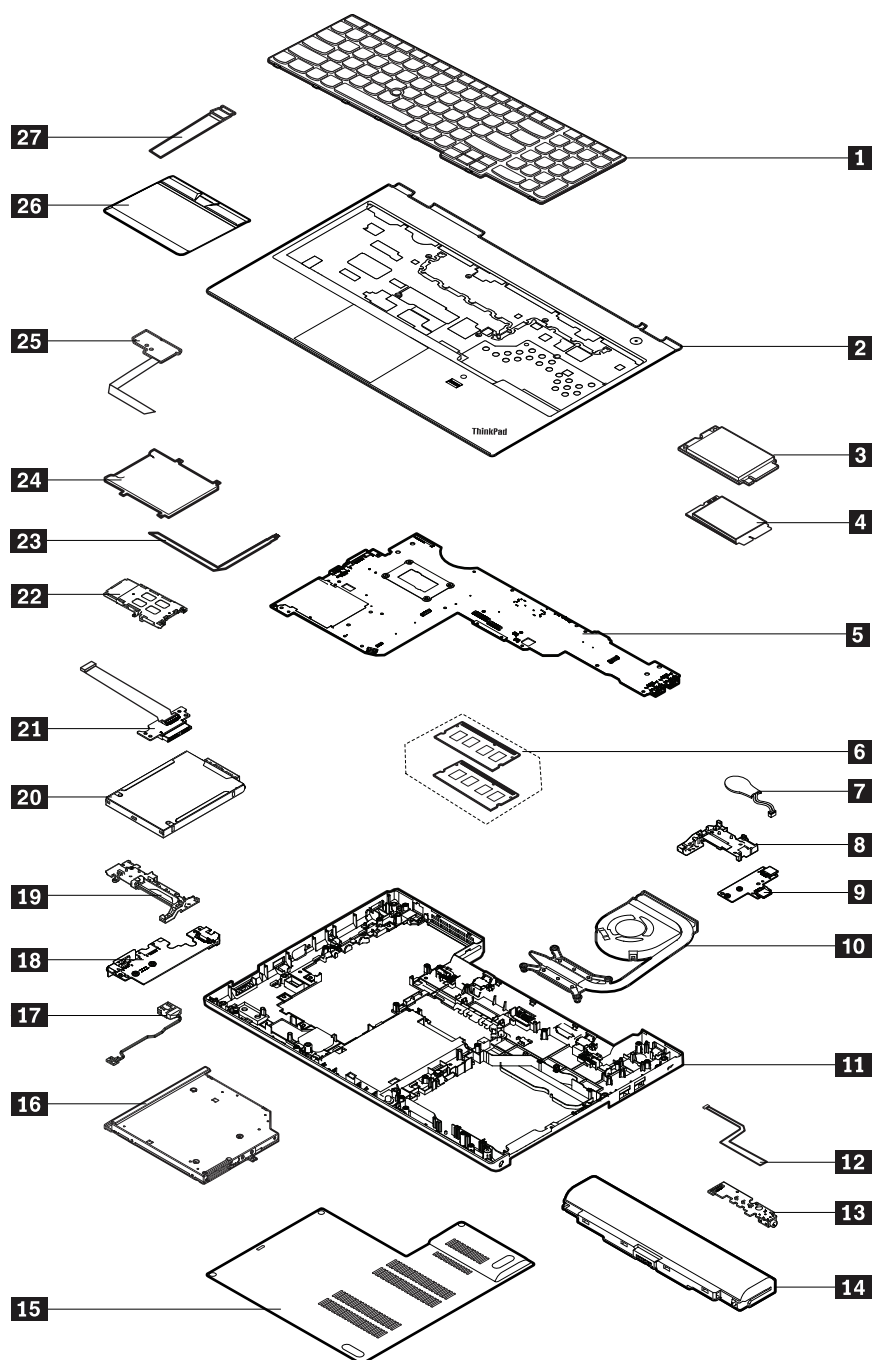
No.	Description	Self-service CRU	Optional-service CRU
1	Keyboard	No	Yes
2	Keyboard bezel assembly (with the fingerprint reader embedded on some models)	No	No
3	Wireless-wide-area-network (WWAN) card	Yes	No
4	Wireless-local-area-network (WLAN) card	Yes	No

No.	Description	Self-service CRU	Optional-service CRU
5	System board assembly	No	No
6	Memory modules	Yes	No
7	Coin-cell battery	Yes	No
8	Saddle bracket (right)	No	No
9	USB card	No	No
10	Thermal-fan assembly	No	No
11	Base cover assembly	No	No
12	Audio cable	No	No
13	Audio card	No	No
14	Battery pack	Yes	No
15	Bottom door	No	No
16	Optical drive	Yes	No
17	Dc-in cable	No	No
18	Ethernet card	No	No
19	Saddle bracket (left)	No	No
20	Hard disk drive assembly or solid-state drive assembly	Yes	No
21	ODD card with cable	No	No
22	Express card or dummy Express card	No	No
23	Smart card cable	No	No
24	Smart card assembly or dummy smart card	No	No
25	Power button card	No	No
26	Trackpad	No	No
27	Trackpad cable	No	No

LCD FRUs and CRUs
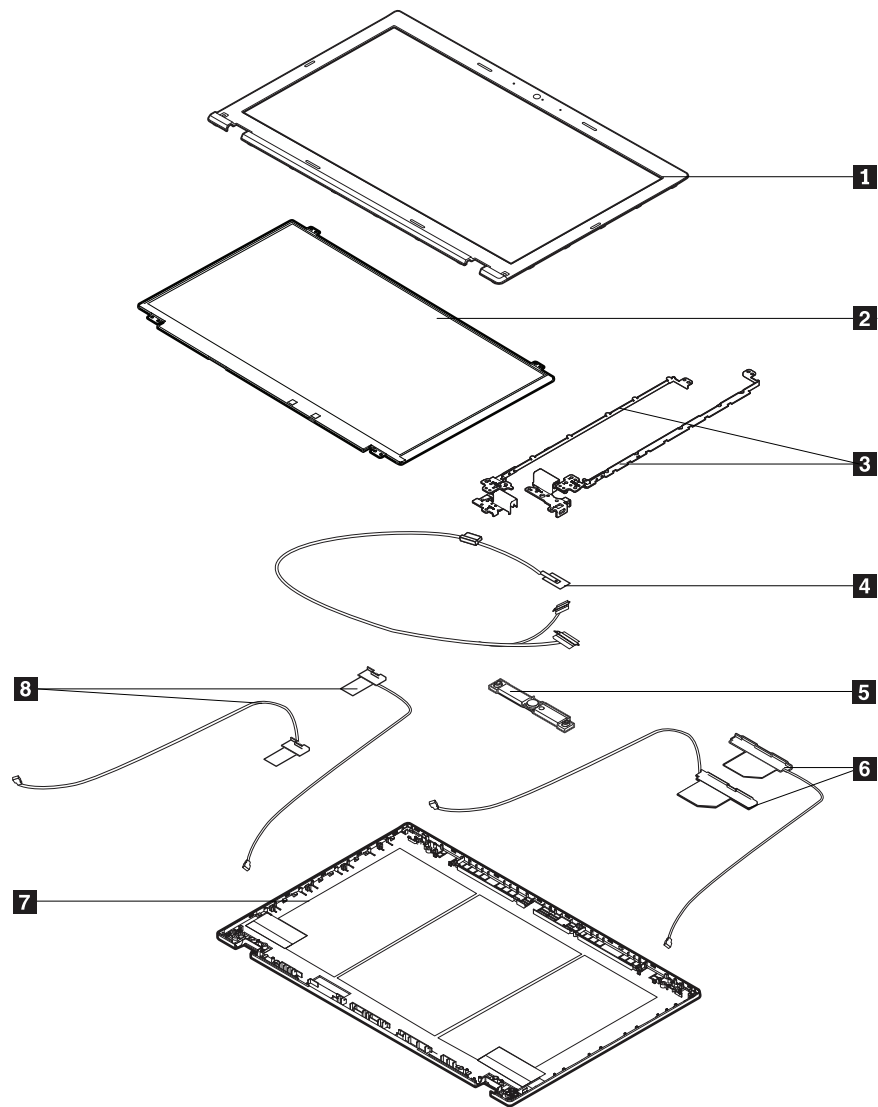
No.	Description	Self-service CRU	Optional-service CRU
1	LCD front bezel	No	No
2	LCD panel	No	No
3	Hinges	No	No
4	LCD cable	No	No
5	One of the following (depending on the model): • Microphone/Camera combo card (with LED and LID sensor) • Microphone card with LID sensor • LID sensor only	No	No
6 8	WLAN antenna assembly/WWAN antenna assembly (depending on the model)	No	No
7	LCD rear cover assembly	No	No

Miscellaneous kits and other FRUs

Miscellaneous kits

FRU description	Self-service CRU	Optional service CRU
Screw kit • M2 * L5, black (29) • M2 * L3, black (12) • M2.5 * L8, black (2) • M2.5 * L6, black (4) • M2 * L3, black, large head, for speaker/USB card/Ethernet card (8) • M2.5 * L4, silver (8) • M2 * L3 mm, gold, for trackpad (4) • M2 * L2.5, silver (6)	N	N

Other FRUs

FRU description	Self-service CRU	Optional service CRU
ac power adapter	Y	N
Power cord	Y	N

Connector and cable guide

This topic provides information to help Lenovo authorized service technicians identify connectors and cables for replacement purpose. To view each FRU and the exploded illustration of the computer, see "Major FRUs and CRUs" on page 56 and "Locating FRUs and CRUs" on page 54.

Note: Depending on your computer model, some connectors or cables might not be available.

System board connectors and cables

Table 8. System board connector and cable guide

Item	Connector (location)	Internal cable required	Cable connection
1	USB 3.0 connector (external)	No	Connect USB-compatible devices to this connector.
2	USB card connector (internal)	No	Connect the USB card to this connector.
3	Micro-SIM-card slot (external)	No	If the computer supports wireless WAN, insert a micro Subscriber Identification Module (SIM) card into this slot to establish wireless-WAN connections.
4	Removable battery connector (external)	No	Connect the removable battery directly to this connector.
5	Docking station connector (external)	No	Connect a supported docking station to your computer through this connector.
6	Wireless-WAN card slot (internal)	No	Insert the wireless-WAN card into this slot.
7	Wireless-LAN card slot (internal)	No	Insert the wireless-LAN card into this slot.
8	Thermal fan connector (internal)	Thermal fan assembly cable	The thermal fan assembly comes with cable. Connect the cable to this connector.
9	Ethernet card connector (internal)	No	Connect the Ethernet card to this connector.
10	dc-in connector (internal)	dc-in cable	The power connector of the computer comes with the dc-in cable. Connect the cable to this connector.
11	VGA connector (external)	No	Connect the computer to an external display.
12	Always On USB connector (external)	No	Connect USB-compatible devices to this connector.

Table 8. System board connector and cable guide (continued)

Item	Connector (location)	Internal cable required	Cable connection
13	Media-card slot (external)	No	Insert a media card into this slot to read the data on the card.
14	Memory module connector (internal)	No	Connect memory modules to this connector.
15	Hard disk drive connector (internal)	No	Connect the hard disk drive directly to this connector.
16	LCD connector (internal)	LCD cable	Connect one end to the LCD panel and the other end to this connector.
17	Power button card connector (internal)	Power button card cable	Connect one end to the power button card and the other end to this connector.
18	Smart card reader connector (internal)	Smart card cable	Connect one end to the smart card reader and the other end to this connector.
19	Fingerprint reader card connector (internal)	Fingerprint reader card cable	Connect one end to the fingerprint reader card and the other end to this connector.
20	TrackPoint pointing stick connector (internal)	TrackPoint pointing stick cable	The TrackPoint pointing stick comes with cable. Connect the cable to this connector.
21	Keyboard connector (internal)	Keyboard assembly cable	The keyboard assembly comes with cable. Connect the cable to this connector.
22	Trackpad connector (internal)	Trackpad cable	Connect one end to the trackpad and the other end to this connector.
23	Optical drive connector (internal)	ODD cable	Connect one end to the ODD card and the other end to this connector.
24	Audio connector (internal)	Audio cable	Connect one end to the Audio card and the other end to this connector.
25	Speaker assembly connector (internal)	Speaker assembly cable	The speaker assembly comes with cable. Connect the cable to this connector.
26	ExpressCard connector (external)	No	Connect ExpressCards to this connector.

Camera/microphone card connector and cable
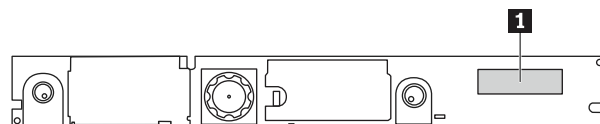
Table 9. Camera/microphone card connector and cable guide

Item	Connector (location)	Internal cable required	Cable connection
1	Camera/microphone card connector (internal)	LED cable	Connect one end to the LED connector on the system board and the other end to this connector.

Wireless-WAN card connectors and cables
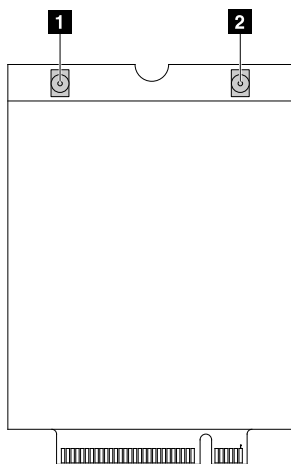
Table 10. Wireless-WAN card

Item	Connector (location)	Internal cable required	Cable connection
1	Wireless-WAN antenna connector (internal)	Wireless-WAN antenna kit	Connect one end of the wireless-WAN red antenna to the A-cover and the other end to this connector.
2	Wireless-WAN antenna connector (internal)	Wireless-WAN antenna kit	Connect one end of the wireless-WAN blue antenna to the A-cover and the other end to this connector.

Wireless-LAN card connectors and cables
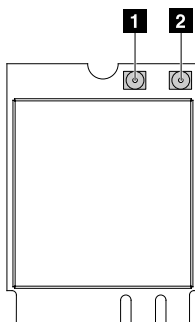
Table 11. Wireless-LAN card

Item	Connector (location)	Internal cable required	Cable connection
1	Wireless-LAN antenna connector (internal)	Wireless-LAN antenna kit	Connect one end of the wireless-LAN gray antenna to the A-cover and the other end to this connector.
2	Wireless-LAN antenna connector (internal)	Wireless-LAN antenna kit	Connect one end of the wireless-LAN black antenna to the A-cover and the other end to this connector.

Ethernet card connector and cable
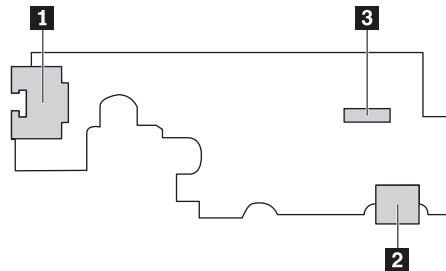
Table 12. Ethernet card connector

Item	Connector (location)	Internal cable required	Cable connection
1	Ethernet connector (external)	No	This connector connects the computer to a local area network (LAN).
2	Mini DisplayPort connector (external)	No	This connector connects your computer to a compatible projector, external display, or high-definition television.
3	Ethernet card connector (internal)	No	This connector connects the Ethernet card and the system board.

Audio card connector and cable

Table 13. Audio card connector

Item	Connector (location)	Internal cable required	Cable connection
1	Audio connector (external)	No	Connect headphones or a headset to this connector.
2	Audio card connector (internal)	Audio cable	Connect one end to the system board and the other end to this connector.

ODD card connector and cable
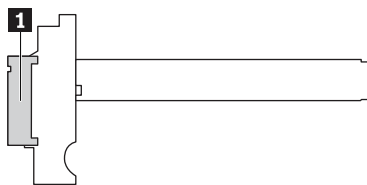
Table 14. ODD card connector

Item	Connector (location)	Internal cable required	Cable connection
1	ODD card connector (external)	No	Connect the Optical drive to this connector.

Smart card connector and cable
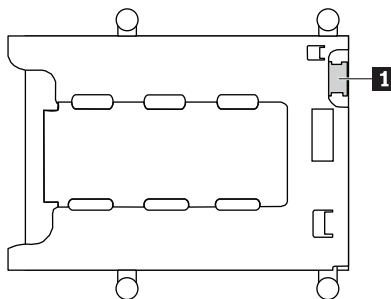
Table 15. Smart card connector

Item	Connector (location)	Internal cable required	Cable connection
1	Smart card connector (internal)	Smart card cable	Connect one end to the smart card card connector on the system board and the other end to this connector.

USB card connector and cable
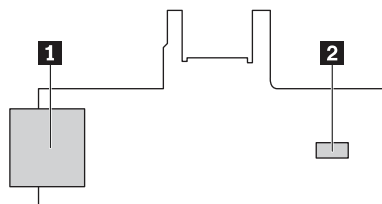
Table 16. USB card connector

Item	Connector (location)	Internal cable required	Cable connection
1	USB 3.0 connector (external)	No	Connect USB-compatible devices to this connector.
2	USB card connector (internal)	No	This connector connects the USB card and the system board.

Looking up FRU information

For detailed FRU information, including part numbers, descriptions, and substitution part numbers, go to http://www.lenovo.com/serviceparts-lookup.

Chapter 8. FRU replacement notices

This chapter presents notices related to removing and replacing parts. Read this chapter carefully before replacing any FRU.

CRU statement for customers:
You can resolve some problems with your product with a replacement part you can install yourself, called a "Customer Replaceable Unit" or "CRU." Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. *Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product.* If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this *Hardware Maintenance Manual*. An electronic version of this manual can be found at http://www.lenovo.com/support. Click **User Guides & Manuals** and then follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

Screw notices

Loose screws can cause a reliability problem. In the ThinkPad notebook computer, this problem is addressed with special nylon-coated screws that have the following characteristics:

- They maintain tight connections.
- They do not easily come loose, even with shock or vibration.
- They are harder to tighten.

Do the following when you service this machine:

- Keep the screw kit in your tool bag. For the part number of the screw kit, go to http://www.lenovo.com/serviceparts-lookup.
- It is recommended to use new screws.
- It is recommended to use each screw only once.
- Use a torque screwdriver if you have one.

Tighten screws as follows:

- **Plastic to plastic**

  Turn an additional 90 degrees after the screw head touches the surface of the plastic part.

  90 degrees more

  (Cross-section)
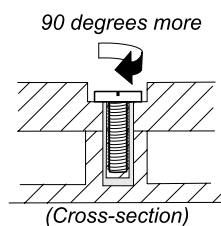
- **Logic card to plastic**

  Turn an additional 180 degrees after the screw head touches the surface of the logic card.

180 degrees more

(Cross-section)
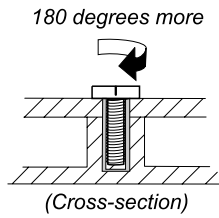
Notes:

- Ensure that you use the correct screw. It is recommended to use new screws for replacements. If you have a torque screwdriver, tighten all screws firmly to the torque specified in the screw information table for each step.
- Ensure torque screw drivers are calibrated correctly following country specifications.

Retaining serial numbers

This topic provides instructions on the following:

- "Restoring the serial number of the system unit" on page 66
- "Retaining the UUID" on page 67

Restoring the serial number of the system unit

When the computer was manufactured, the EEPROM on the system board was loaded with the serial numbers of the system and all major components. These numbers need to remain the same throughout the life of the computer.

If you replace the system board, you must restore the serial number of the system unit to its original value.

The serial number of the system unit is written on the label attached to the bottom of the computer.

If you cannot find the serial number of the system unit on the bottom of the computer, try the following method to get the number:

Note: Before you perform the operation, ensure that the UEFI/Legacy setting within the **Startup** menu in the ThinkPad Setup program is set to **UEFI Only**.

1. Connect a USB memory key to the computer.
2. Go to http://www.lenovo.com/maintenanceutilities and follow the instructions on the screen to create a Maintenance Key.

   Note: Only an authorized Lenovo service technician can access the above Web site.
3. Restart the computer.
4. When the logo is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.
5. Type 1 under **Enter the action desired**, then press Enter. The ThinkPad Serial Number Update Utility for Asset ID screen is displayed.
6. Type 2 under **Enter the action desired**, then press Enter. The serial number of each device in your computer is displayed; the serial number of the system unit is listed as follow:
   20- Serial number
7. Record the serial number of the system unit.

After you replace the system board, do the following to restore the serial number of the system unit:

1. Connect the Maintenance Key to the computer.

2. When the logo is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.

3. Type 1 under **Enter the action desired**, then press Enter. The ThinkPad Serial Number Update Utility for Asset ID screen is displayed.

4. Type 1 under **Enter the action desired**, then press Enter. Then follow the instructions on the screen to restore the serial number of the system unit.

Retaining the UUID

The Universally Unique Identifier (UUID) is a 128-bit number uniquely assigned to your computer at production and stored in the EEPROM of your system board.

The algorithm that generates the number is designed to provide unique IDs until the year A.D. 3400. No two computers in the world have the same number.

When you replace the system board, perform the following steps to create a new UUID for the system board if the system board does not have a UUID:

Note: Before you perform the operation, ensure that the UEFI/Legacy setting within the **Startup** menu in the ThinkPad Setup program is set to **UEFI Only**.

1. Connect a USB memory key to the computer.

2. Go to http://www.lenovo.com/maintenanceutilities and follow the instructions on the screen to create a Maintenance Key.

   Note: Only an authorized Lenovo service technician can access the above Web site.

3. Restart the computer.

4. When the logo screen is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.

5. Type 2 under **Enter the action desired**, then press Enter. The Auto UUID generation utility interface is displayed.

6. Type y under **Change UUID. OK? [Y/N]**, then press Enter. A new UUID is created and written. If a valid UUID already exists, it is not overwritten.

Reading or writing the ECA information

Information on Engineering Change Announcements (ECA) are stored in the EEPROM of the system board. The electronic storage of this information simplifies the procedure to check if the ECA has been previously applied to a machine. The machine does not need to be disassembled to check for the ECA application.

To check what ECAs have been previously applied to the machine, do the following:

1. Connect a USB memory key to the computer.

2. Go to http://www.lenovo.com/maintenanceutilities and follow the instructions on the screen to create a Maintenance Key.

   Note: Only an authorized Lenovo service technician can access the above Web site.

3. Restart the computer.

4. When the logo screen is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.

5. From the main menu, select **6. Set ECA Information**.

6. To read the ECA information, select **2. Read ECA/rework number from EEPROM** and follow the instructions on the screen; To read box build date, select **5. Read box build date from EEPROM**, and follow the instructions on the screen.

After an ECA has been applied to the machine, the EEPROM must be updated to reflect the ECA's application. Use the Maintenance Key to update the EEPROM.

Note: Only the ECA number is stored in the EEPROM. The machine type of the ECA is assumed to be the same as the machine type of the machine that had the ECA applied to it.

1. Insert the Maintenance Key, and then restart the computer.
2. From the main menu, select **6. Set ECA Information**.
3. To write the ECA information, select **1. Write ECA/rework number from EEPROM**, and follow the instruction; To write box build date, select **4. Write box build date from EEPROM**, and follow the instruction on the screen.

If the system board is being replaced, try to read the ECA information from the old system board and transfer the information to the new system. If the system board is inoperable, this will not be possible.

Chapter 9. Removing or replacing a FRU

This chapter provides instructions on how to remove or replace a FRU.

General guidelines:

When removing or replacing a FRU, be sure to observe the following general guidelines:

1. Do not try to service any computer unless you have been trained and certified. An untrained person runs the risk of damaging parts.

2. Before replacing any FRU, review Chapter 8 "FRU replacement notices" on page 65.

3. Begin by removing any FRUs that have to be removed before replacing the failing FRU. Such FRUs are listed at the beginning of each FRU replacement procedure. Remove them in the order in which they are listed.

4. Follow the correct sequence in the steps for removing a FRU, as given in the drawings by the numbers in square callouts.

5. When turning a screw, turn it in the direction as shown by the arrow in the drawing.

6. When removing a FRU, move it in the direction as shown by the arrow in the drawing.

7. To put the new FRU in place, reverse the removal procedure and follow the notes that pertain to replacement.

8. When replacing a FRU, use the correct screws as shown in the replacement procedure.

⚠ **DANGER**

Before removing any FRU, turn off the computer, unplug all power cords from electrical outlets, remove the battery pack, and then disconnect any interconnecting cables.

Attention: After replacing a FRU, do not turn on the computer until you have made sure that all screws, springs, and other small parts are in place and none are loose inside the computer. Verify this by shaking the computer gently and listening for rattling sounds. Metallic parts or metal flakes can cause electrical short circuits.

Attention: The system board is sensitive to, and can be damaged by, electrostatic discharge (ESD). Before touching it, establish personal grounding by touching a ground point with one hand or by using an ESD strap.

Before servicing the computer

Carefully read this topic before servicing the computer.

Removing the SIM card

Depending on the model, the computer you are servicing might have a SIM card slot. If the customer has installed a SIM card in the slot, remove it before servicing.

To remove the SIM card, you must remove the battery pack first. See "1010 Battery pack" on page 70.
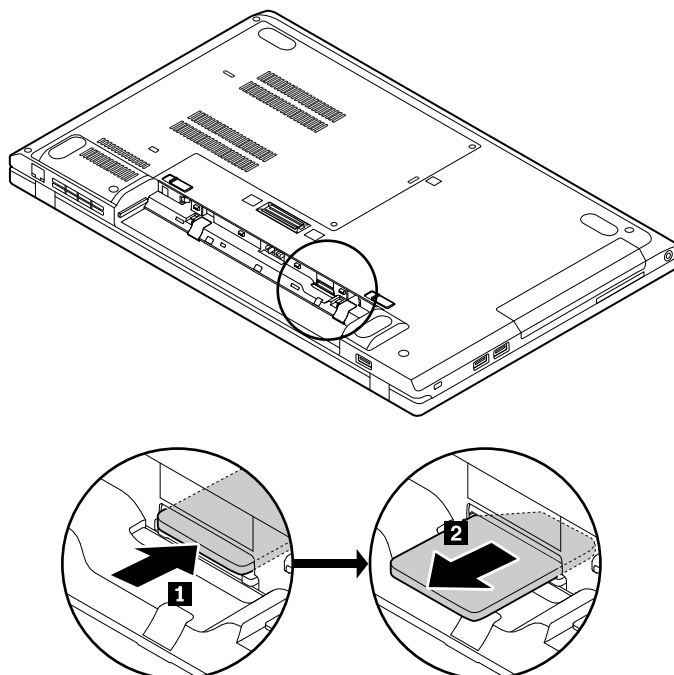
After you finish the service, insert the card back into the slot.

1010 Battery pack

Important notices for replacing a battery pack:

- This system supports only batteries specially designed for this specific system and manufactured by Lenovo or an authorized builder. The system does not support unauthorized batteries or batteries designed for other systems. If an unauthorized battery or a battery designed for another system is installed, the system will not charge.

  Attention: Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.

- The Lenovo Solution Center program provides an automatic battery diagnostic test that determines if the battery pack is defective. A battery pack FRU should not be replaced unless this diagnostic test shows that the battery is defective. The only exception to this is if the battery pack is physically damaged or a customer is reporting a possible safety issue.

- If the Lenovo Solution Center program is not installed in the computer, the customer should download this program before a non-physically damaged battery pack is replaced. Note that a physically damaged battery pack is a not covered by the warranty.

Removal steps of the battery pack

⚠️**DANGER**

Use only the authorized battery specified for your computer. Any other battery could ignite or explode.

Unlock the battery latches and hold them in the unlocked position **1**. Then remove the battery pack **2**.
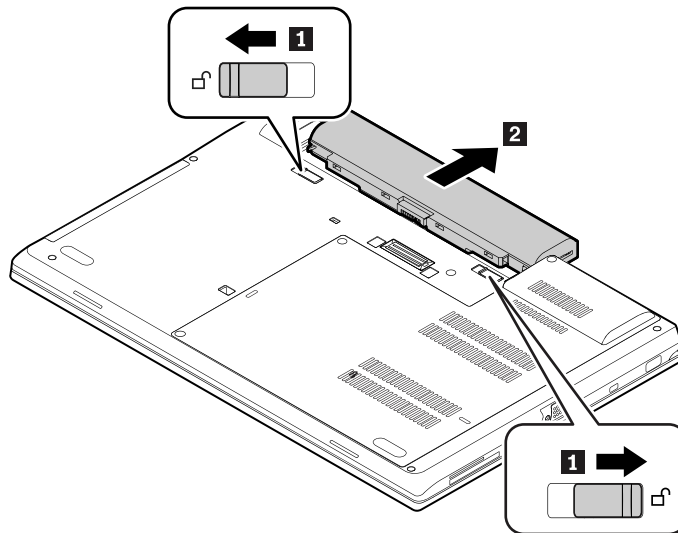
When installing: Install the battery pack along the slide rails of the slot. Ensure that the battery latches are in the locked position.

1020 Bottom door

For access, remove this FRU:
* "1010 Battery pack" on page 70

Removal steps of the bottom door

Note: Loosen the screws **1**, and then remove the bottom door **2**.
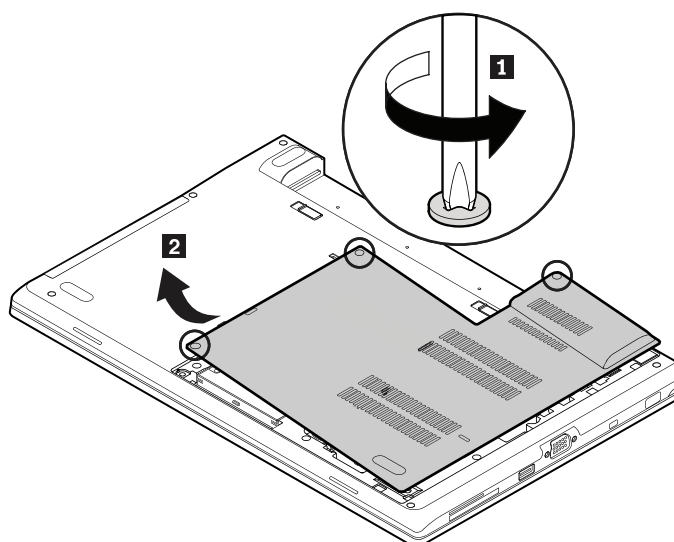
1030 Optical drive

Removal steps of the optical drive

For access, remove this FRU:
- "1010 Battery pack" on page 70
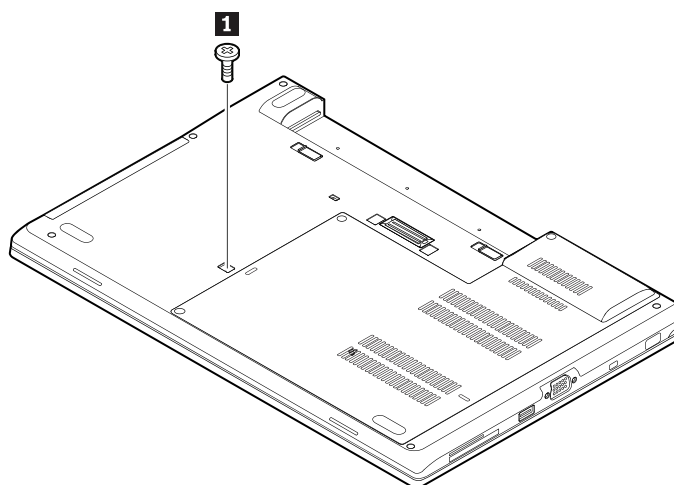
Step	Screw (quantity)	Color	Torque
1	M2 × 5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)
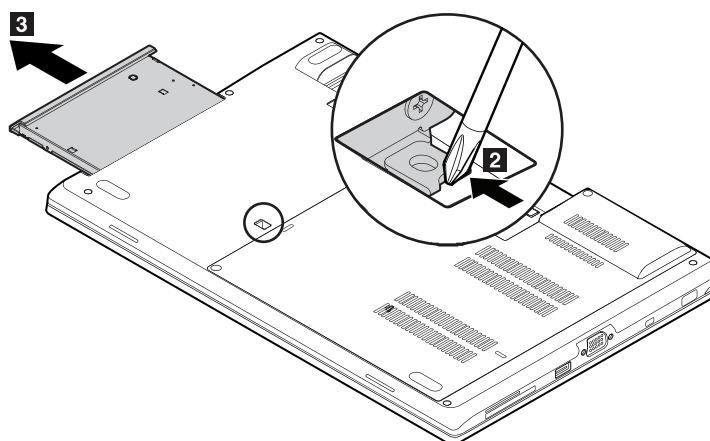
1040 Internal storage drive

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71

Attention:

- Do not drop the drive or apply any physical shock to it. The drive is sensitive to physical shock. Improper handling can cause damage and permanent loss of data.

- Before removing the drive, have the user make a backup copy of all the information on it if possible.

- Never remove the drive while the computer is operating or is in suspend mode.

Removal steps of the internal storage drive
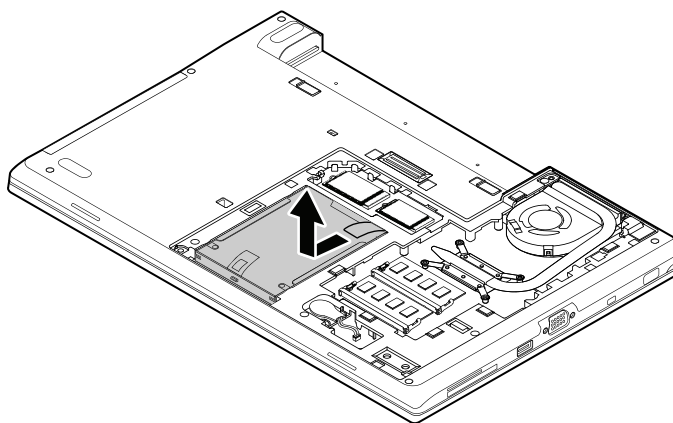
Removal steps of the internal storage drive bracket
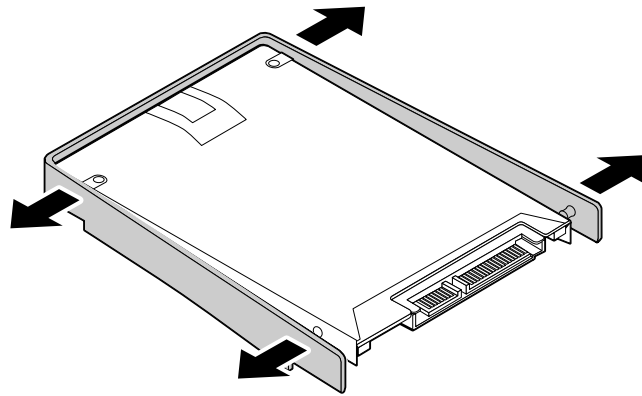
1050 Memory module

Removal steps of the memory module

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
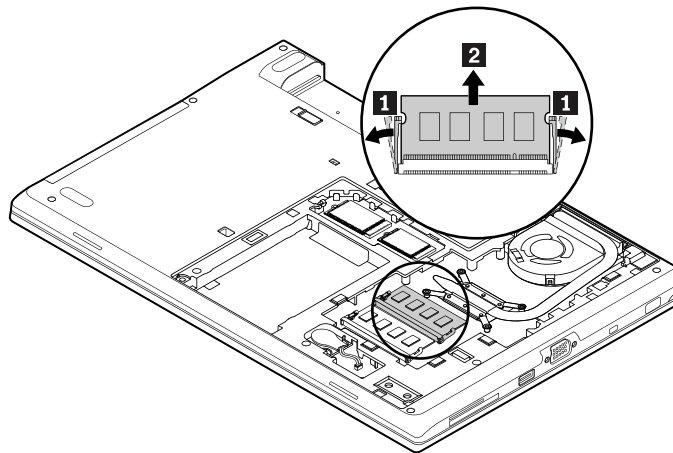
When installing:

- Insert the notched end of the memory module into the memory slot at an angle of about 20 degrees. Press the memory module firmly, and pivot it downward until it snaps into place. Ensure that the memory module is firmly installed and does not move easily.

   Note: Do not apply any pressure to the memory module.

- If only one memory module is installed, ensure that you install it into the bottom slot, which is the primary slot.

1060 WWAN card

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
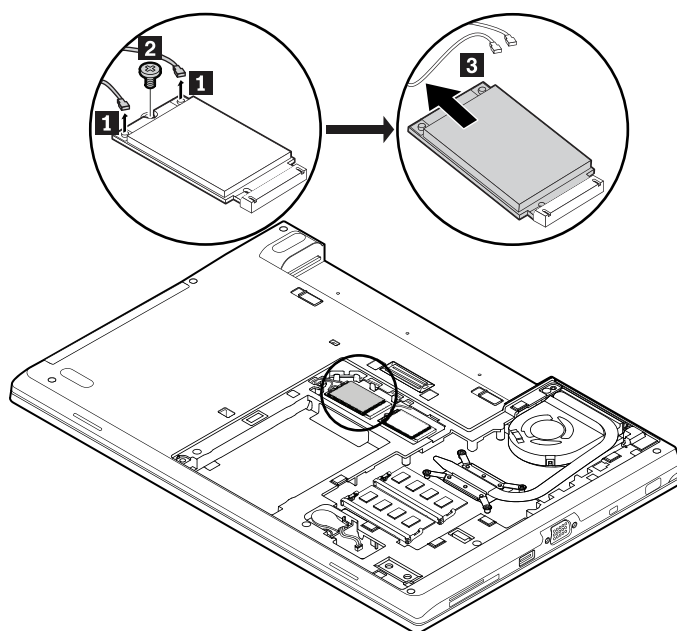
Step	Screw (quantity)	Color	Torque
2	M2 × 3 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

When installing: Plug the red cable into the main connector and the blue cable into the auxiliary connector.

1070 WLAN card

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71

Removal steps of the WLAN card
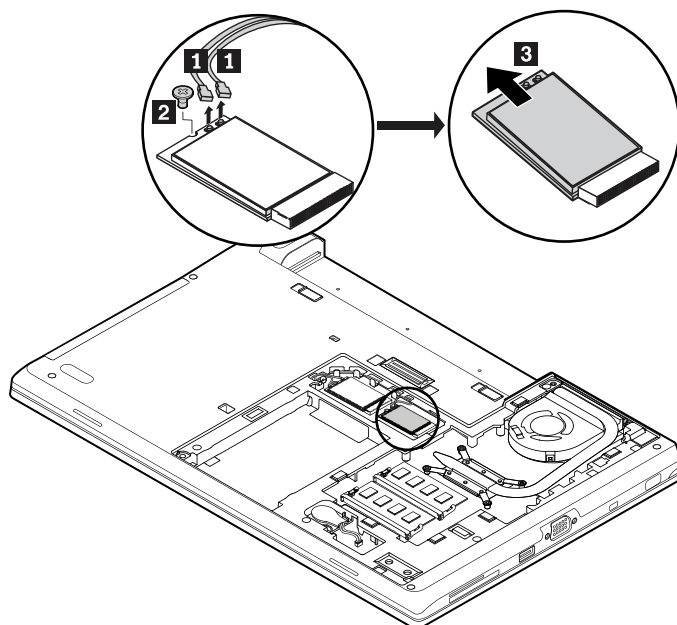
Step	Screw (quantity)	Color	Torque
2	M2 × 3 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

When installing: Plug the gray cable into the connector labeled **MAIN** on the card; and plug the black cable into the connector labeled **AUX** on the card.

1080 Coin-cell battery

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71

Removal steps of the coin-cell battery

⚠ **DANGER**

> **Use only the authorized battery specified for your computer. Any other battery could ignite or explode.**
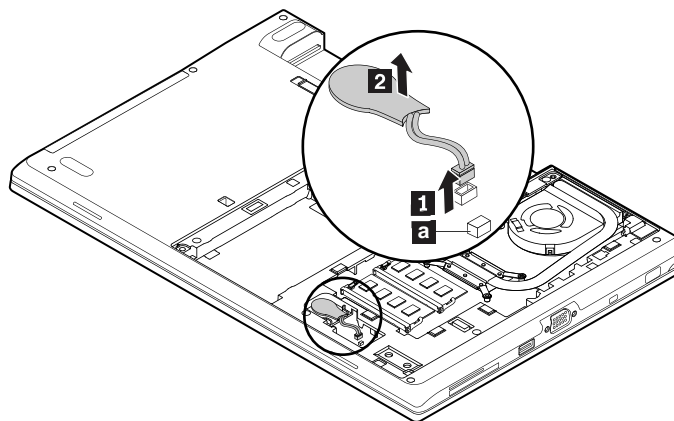
Attention: The tamper detect switch **a** is sensitive. When you are installing a new coin-cell battery, do not stack or route the cable of the coin-cell battery upon the tamper detect switch.

When installing: Ensure that the connector is firmly attached.

1090 Thermal-fan assembly

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71

Attention:

- Do not handle the thermal-fan assembly roughly. Improper handling of the thermal-fan assembly can cause distortion or deformation and imperfect contact with components.

- Do not touch or apply any excessive force to the fan motor. It might cause damage to the thermal-fan assembly or might cause the computer to malfunction.

Removal steps of the thermal-fan assembly

Detach the thermal-fan assembly connector **1**. Loosen the screws **2** in ascending alphabetical order as illustrated, but do not remove them.
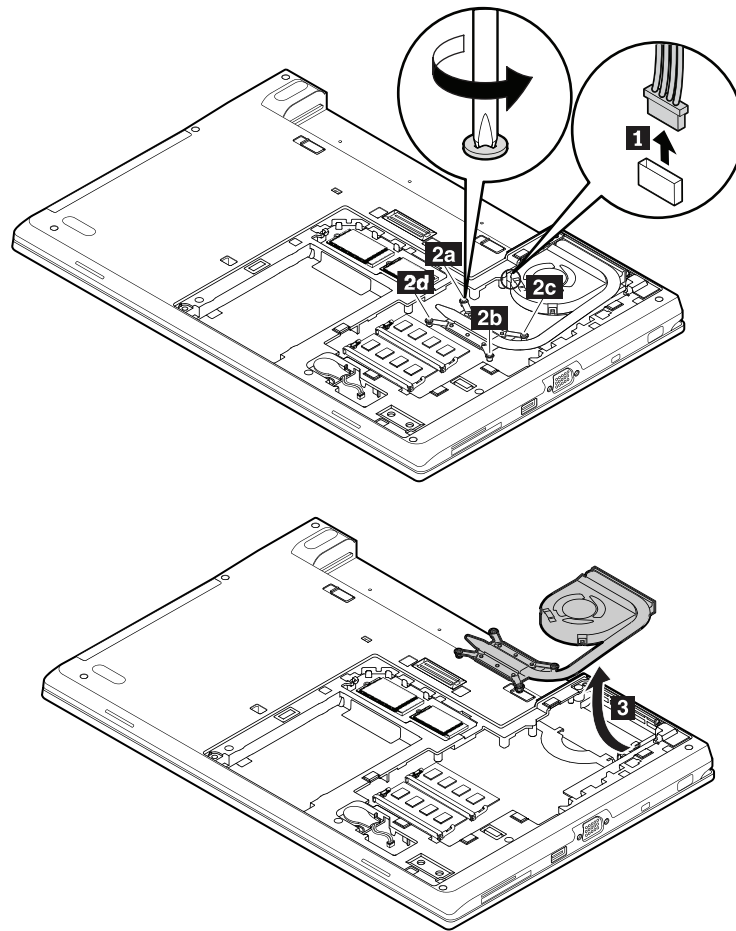
When installing:

- Attach the thermal-fan assembly connector to the system board and tighten the screws in ascending alphabetical order.
- Before you attach the old thermal-fan assembly to the computer, apply thermal grease, at an amount of 0.2 grams, on the parts marked **a** as in the following illustration. Either too much or too less application of grease might cause a thermal problem due to imperfect contact with a component. If you are installing a new thermal-fan assembly, peel the thin film off from the part marked **a**.
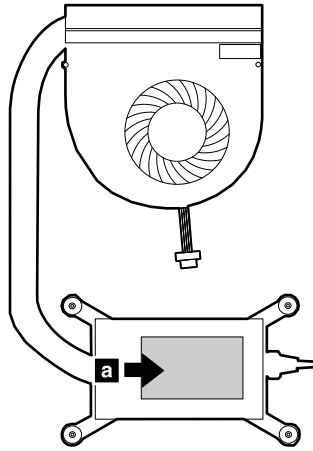
1100 Keyboard

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70

Removal steps of the keyboard

1. Unlock the keyboard frame.
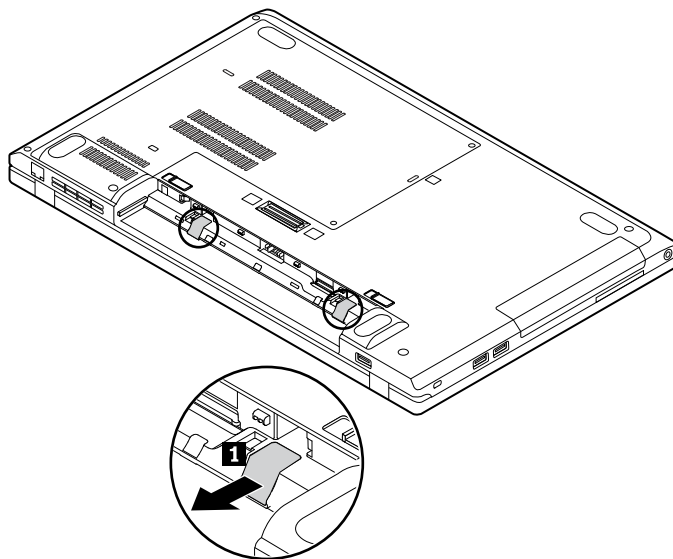
2. The screws that secures the keyboard are beneath the keyboard frame. To reveal the screw heads, use the flat end of the multi-tool to slide the keyboard forward by 2.5 mm (0.1 inch).

   Note: Do not press or hold the keys while sliding the keyboard frame, otherwise the keyboard frame cannot be moved.
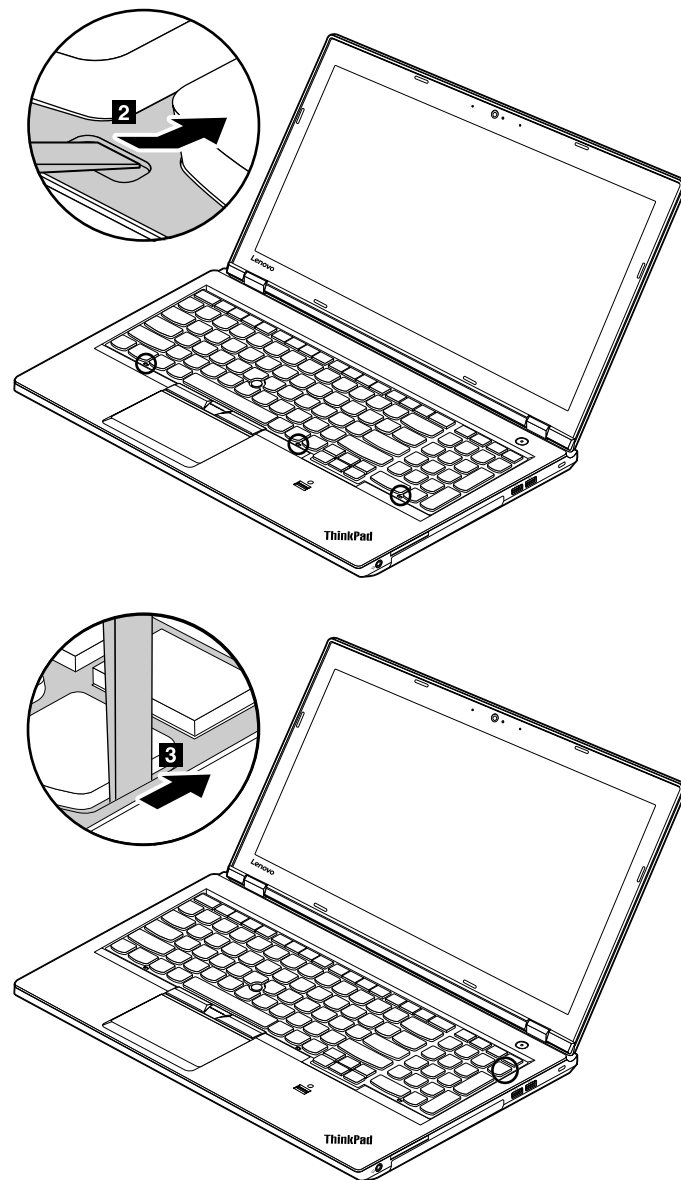
3. Use the cross end of the multi-tool to loosen the screws.
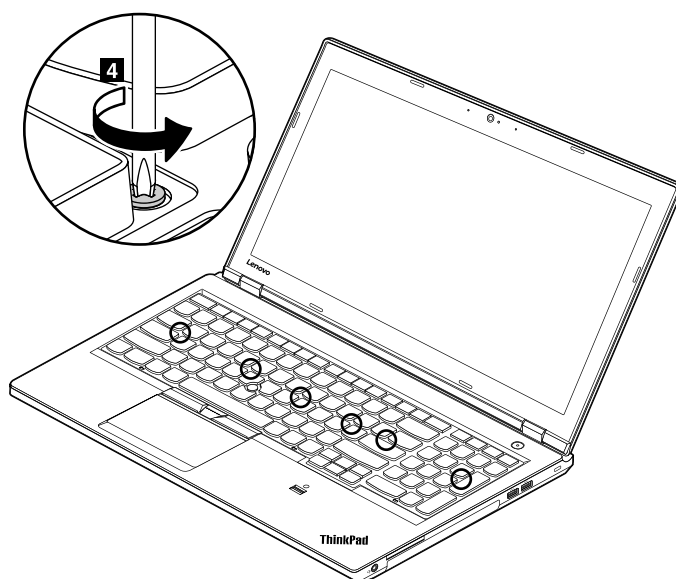
4. Pivot the keyboard slightly upward **5** until you can see the connectors on the bottom side of the keyboard. Then turn over the keyboard **6**.
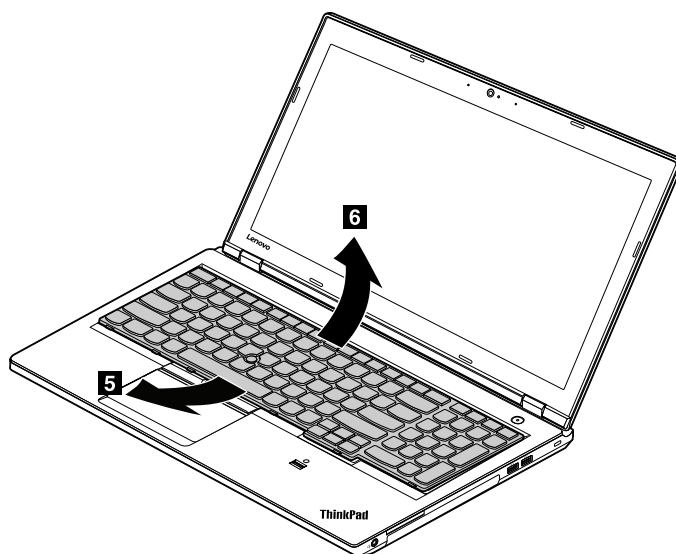
5. Detach the connectors. Then remove the keyboard.
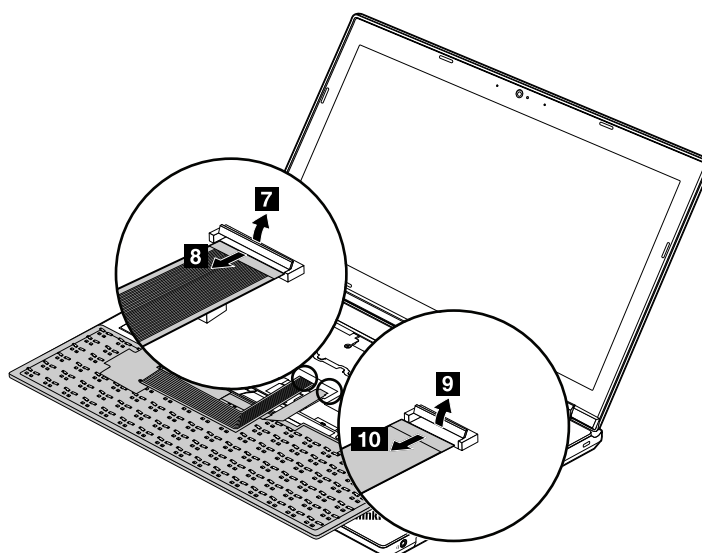
1110 Keyboard bezel assembly

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
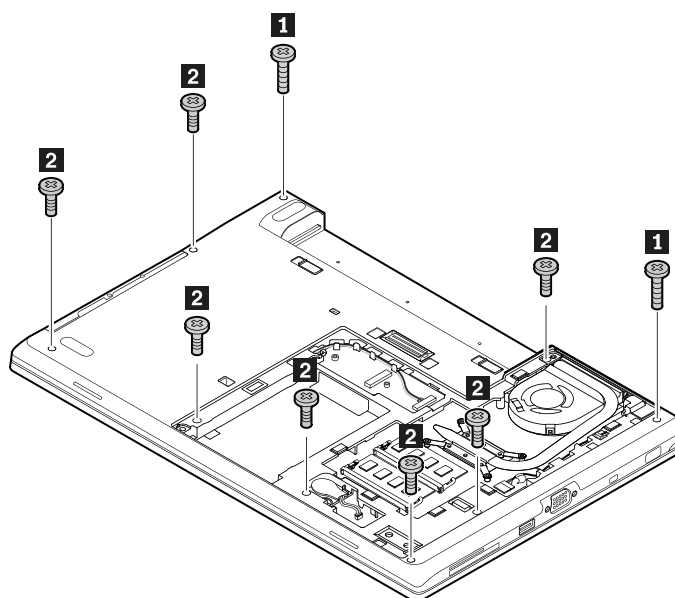
Step	Screw (quantity)	Color	Torque
1	M2.5 × 8 mm, flat-head, nylon-coated (2)	Black	0.29 Nm (3.0 kgf-cm)
2	M2 × 5 mm, flat-head, nylon-coated (7)	Black	0.181 Nm (1.85 kgf-cm)
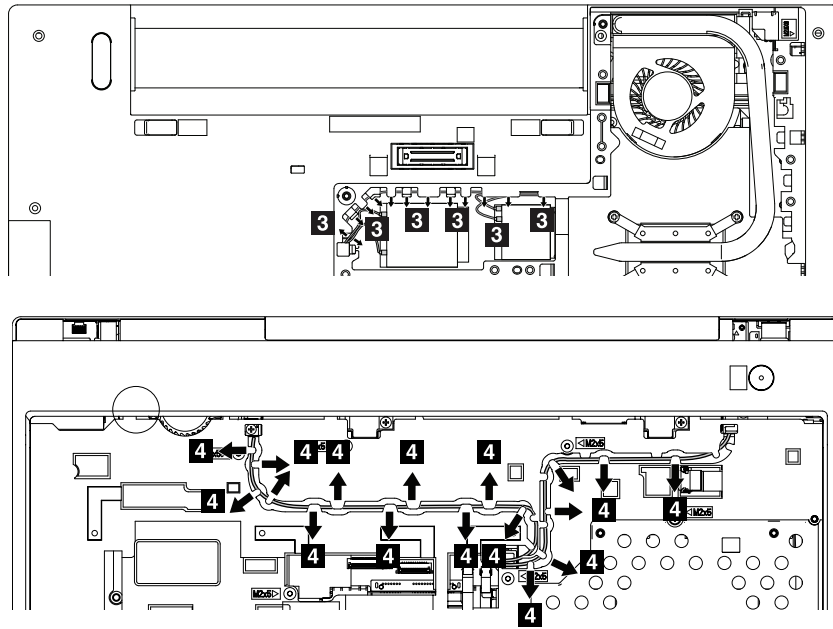
When installing:

- Ensure that you route the cables firmly in the correct position.
- When you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.
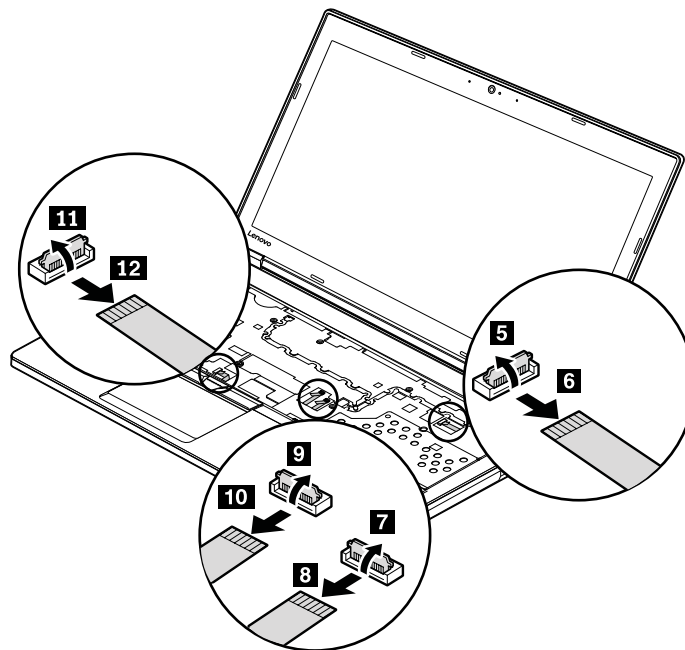
When installing: Ensure that the connectors are attached firmly to the system board.
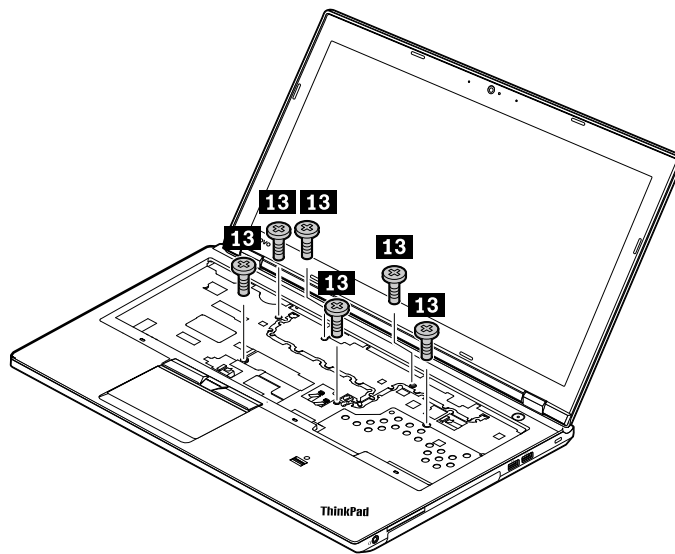
Step	Screw (quantity)	Color	Torque
13	M2 × 5 mm, flat-head, nylon-coated (6)	Black	0.181 Nm (1.85 kgf-cm)
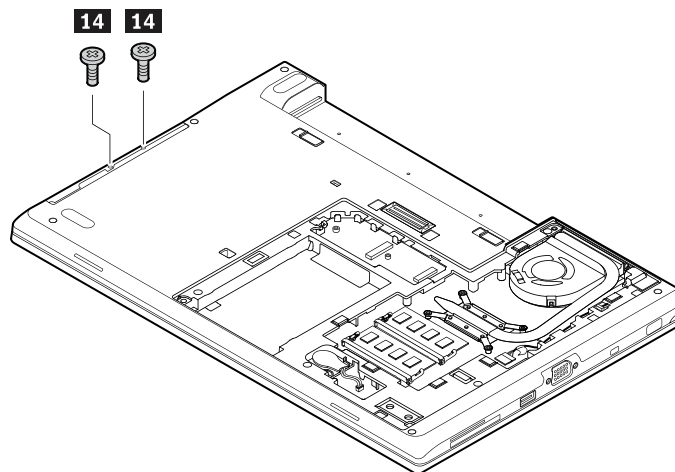
Step	Screw (quantity)	Color	Torque
14	M2 × 3 mm, flat-head, nylon-coated (2)	Black	0.181 Nm (1.85 kgf-cm)
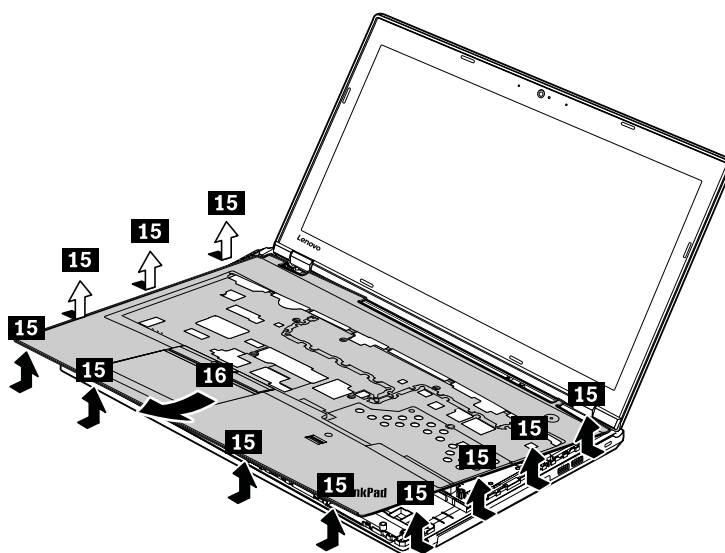
1120 Smart card reader and dummy smart card

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

If the computer you are servicing supports the smart card, follow the following instructions to remove or replace the smart card reader and smart card door.

Removal steps of the smart card reader
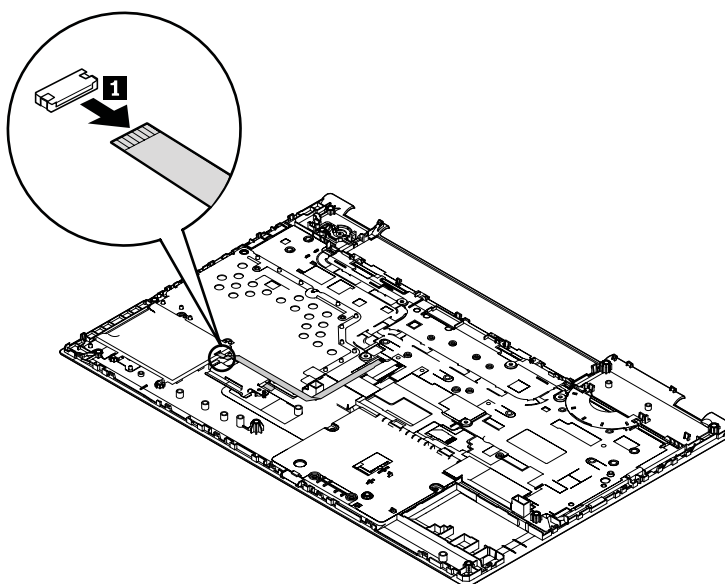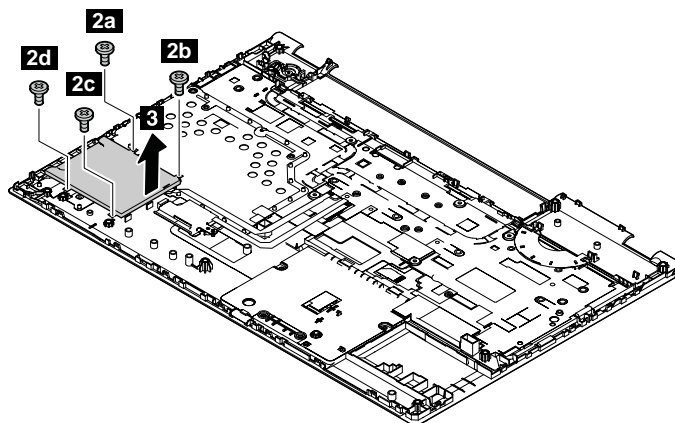
Step	Screw (quantity)	Color	Torque
2	M2 × 2.5 mm, flat-head, nylon-coated (4)	Silver	0.181 Nm (1.85 kgf-cm)

If the computer you are servicing has a dummy smart card installed. Follow the following instructions to remove or replace the dummy smart card.

Removal steps of the dummy smart card
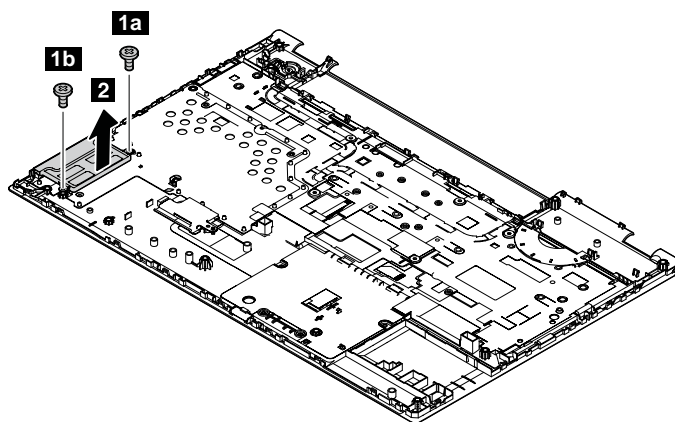
Step	Screw (quantity)	Color	Torque
1	M2 × 2.5 mm, flat-head, nylon-coated (2)	Silver	0.181 Nm (1.85 kgf-cm)

1130 Trackpad module

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75

- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

Removal steps of the clickpad module
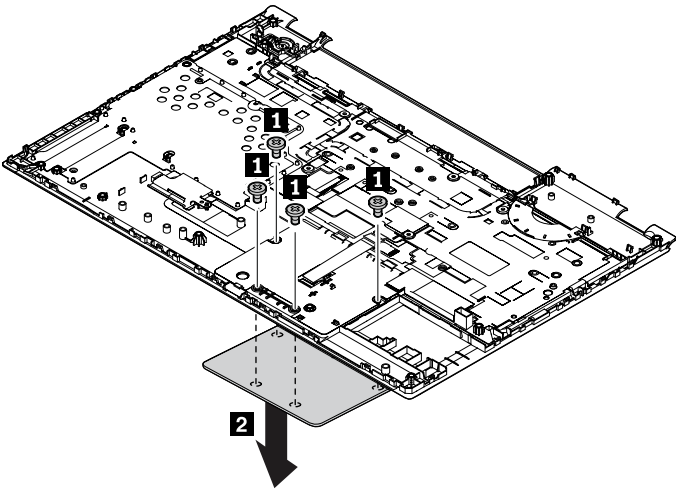
Step	Screw (quantity)	Color	Torque
1	M2 × 3 mm, flat-head, nylon-coated (4)	Gold	0.181 Nm (1.85 kgf-cm)

1140 Trackpad cable

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

Removal steps of the trackpad cable
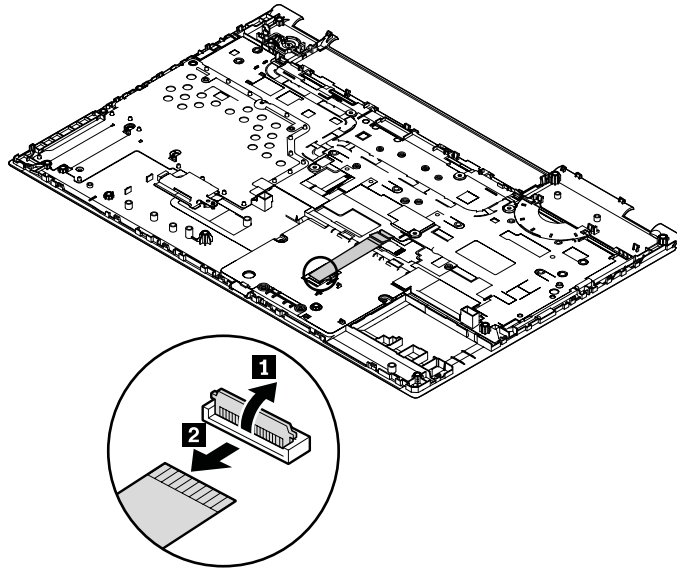
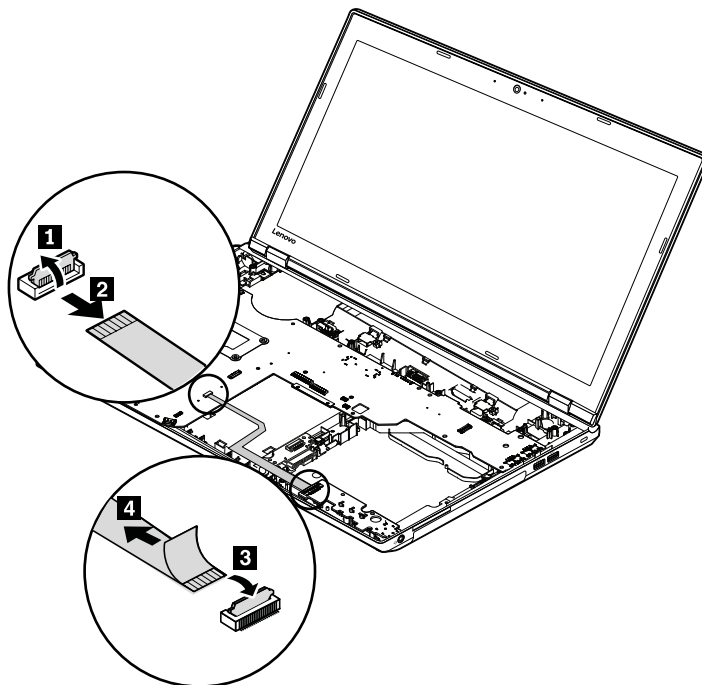**When installing:** Ensure that the connectors are firmly attached.
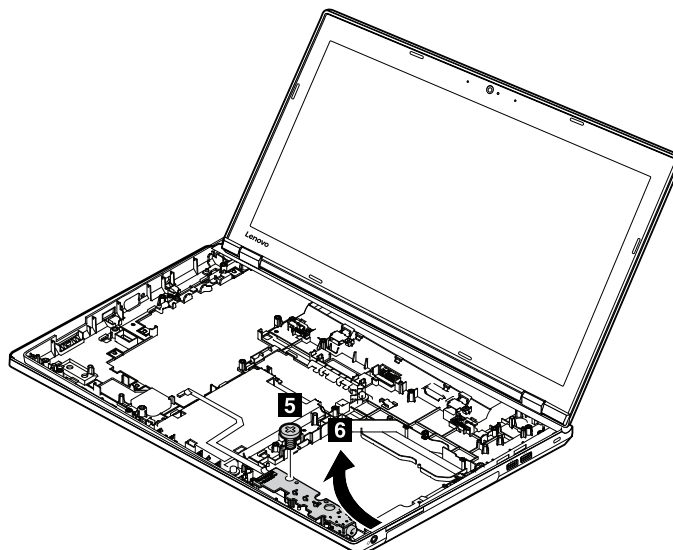
1150 Power button card

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

Removal steps of the power button card
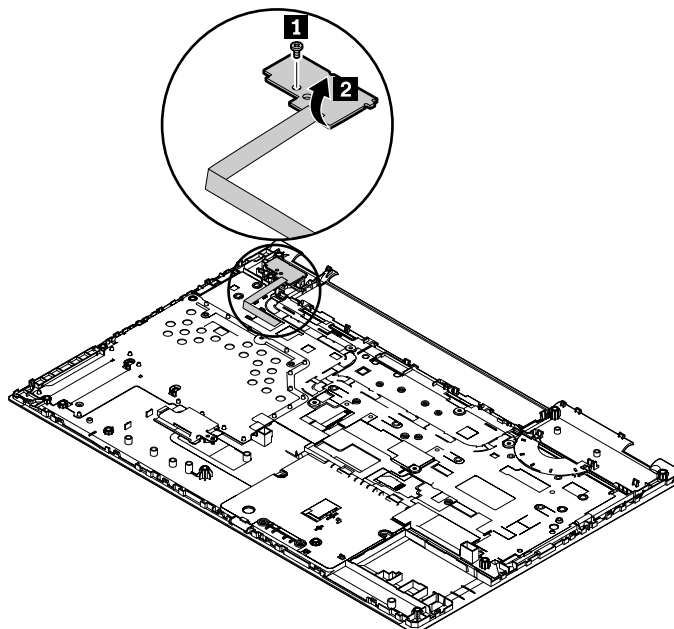
Step	Screw (quantity)	Color	Torque
1	M2 × 3 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

1160 System board assembly

Important notices for handling the system board:
When handling the system board, bear the following in mind:

- The system board has an accelerometer, which can be broken if several thousands of G-forces are applied.

  Note: Dropping a system board from a height of as little as 6 inches so that it falls flat on a hard bench can subject the accelerometer to as much as 6000 G's of shock.

- Be careful not to drop the system board on a bench top that has a hard surface, such as metal, wood, or composite.

- If a system board is dropped, be sure to document the drop in any reject report, and replace the system board.

- Avoid rough handling of any kind.

- At every point in the process, be sure not to drop or stack the system board.

- If you put a system board down, be sure to put it only on a padded surface such as an ESD mat or a corrugated conductive surface.
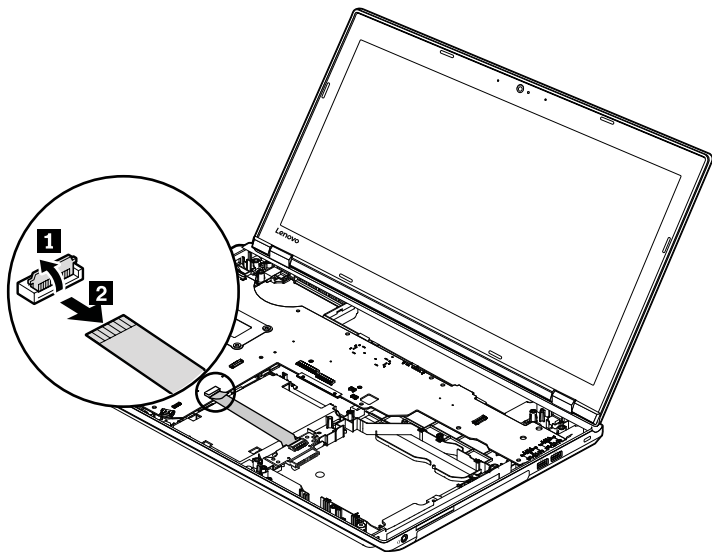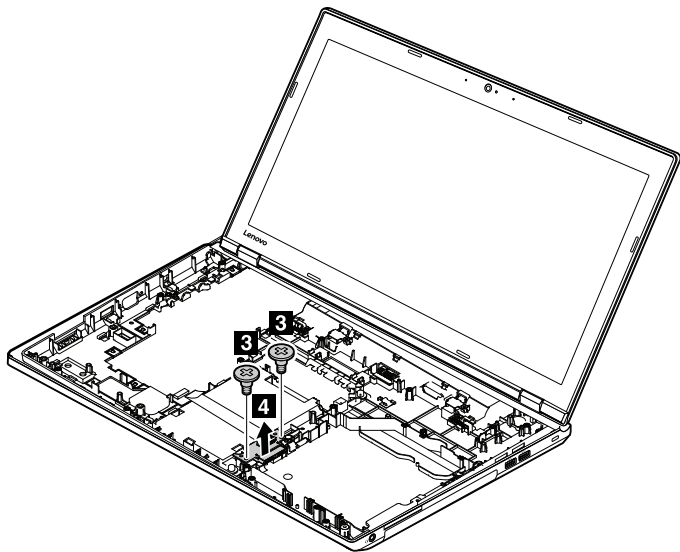
For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
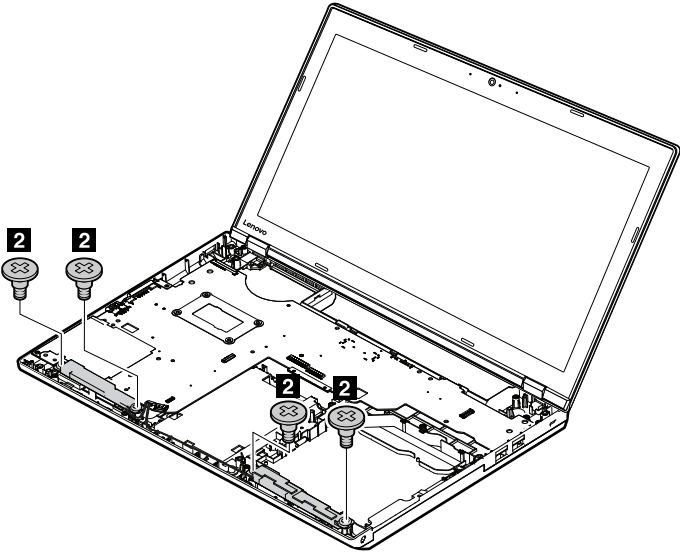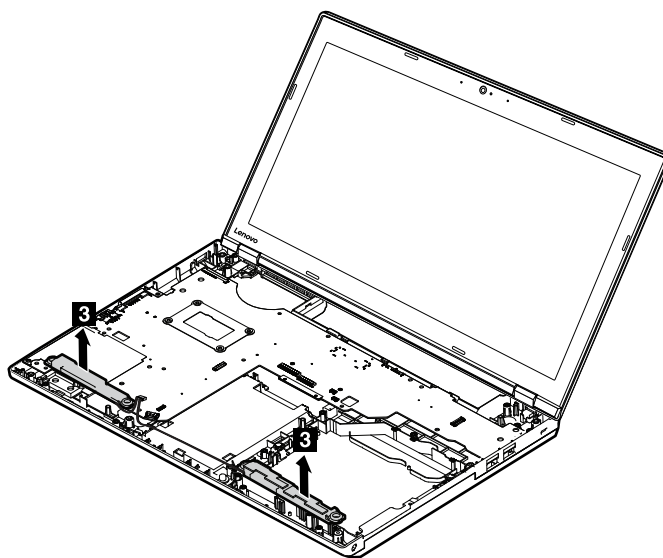- "1080 Coin-cell battery" on page 76
- "1090 Thermal-fan assembly" on page 76
- "1100 Keyboard" on page 78

- "1110 Keyboard bezel assembly" on page 81

Locations of the major sensitive components on the system board

Attention: The following components on the system board are extremely sensitive. When you service the system board, avoid any kind of rough handling.

a Microprocessor
b Accelerometer chip for the hard disk drive Active Protection System® (APS)
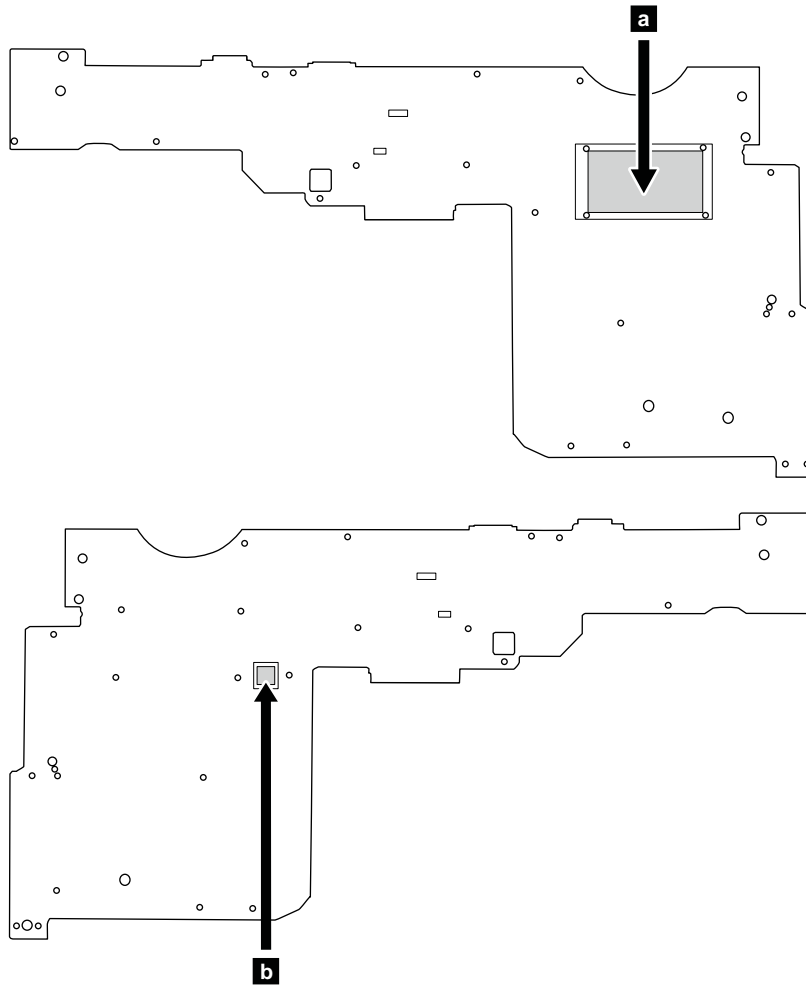
Removal steps of the system board assembly
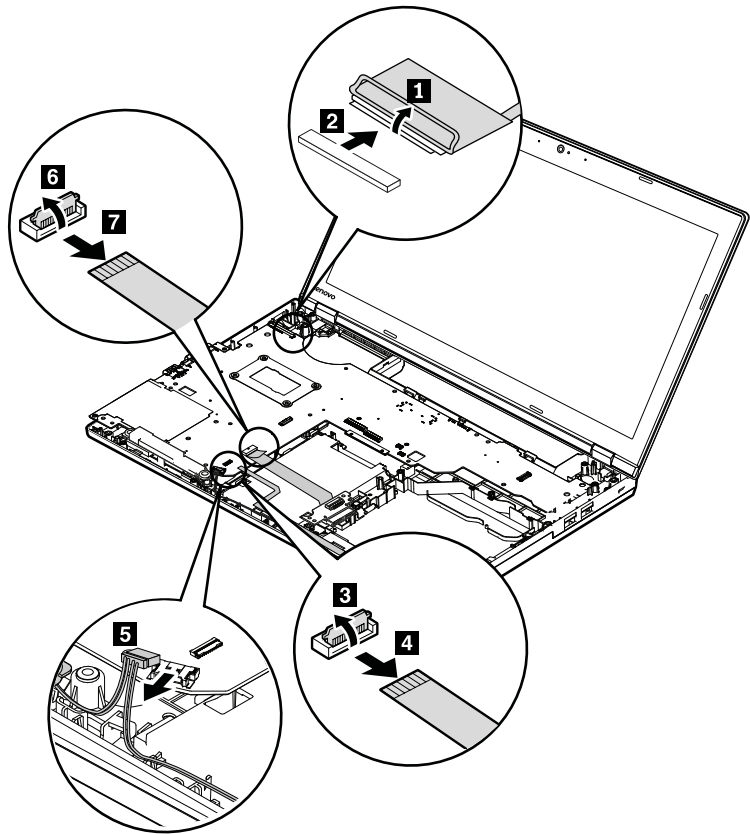
When installing: Ensure that the connectors are firmly attached to the system board assembly.
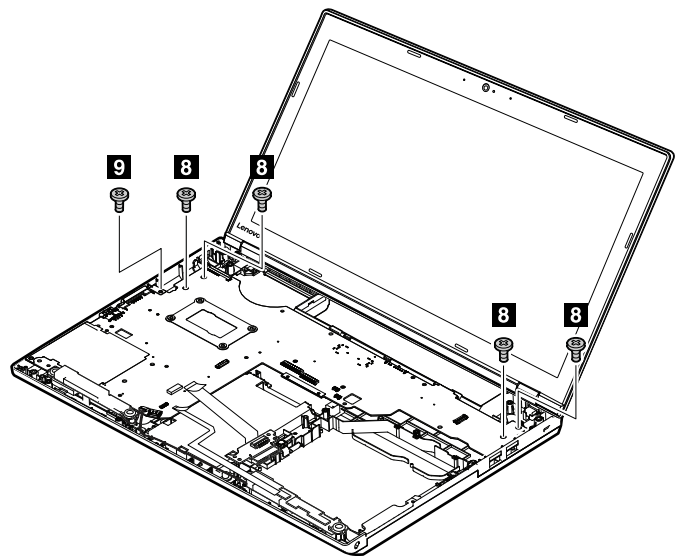
Step	Screw (quantity)	Color	Torque
8	M2 × 3 mm, flat-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)
9	M2 × 5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)
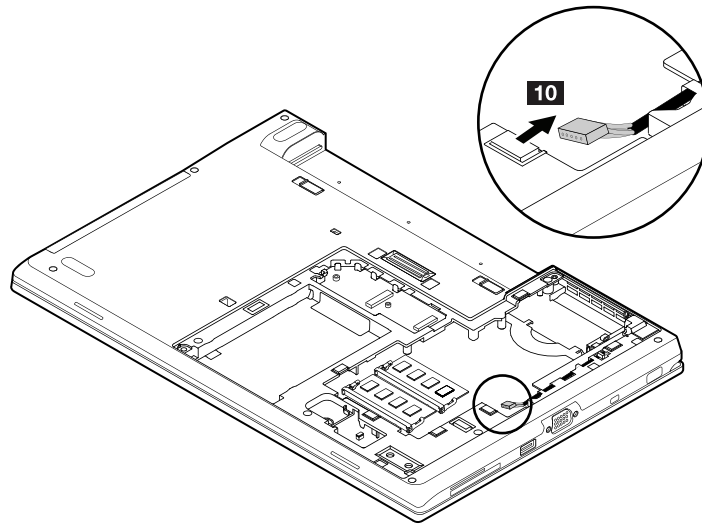
When installing: Ensure that the connector is firmly attached to the system board assembly.
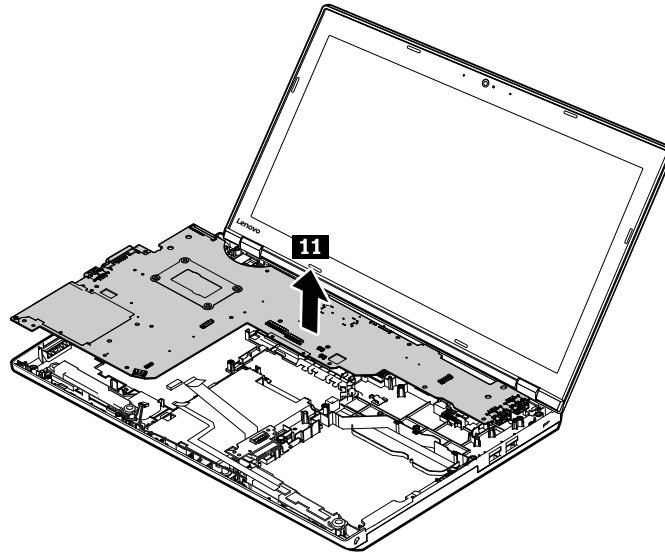
1170 Audio card and audio cable

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

Removal steps of the audio card and audio cable

When installing: Ensure that the connectors are attached firmly to the system board assembly.

Step	Screw (quantity)	Color	Torque
5	M2 × 5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

1180 ODD card

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71

- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

Removal steps of the ODD card

When installing: Ensure that the connector is firmly attached.

Step	Screw (quantity)	Color	Torque
3	M2 × 5 mm, flat-head, nylon-coated (2)	black	0.181 Nm (1.85 kgf-cm)

1190 Speaker assembly

For access, remove these FRUs in order:
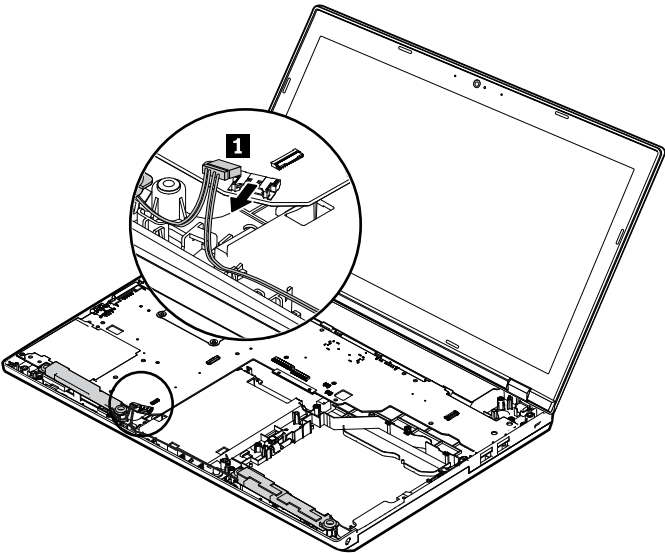
When installing: Ensure that the connector is firmly attached.

Step	Screw (quantity)	Color	Torque
2	M2.0 × 3 mm, flat-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)

1200 Saddle bracket, dc-in cable, and base cover assembly

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1080 Coin-cell battery" on page 76
- "1090 Thermal-fan assembly" on page 76
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81
- "1160 System board assembly" on page 88
- "2010 LCD unit" on page 98

Removal steps of the left saddle brackets
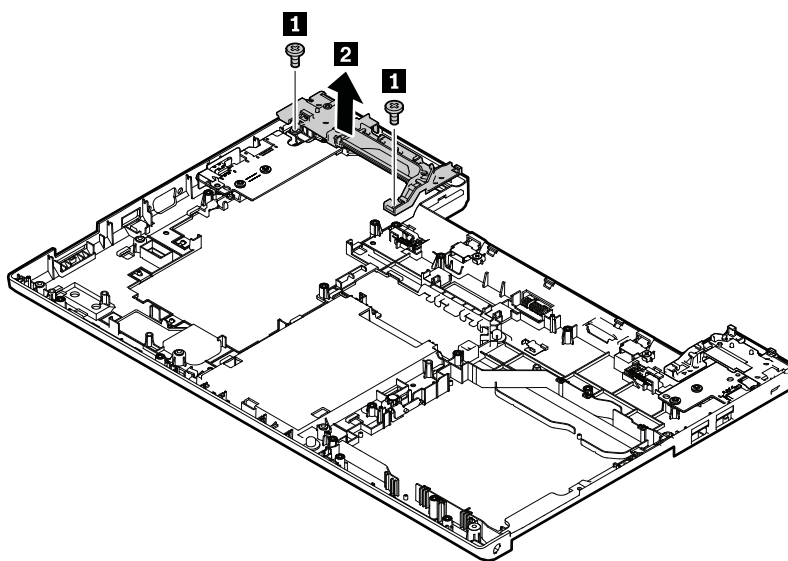
Step	Screw (quantity)	Color	Torque
1	M2 × 5 mm, flat-head, nylon-coated (2)	black	0.181 Nm (1.85 kgf-cm)

Removal steps of the Ethernet card
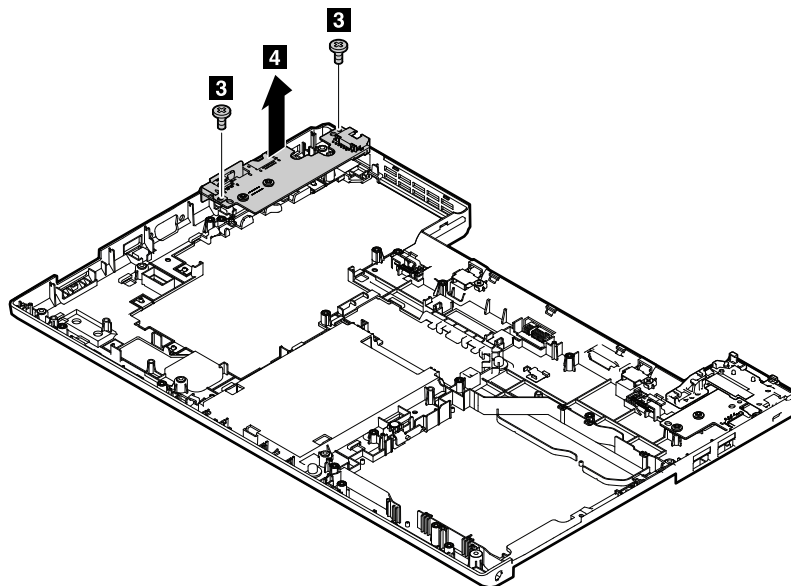
Step	Screw (quantity)	Color	Torque
3	M2 × 5 mm, flat-head, nylon-coated (2)	black	0.181 Nm (1.85 kgf-cm)

Removal steps of the right saddle brackets
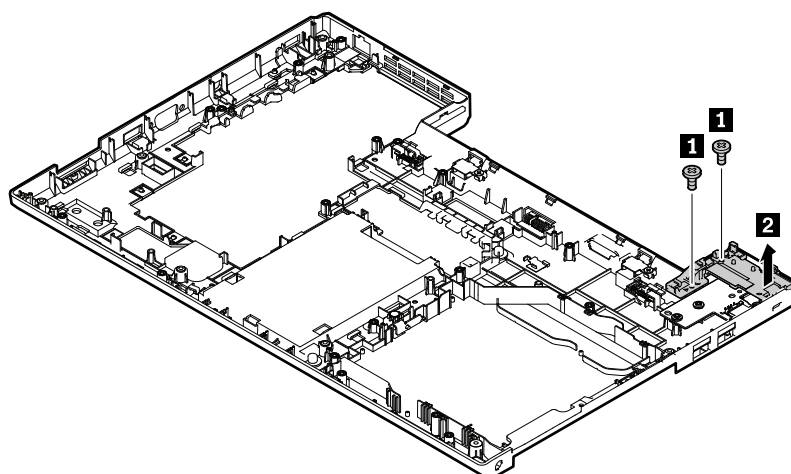
Step	Screw (quantity)	Color	Torque
1	M2 × 5 mm, flat-head, nylon-coated (2)	Black	0.181 Nm (1.85 kgf-cm)

Removal steps of the USB card
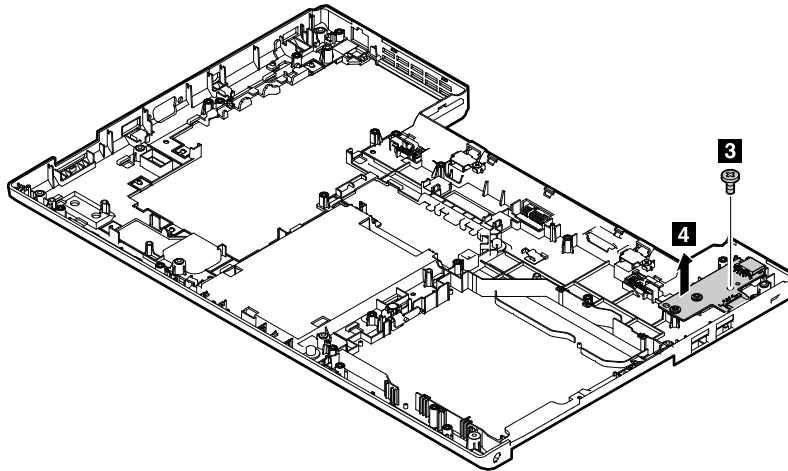
Step	Screw (quantity)	Color	Torque
3	M2 × 5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

Applying labels to the base cover

The new base cover FRU is shipped with a kit containing labels of several kinds. Apply those labels when you replace the base cover. For the labels that are not shipped with the new base cover FRU, peel them from the old base cover assembly, and adhere them to the new one.

The following illustration shows the location of each label.
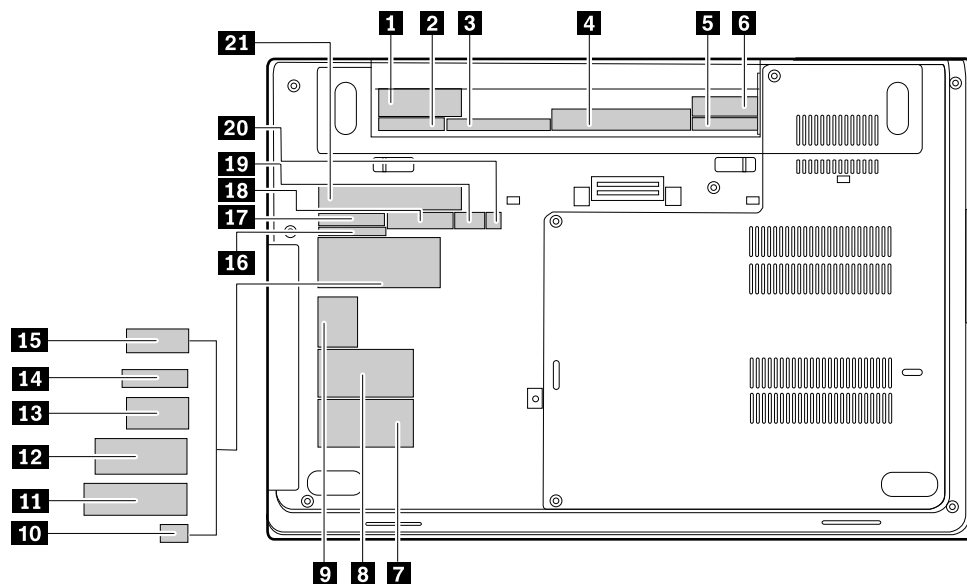
1 Windows COA label (for Windows 7 only)

2 FCC label

3 WWAN MAC label Information label

4 System label

12 Indonesia rating label

13 IMEI label

14 China GEO label

15 Brazil WWAN label

5 Machine type and S/N label	**16** CMIIT ID label
6 GEO label	**17** CECP label or Argentina CNC label
7 **8** Asset tag	**18** KC Safety label
9 Genuine Microsoft label (for Windows 10 only)	**19** ICASA System label
10 Indonesia Postel LBL label	**20** Malaysia MCMC label
11 Israel LBL label	**21** Wireless label for special-bid product

2010 LCD unit

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81

Removal steps of the LCD unit
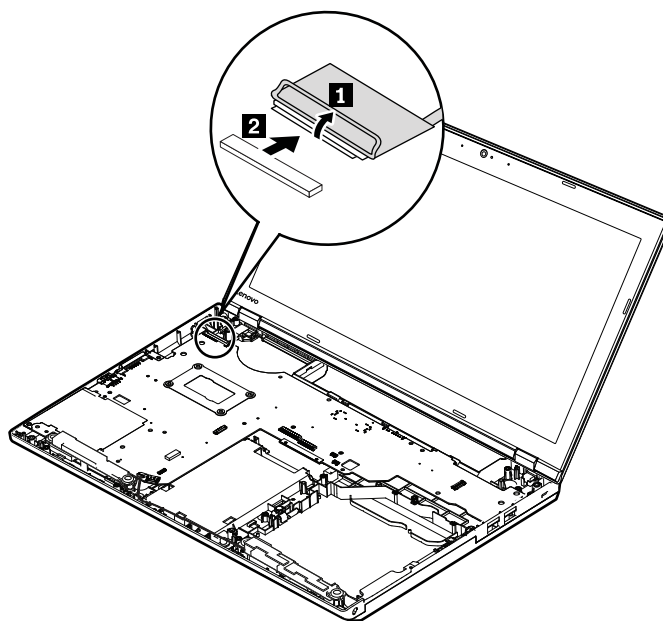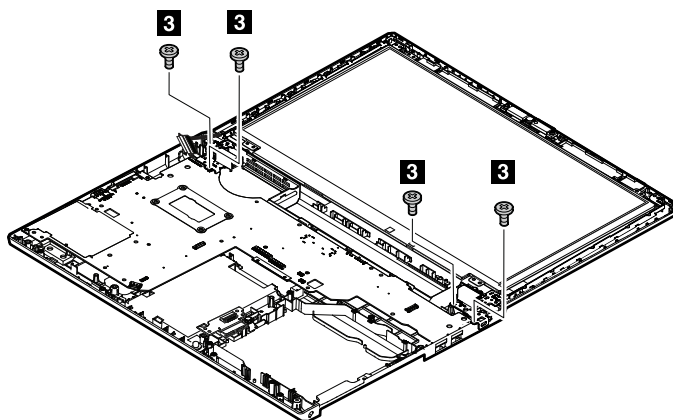
Step	Screw (quantity)	Color	Torque
3	M2.5 × 6 mm, flat-head, nylon-coated (4)	Black	0.29 Nm (3.0 kgf-cm)
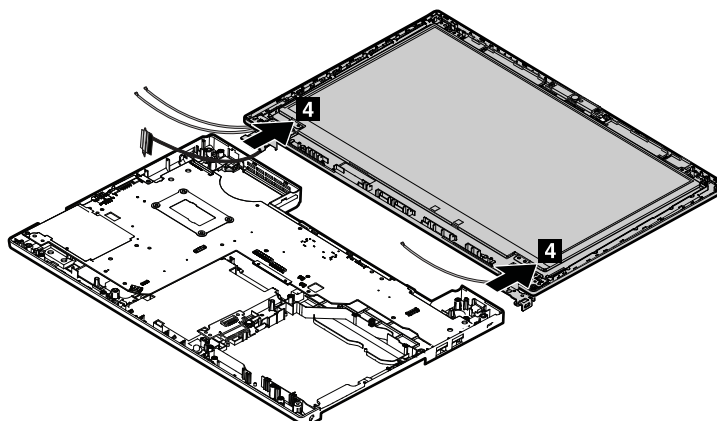
When installing: When you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.

2020 LCD front bezel

For access, remove this FRU:
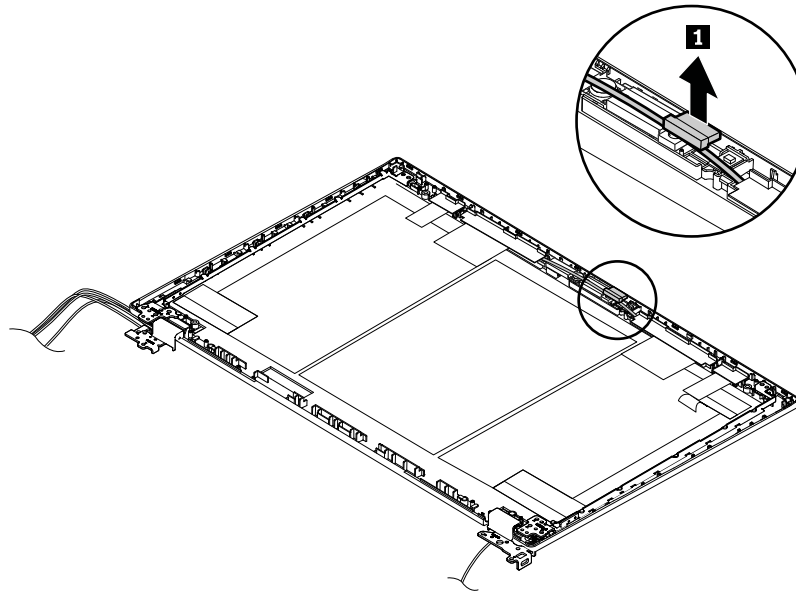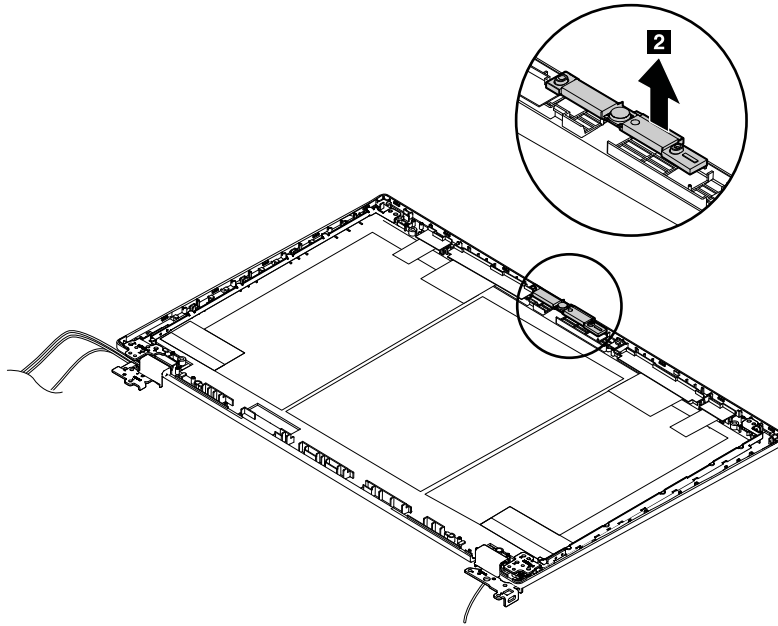- "1010 Battery pack" on page 70

Removal steps of LCD front bezel
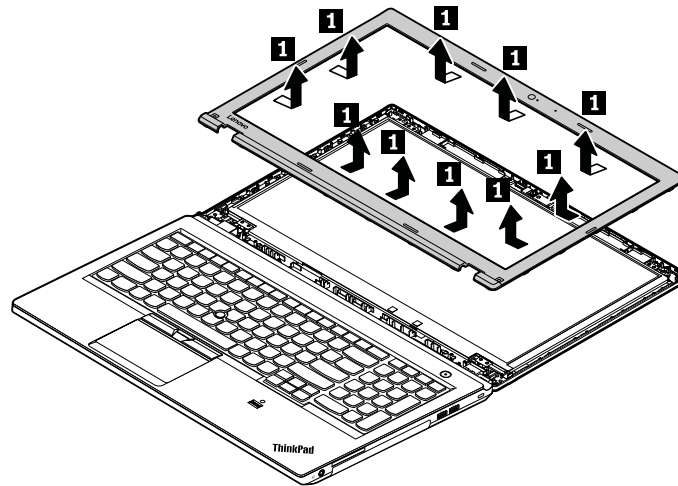
2030 Camera/microphone combo card

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "2020 LCD front bezel" on page 99

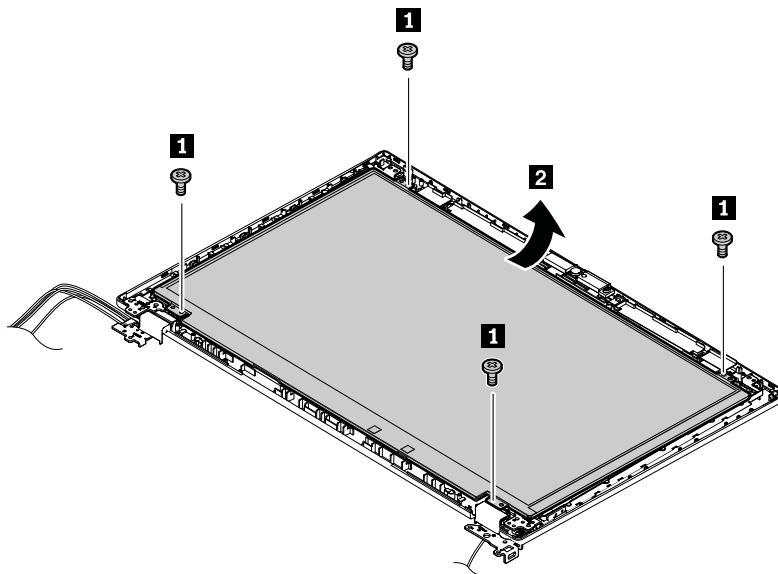**Removal steps of the camera/microphone combo card**
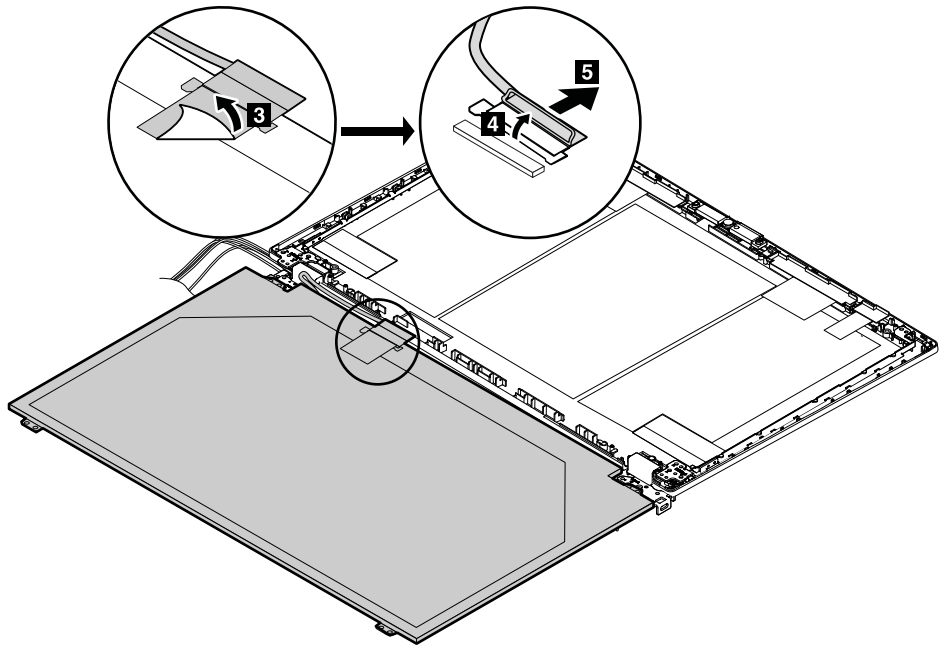
2040 Hinges, LCD panel, and LCD cable

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81
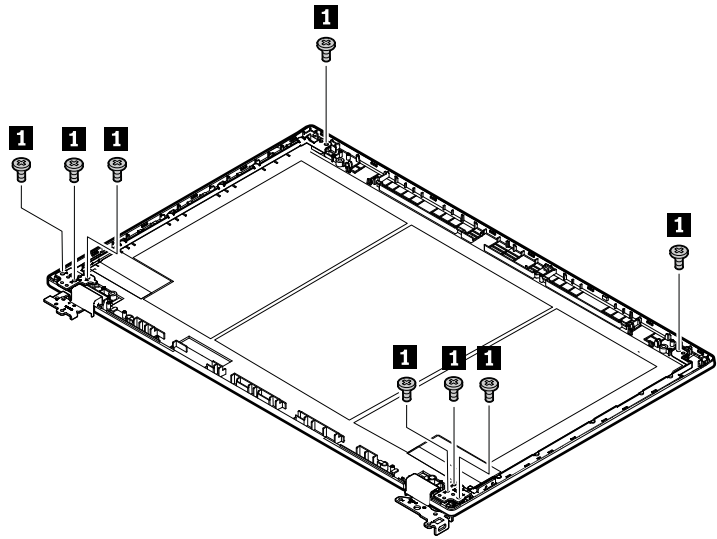- "2010 LCD unit" on page 98
- "2020 LCD front bezel" on page 99
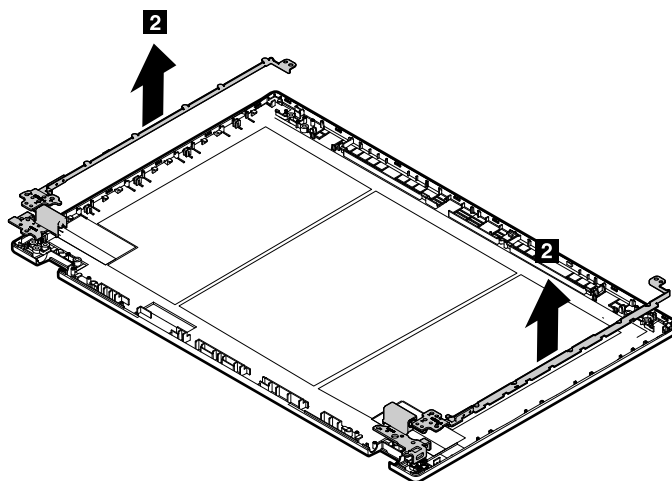
Removal steps of the LCD panel and LCD cable

Step	Screw (quantity)	Color	Torque
1	M2 × 3 mm, flat-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)

Removal steps of the hinges

| Step	Screw (quantity)	Color	Torque
1	M2.5 × 4 mm, flat-head, nylon-coated (8)	Silver	0.29 Nm (3.0 kgf-cm)

2050 LCD cable

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81
- "2010 LCD unit" on page 98
- "2020 LCD front bezel" on page 99
- "2030 Camera/microphone combo card" on page 100
- "2040 Hinges, LCD panel, and LCD cable" on page 101

Removal steps of the LCD cable

Note: Depending on the model, the shape and location of the LCD cable might be different from the illustration.
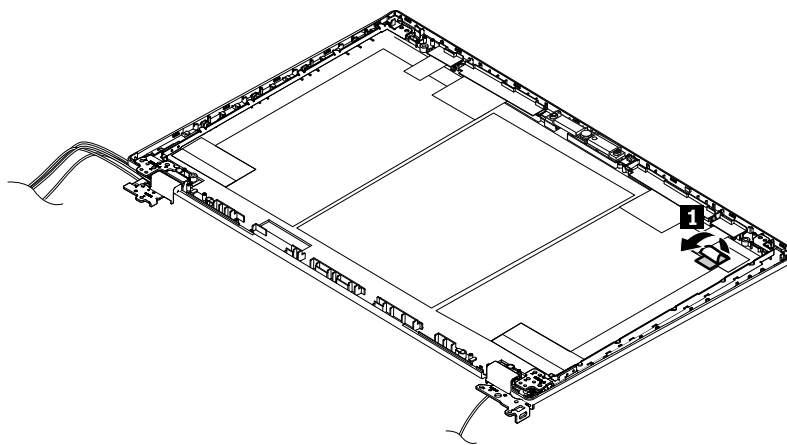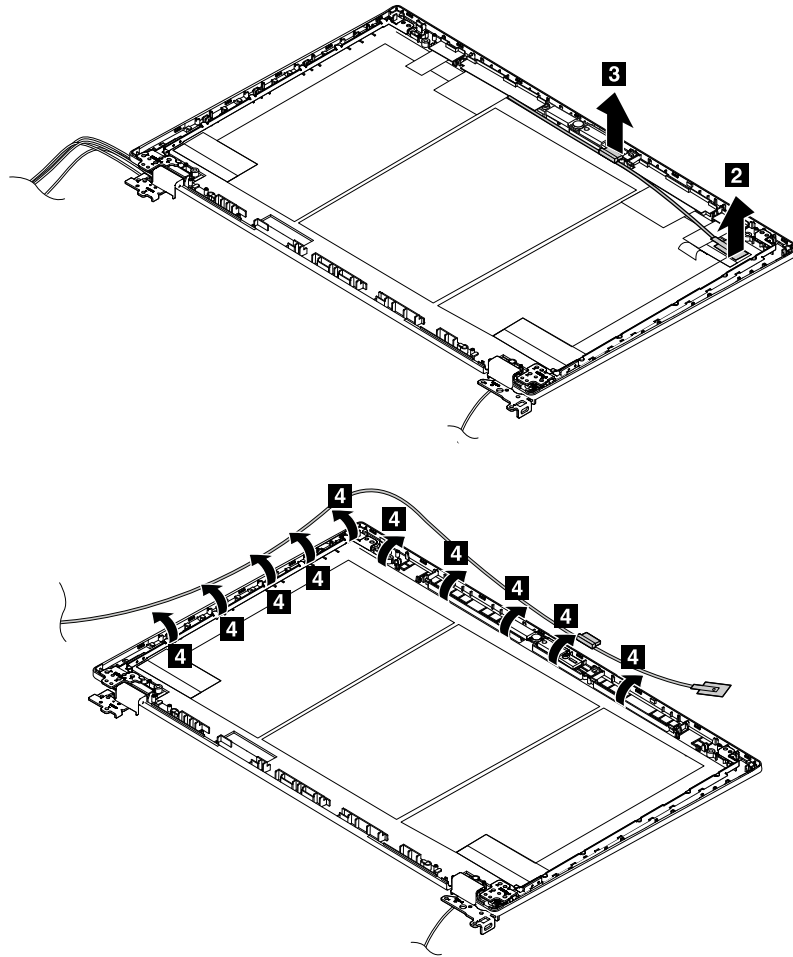
2060 Antenna assembly and LCD rear cover assembly

For access, remove these FRUs in order:
- "1010 Battery pack" on page 70
- "1020 Bottom door" on page 71
- "1030 Optical drive" on page 72
- "1040 Internal storage drive" on page 73
- "1060 WWAN card" on page 74
- "1070 WLAN card" on page 75
- "1100 Keyboard" on page 78
- "1110 Keyboard bezel assembly" on page 81
- "2010 LCD unit" on page 98
- "2020 LCD front bezel" on page 99
- "2030 Camera/microphone combo card" on page 100
- "2040 Hinges, LCD panel, and LCD cable" on page 101
- "2050 LCD cable" on page 103

Removal steps of the WLAN antenna assembly
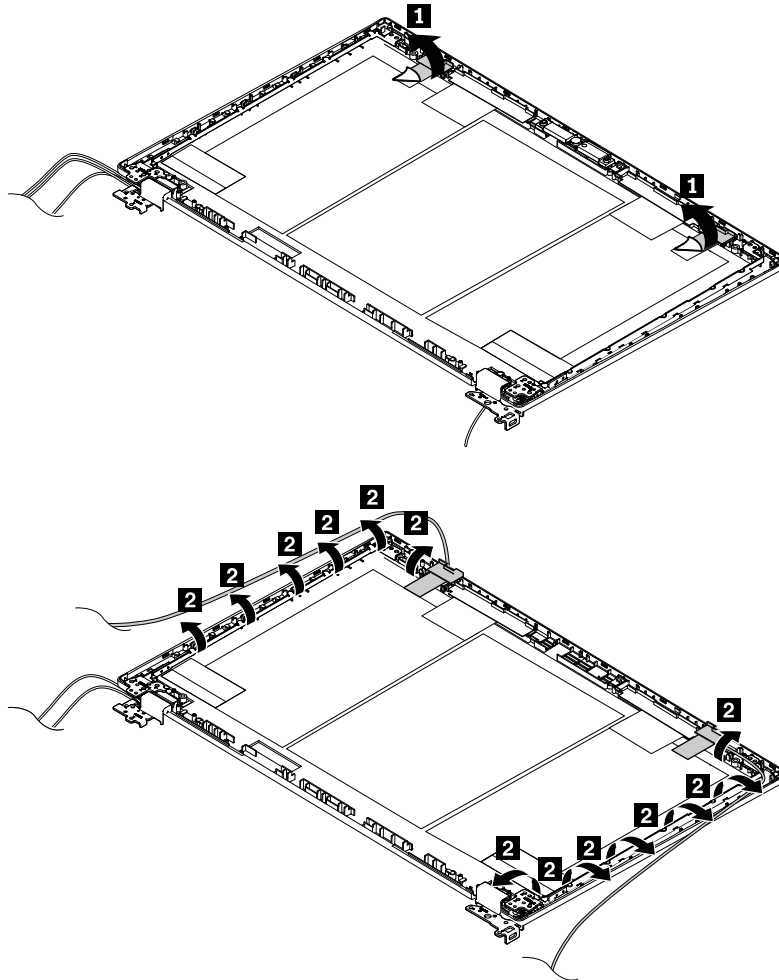
Attention: When installing: When you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.
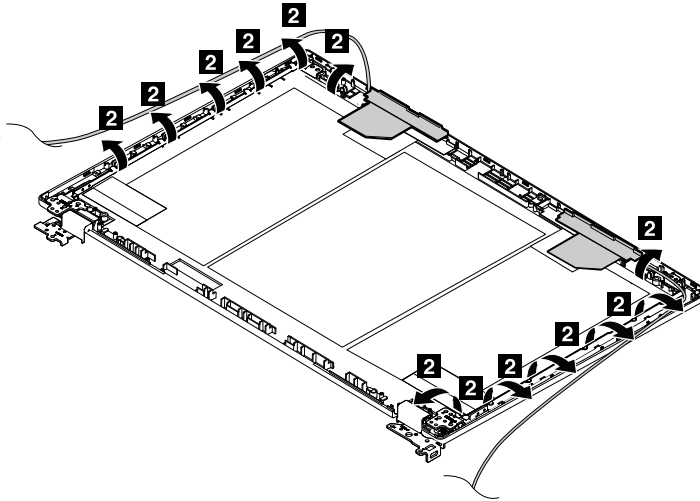
Removal steps of the WWAN antenna assembly
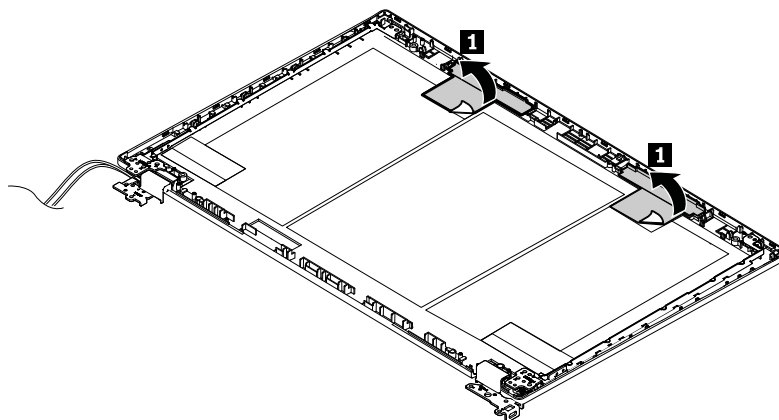
Attention: When installing: When you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.

Removal steps of the LCD rear cover assembly

Attention: When installing: When you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.
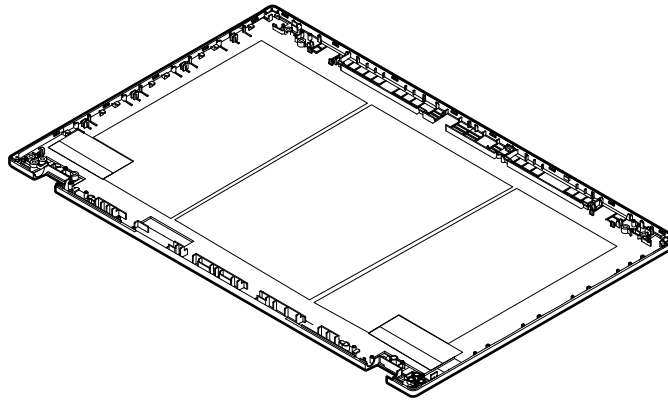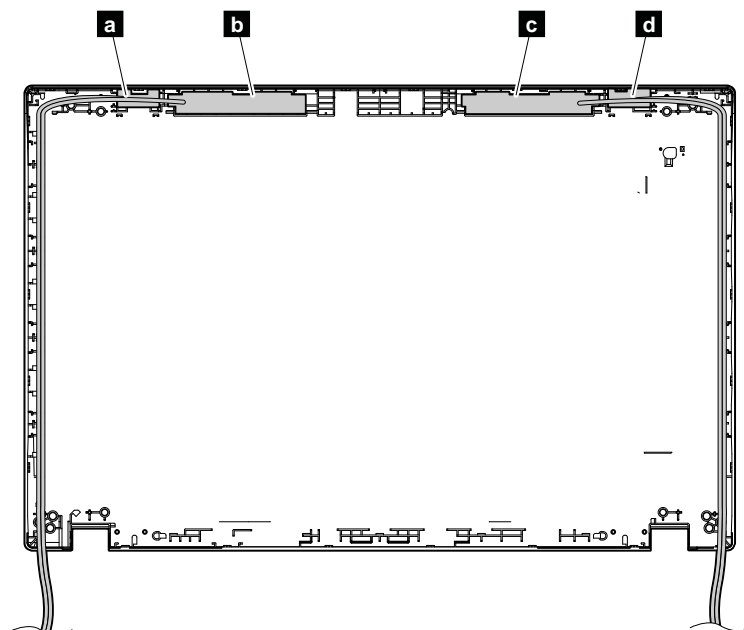
Antenna locations

a WLAN antenna (main, gray)
b WWAN antenna (main, red)
c WWAN antenna (auxiliary, blue)
d WLAN antenna (auxiliary, black)

Appendix A. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service.

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Appendix B. Abbreviation table

The following table lists all abbreviations used in this manual.

Abbreviation	Term
BGA	Ball Grid Array
CMOS	Complementary Metal Oxide Semiconductor
CMV	Custom Model Variant
CRC	Cyclic redundancy check
CRT	Cathode ray tube
CRU	Customer Replaceable Unit
CTO	Configure To Order
EAIA	Enhanced Asset Information Area
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFI	Extensible Firmware Interface
ESD	Electrostatic discharge
FRU	Field Replaceable Unit
GAV	General Announce Variant
IC	Integrated circuits
LCD	Liquid Crystal Display
MTM	Machine type and model
POST	Power-on self-test
RFID	Radio-frequency identification
SVP	Supervisor password
UUID	Universally unique identifier

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